Documentation of HIV prevention research and programmatic learnings from India

VULNERABLE POPULATIONS
ALCOHOL USE
CONDOM USE
MALE MIGRANTS
COMMUNITY MOBILIZATION
HIGH-RISK GROUPS
HIV PREVENTION
STRUCTURAL INTERVENTIONS
FEMALE SEX WORKERS
VIOLENCE
LONG-DISTANCE TRUCKERS
CLIENTS OF SEX WORKERS
CELL PHONE USE
MEN WHO HAVE SEX WITH MEN
INJECTING DRUG USERS

Selected peer-reviewed journal publications from the Knowledge Network Project

Volume 1

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Documentation of HIV prevention research and programmatic learnings from India

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Volume 1 2013

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Introduction to the volume

Over the past decade (2000-11), India has achieved dramatic success in reversing the HIV epidemic. The incidence of new HIV infections has declined nationally by more than half, and adult HIV prevalence has reduced significantly in the high HIV prevalence states of Andhra Pradesh, Karnataka, Maharashtra, Manipur, Nagaland and Tamil Nadu.[1] Moreover, HIV prevalence has declined among female sex workers in many high prevalence areas. These successes are largely due to the implementation of upscaled HIV prevention interventions by the National AIDS Control Organization (NACO),[2] other donors and non-governmental organizations, under the National AIDS Control Program III (2007-12). As the epidemic in India is concentrated in vulnerable sub-populations, these interventions were focused on high-risk groups–female sex workers, men who have sex with men (MSM)/ transgenders, injecting drug users (IDUs) and bridge populations (truckers and clients of female sex workers).[3]

At this critical juncture, it is important to understand the lessons learnt from the implementation of HIV prevention programs and the vulnerabilities that need to be addressed to reach the goal of zero new infections. To support this understanding, the Population Council and its Knowledge Network Project partners have been engaged in a project to document and disseminate evidence-based lessons from upscaled HIV prevention programs in India. As part of this initiative, we have compiled this volume of articles published in peer-reviewed journals, which represents selected documented work. The volume is divided into four sections: Section I presents evidence on the changing epidemiology of the epidemic and the impact of HIV/AIDS prevention programs; Section II brings together learnings from program interventions including community mobilization interventions for female sex workers; Section III focuses on the vulnerabilities of high-risk groups such as female sex workers, MSM and IDUs; and Section IV includes papers on the vulnerabilities of bridge populations such as migrants, male clients of sex workers and trucker populations. Research highlights are presented at the start of each section. Sequential page numbers have been added to the published papers for easy reference.

We hope that this compilation of papers will be a useful reference tool to guide policy makers, program managers, and field teams in different states of India in the design and implementation of HIV prevention programs under the fourth phase of the National AIDS Control Program.

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[1]NIMS and NACO, *Technical Report, India, HIV Estimates-2012,* New Delhi: NACO, 2012.

[2]Kumar et al., Impact of targeted interventions on heterosexual transmission of HIV in India. *BMC Public Health* 2011, 11:549.

[3]NIMS and NACO, *Technical Report, India, HIV Estimates-2012,* New Delhi: NACO, 2012.

I Epidemiology and impact of HIV prevention programs

RESEARCH HIGHLIGHTS

Epidemiology and impact of HIV prevention programs

- Studies prior to NACP III have called for an effective national response that increases prevention coverage of high-risk groups, enhances access and uptake of care and treatment services, ensures systems and capacity for evidence-based programming, and builds technical and managerial capacity (Chandrasekaran et al., 2006).

Evidence-based planning and intensive programming efforts were key to India's success in reducing the number of new HIV infections by more than 50 percent over the past decade. Continuing evidence-based planning can lead India to a year with zero new infections.

- A focus on zero new HIV infections demands the expansion of the program to sexual partners of high-risk populations by ensuring the early detection of HIV and motivating HIV-infected men and women to adopt safe sex practices. As a result of evidence-based planning and intensive programming efforts with high-risk population groups, HIV prevention programs have resulted in a reduction in new HIV infections among adults across India, specifically in Mumbai (the epicenter of the HIV epidemic); the decline has been higher among female sex workers and their clients than among men who have sex with men and injecting drug users (Mishra et al., 2012).

- Concerted efforts that target high-risk groups (female sex workers, men who have sex with men, transgenders, injecting drug users) must be continued and strengthened in order to maintain condom use with high-risk partners and promote condom use in sex with regular partners. An analysis of two rounds of the Integrated Behavioral and Biological Assessment data indicates that the comprehensive HIV prevention program for female sex workers led to increased condom use with commercial partners and decreased/stabilized prevalence of sexually transmitted infections and HIV; however, condom use with regular partners continues to be low (Adhikary et al., 2012).

- Designing parallel policies for development and AIDS prevention is not cost-effective or sustainable as many of the vulnerabilities of high-risk groups are related to development issues such as lack of access to housing, social entitlements and basic financial services (banks, savings accounts). Development and prevention need to be approached in an integrated manner and in partnership with relevant stakeholders. As highlighted in a review analysis of structural interventions and their effect by Gupta et al. (2013), high HIV prevalence in several countries is due to lack of integration between HIV prevention programs and developmental programs; therefore, the convergence of these programs is highly recommended.

Review

Containing HIV/AIDS in India: the unfinished agenda

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India's HIV epidemic is not yet contained and prevention in populations most at risk (high-risk groups) needs to be enhanced and expanded. HIV prevalence as measured through surveillance of antenatal and sexually transmitted disease clinics is the chief source of information on HIV in India, but these data cannot provide real insight into where transmission is occurring or guide programme strategy. The factors that influence the Indian epidemic are the size, behaviours, and disease burdens of high-risk groups, their interaction with bridge populations and general population sexual networks, and migration and mobility of both bridge populations and high-risk groups. The interplay of these forces has resulted in substantial epidemics in several pockets of many Indian states that could potentially ignite subepidemics in other, currently low prevalence, parts of the country. The growth of HIV, unless contained, could have serious consequences for India's development. India's national response to HIV began in 1992 and has shown early success in some states. The priority is to build on those successes by increasing prevention coverage of high-risk groups to saturation level, enhancing access and uptake of care and treatment services, ensuring systems and capacity for evidence-based programming, and building in-country technical and managerial capacity.

Introduction

The first instance of HIV in India was detected in Chennai in the southern state of Tamil Nadu in 1986.[1] The National AIDS Control Programme was started in 1987 and focused mainly on surveillance in perceived high-risk areas, blood screening, and health education.[2] By 1990, a medium-term plan was formulated that focused on four high-risk cities. The first HIV/AIDS project with support from the World Bank began in 1992.[3] Programming has since expanded with assistance from several bilateral donors and, most recently, the Bill & Melinda Gates Foundation through its Avahan—India AIDS Initiative.[4] The National AIDS Control Organization (NACO) estimated that adult HIV prevalence in India was 0·88% in 2005, which translates into about 5·2 million people infected with HIV, or one in eight of worldwide HIV cases.[5] This number, however, masks distinct regional and subregional variations (figure 1) in a country with a population of 1 billion across 31 states and 593 districts.[6] This review will explore what is known and yet to be understood about the current extent and features of the various Indian subepidemics and discuss the status, challenges, and needs of a national response. Given the early stage of the epidemic in India, the emphasis of the discussion on national response will be on prevention, although the growing importance of the need for treatment is clear.

Data sources and limitations

Data related to the HIV epidemic in India come from: (1) routine sentinel HIV surveillance from antenatal and sexually transmitted disease (STD) clinics, and from interventions with populations at greatest risk (high-risk groups), including female sex workers, men who have sex with men, and injecting drug users; (2) mapping and size estimation exercises of high-risk groups; (3) some behavioural surveys in high-risk groups and the general population; (4) limited biological surveys in high-risk groups and the general population; and (5) facility-based studies. Depending upon the availability and extent of these data, it is possible to describe the epidemic drivers and suggest opportunities for programmatic response.

The Indian sentinel surveillance system

The main source of HIV prevalence data in India comes from the surveillance system of unlinked anonymous HIV testing in antenatal and STD clinics. The sentinel surveillance system has been expanding rapidly—from a total of 180 sites in 1998 to 393 antenatal clinics and 179 STD sites in 2005.[3,5] About 295 districts had at least one antenatal sentinel surveillance site as of 2005.

Prevalence estimated from antenatal surveillance sites has several limitations. Antenatal sites in India are largely located at government hospitals in urban areas, although 72% of the population is rural.[6] Antenatal coverage of women varies from over 90% in some southern states to as low as 34% in the northern states, while use of public-health services for antenatal care is estimated at 60%.[7,8] The low mean age for voluntary sterilisation of 25·7 years and the high proportion of women choosing this means of family planning—around 50% in the southern states—further skews antenatal clinic data.[7,9]

Interpreting estimated HIV infection numbers in the country either as point prevalence or as a trend series poses problems because of three factors: (1) rapid site expansion leading to sites with differing characteristics from year to year, (2) changing assumptions in estimation procedures, and (3) variable patterns of antenatal clinic attendance, which means that the data is not representative of the general population.[10] There is limited data on antenatal prevalence compared with general population HIV prevalence and no reported antenatal HIV validation studies. Where data do exist to compare antenatal and general population prevalence, the antenatal HIV prevalence was lower. For example, three studies in Tamil Nadu done in 1998, 1999–2000, and 2003–04 reported HIV prevalences of 2·1% in women, 1·4% in an urban sample of men and women,

and 0·3% and 1·4% among women and men, respectively.[11–13] By contrast, the corresponding antenatal prevalence data from nearby sentinel sites for those periods were 0·8%, 0·75%, and 0·6%. Despite these limitations, antenatal clinic data over time can point clearly to certain areas with consistently higher prevalence that warrant programme focus.

Sentinel surveillance in STD clinics for general populations and interventions for high-risk groups offer more insight into HIV epidemics at their early stages.[14] In India, roughly 30% of all districts have established sentinel surveillance sites at government STD clinics.[5] Little is known about potential biases of people attending government STD clinics, but one survey shows that only 10–40% of respondents from the general population with STD symptoms reported seeking treatment at government STD clinics during their last episode.[15] Anonymous HIV data is also collected annually from 132 out of 302 targeted interventions with high-risk groups as part of surveillance activities.[16] This collection offers a simple and lower cost method of monitoring trends in high-risk groups over time, but is subject to all the potential biases of facility-based sampling.[14,17] Surveillance through antenatal clinic sites can be a good late marker of trends once HIV enters the general population. However, for understanding drivers of an early stage epidemic, programme planning and measurement of programme effectiveness, mapping and size estimation of high-risk groups, periodic assessment of risk behaviours, and biomarker data are crucial.[14,18–23] With some exceptions, such data are sparse in India. There are few systematic processes of data collection in these areas; public-health research output in India is low in general.[24]

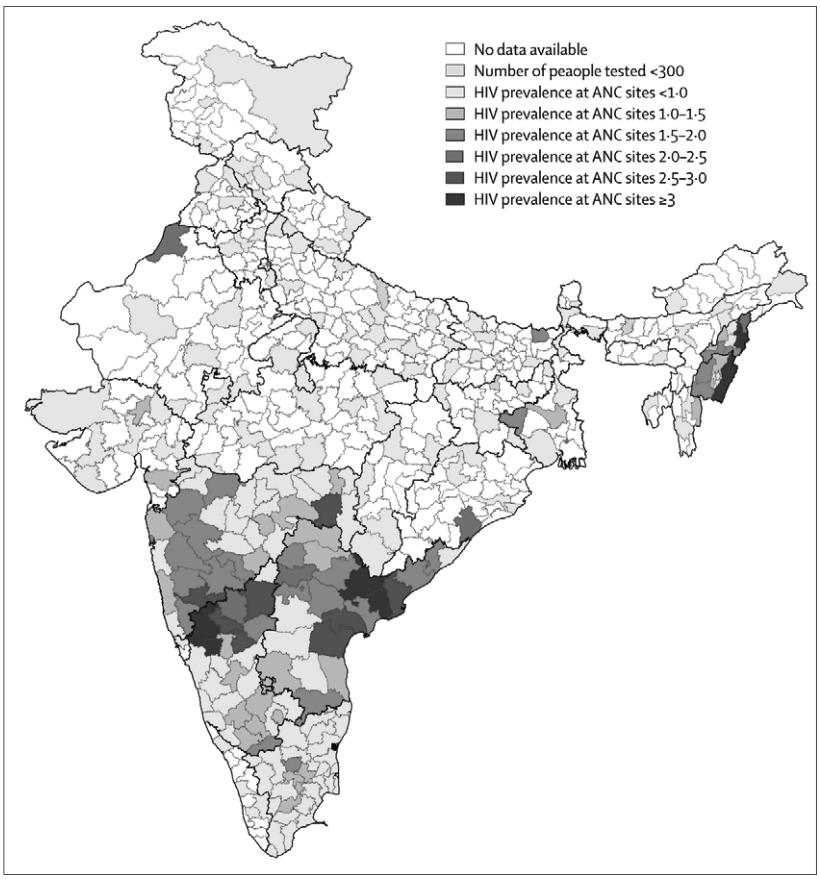

Figure 1: **2005 antenatal clinic HIV prevalence by district[5]**
District antenatal clinic HIV prevalence is an average of all antenatal clinic sites in the district. ANC=antenatal clinic.

Grouping Indian states by data availability, epidemic stage, and response

For the purposes of this review, we categorised Indian states into four groups that broadly reflect differences in (1) extent and availability of data, (2) severity of the epidemic and its drivers, based on available data, and (3) status and comprehensiveness of response (table 1).

With a total population of 292 million, the states of Maharashtra, Karnataka, Andhra Pradesh, and Tamil Nadu (Group I) account for nearly 3·5 million HIV infections.[5,6] Transmission is largely heterosexual.[3] As a consequence of years of sustained large-scale prevention efforts, there are fairly comprehensive mapping and size estimations of some high-risk groups and some behavioural, biological, and facility-based studies.

Manipur, Nagaland, and Mizoram (Group II) have a combined population of 5·5 million and abut Burma, an important source of heroin.[93] 50–75% of districts in Manipur and Nagaland report over 1% antenatal HIV prevalence, while Mizoram has shown consistent antenatal HIV prevalence of over 1% for 3 years in at least one district.[5] Transmission in these states is primarily via injecting drug use, and there is reasonable to extensive mapping and size estimation data for some high-risk groups.[3]

Delhi, Goa, Gujarat, Kerala, and West Bengal (Group III) form a loose grouping of states with a population of 187 million where on average, antenatal clinic sentinel surveillance covers 40–50% of districts, but no district shows over 1% prevalence consistently over 3 years.[5,6] Transmission in these states appears to be heterosexual. There is also reasonable mapping and size estimation data for some high-risk groups, the comprehensiveness of the mapping varying across states, depending on the extent of programming.

The rest of India (Group IV), consisting of states adjoining those in the first, second, and third categories, has a combined population of 576 million.[6] Typically, this group of states has antenatal clinic surveillance data in about 25% of the districts (with one or two exceptions), but no district covered under sentinel surveillance shows over 1% antenatal HIV prevalence consistently over 3 years.[5] Transmission in these states is most likely heterosexual, although mapping of high-risk groups is probably not comprehensive, as evidenced from the limited extent of HIV programming.

Drivers of India's subepidemics

In this section, we focus on what is known about (1) high-risk group presence, reported condom use, and HIV prevalence, (2) bridge and general population sexual networks, and (3) migration and mobility of both high-risk and bridge populations. The data reviewed came primarily from Group I, II, and to a lesser extent Group III states, since the states in Group IV are less studied and documented. The limited data indicates that India's epidemics seem to be largely driven and maintained

	Selected characteristics	HIV prevalence	Current HIV sentinel surveillance[5,25]	High-risk group data
Group I				
Four high prevalence states in south and west (Andhra Pradesh, Karnataka, Maharastra, Tamil Nadu)	Population:[6] 292 million Predominant HIV risk behaviour:[3] sexual Number of estimated high-risk group FSW: 338 000 (Avahan programme data;* FSW as proportion of female urban population: 1·27%) 150 421–194 594 (NACO;[26] size estimation, coverage; FSWs as proportion of female urban population: 0·56–0·73%) 869 000 (estimate)[27] MSM: 115 000 (Avahan programme data*) 37 548–58 396 (NACO)[26] IDU: 8760–10 938 (NACO)[26] Prevention programming history:[28] From 7 to 12 years of FSW and high-risk male prevention programming IDU and MSM prevention programming more recent and limited	Regionally >1% median ANC HIV prevalence At least 25% districts with >1% ANC HIV prevalence over 3 years[5] FSW: 1·2–50·2%[25,29–31] MSM:4·4–14·8%[25,32–34] TG: 43·9–68%[5,32,33] IDU: 0–33·2%[25,35] STD: 3·6–32·4%[5,36]	ANC HIV surveillance in some districts for over 7 years ANC HIV surveillance in all districts for past 2 years Overall 25–40% of districts have HIV sentinel surveillance among STD patients in district STD clinics. By state, 5–25% of districts have facility-based sentinel surveillance for high-risk groups–FSW, IDU, and MSM	Reasonable to high quality mapping and size estimation of FSWs, MSMs, IDUs Some behavioural and STI/HIV prevalence survey data[11–13,29,31,34,37–53] Some facility-based studies[30,32,33,35,36,44,54–58]
Group II				
Three northeast states (Nagaland, Manipur, Mizoram)	Population:[6] 5·7 million Predominant HIV risk behaviour: IDU Number of estimated high-risk group FSW: 7998 (NACO;[26] FSWs as proportion of female adult urban population: 1·28%) MSM: 1058–2700 (NACO)[26] IDU: 54 000 (Avahan program data;* excludes Mizoram) 45 936–53 952 (NACO;[26] IDUs as proportion of adult population: 1·9–2·7%) Prevention programming history:[29] Over 8 years of IDU prevention programming Sex worker and MSM prevention programming more recent and limited	Regionally >1% median ANC HIV prevalence (except Mizoram) At least 25% districts with >1% ANC HIV prevalence (except Mizoram)[5] FSW: 4–29·7%[25,59,60] MSM: 15·6%[25] IDUs: 0·4–33·6%[25] STD: 3·5–15·6%[5]	As above for Nagaland and Manipur, except that surveillance for high-risk groups is limited to one site per group per state For Mizoram, 38% of districts have ANC surveillance and 13% of STD clinics have surveillance. High-risk group surveillance is the same as Manipur and Nagaland	Good quality mapping and size estimation of IDUs/sex workers Some facility and population-based studies[59–64]
Group III				
A loose grouping of states (Kerala, Gujarat, Goa, West Bengal, Pondicherry, Delhi)	Population:[6] 187 million Predominant HIV risk behaviour: largely sexual (presumed) Number of estimated high-risk group FSW: 413 000–500 000 (estimate)[27] 104 217–125 907 (NACO;[26] size estimation, coverage; FSWs as proportion of female urban population: 0·60–0·73%) MSM: 26 166–76 074 (NACO)[26] IDU: 15 364–24 787 (NACO)[26] Prevention programming history:[28] From 7 to 12 years of FSW and high-risk male prevention programming IDU and MSM prevention programming more recent and limited	Regionally <1% median ANC HIV prevalence No district with ANC HIV prevalence >1% consistently over 3 years[5] FSW: 0·5–43%[25,65–68] MSM: 0·5–39·6%[25] IDU: 0·8–22·8%[25] STD: 0–16·5%[5]	On average, 40–50% of districts covered by sentinel surveillance of ANC and HIV among STD clinics Surveillance for high-risk groups is limited to one site except in West Bengal	Reasonable to good quality mapping and size estimation of sex workers Some behaviour/prevalence data[65–77] Few facility-based studies[78,79]
Group IV				
Rest of India (north, central, parts of the northeast)	Population:[6] 576 million Predominant HIV risk behaviour: largely sexual (presumed) Number of estimated high-risk group FSW: 870 000–1000 000 (estimate) 29 422–85 376 (NACO;[26] limited size estimation exercises, coverage numbers; FSWs as proportion of female urban population: 0·09–0·27%) MSM: 2655–12 153 (NACO)[26] IDU: 8268–15 956 (NACO)[26] Prevention programming history:[28] 7 to 12 years of limited high-risk group prevention programming	As in Group III FSW: 0–10·8%[25] MSM: 0·4–1·6%[25] IDU: 0–10·9%[25] STD: 0–8·6%[25,80,81]	On average about 25% of districts covered by sentinel surveillance of ANC and HIV Surveillance in high-risk groups sparse	Limited availability of mapping and size estimation data Little or no behavioural/biological survey data[82–84] Few facility-based studies[81,84–92]

ANC=antenatal clinic, FSW=female sex worker, IDU=injecting drug user, MSM=men who have sex with men, STD=sexually transmitted disease, TG=transgender. *Avahan is working in six states: Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Nagaland, and Manipur. In these states Avahan has invested in mapping and size estimation exercises in uncovered districts or parts of districts to gain a comprehensive denominator of high-risk groups for programming purposes. In Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra mapping and size estimation exercises were done for FSW and MSM populations. In Nagaland and Manipur they were done for IDU populations. Where size estimation or coverage data is cited as "Avahan programme" this refers to all data available in states on estimated size and coverage of interventions from both Avahan and state AIDS control societies of NACO.

Table 1: **Summary of selected characteristics, HIV prevalence, surveillance populations and surveillance coverage, data availability, and prevention programme history by groups of states**

through contact between high-risk subpopulations and bridge populations with onward transmission to spouses/girlfriends but without further spread—a so-called truncated epidemic.[94] There may be some exceptions in coastal Andhra Pradesh, southern Maharastra, and northern Karnataka, where local networks might sustain ongoing transmission.[94] Consequently, this discussion focuses on high-risk populations and key bridge populations, mainly clients of sex workers.

High-risk group presence and transmission risk

Female sex workers

Non-governmental organisations and social research organisations have done mapping and size estimation for female sex workers in urban areas in the Group I and II states and for most states in Group III over the past few years. Mapping and size estimation in Group IV states remain limited to large cities. A simple comparison of estimated female sex worker population per urban adult female population suggests female sex worker numbers in Group IV states have been substantially underestimated (eg, 0·56–0·73% in Group I states compared with 0·09–0·27% in Group IV states; table 1).

Transmission risk varies considerably by typology of sex work in the Group I states, both in the number of commercial transactions per day and, to some extent, by social norms regarding condom use.[95–98] According to data from the Avahan programme, only about 5–10% of sex work solicitation in the southern states occurs in brothel settings (figure 2), compared with 55–65% street-based and 20–30% home-based solicitation. In certain cities other typologies of sex work have been documented, including bar-based and cell phone-based, although the relative numbers of partners and risk behaviour in these types is not well described.[99] Typologies of female sex workers are fluid, in response to economic and other environmental pressures.[100,101] This dynamic situation complicates HIV prevention responses.

HIV prevalence in female sex workers varies widely across Group I states. In studies where reported condom use is high, HIV prevalence is relatively low in female sex workers. The comparatively low 9·5% HIV prevalence in population-based samples of female sex workers in Tamil Nadu correlates with high rates (80–90%) of self-reported condom use.[31,41] In the other three Group I states, HIV prevalence in female sex workers ranging between 4% and 49% have been documented.[25,29,30] HIV prevalence data in female sex workers from other state groups are in the range 0–43%.[25,59,60,65–68] Recent reports of higher HIV prevalence in young female sex workers in long standing prevention programmes suggest that prevention programmes need to address new entrants into the trade.[69,70] STD prevalence rates in female sex workers are variable but high. For example, reactive syphilis serology has been documented to range between 4% and 31%.[29,31,66–68,102]

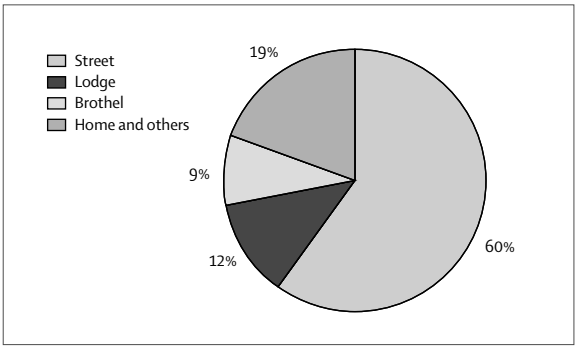

Figure 2: **Typology of female sex work in southern India (Avahan programme data, 2005)**

Men who have sex with men

Quantifying male-male sexual activity in India requires in-depth understanding of a complex tapestry of self-clagssification (kothis: mainly anal receptive; doubledeckers: both anal insertive and receptive; panthis: anal insertive; and transgenders) related to sexual behaviour and varying levels of risk.[103,104] Size estimation and HIV prevalence data for men who have sex with men are difficult to interpret, since eligibility criteria for inclusion are not always clear. Male to male sexual activity seems common in both urban and rural India. One population-based study of five rural districts found that 10% of single men and 3% of married men reported anal sex with a man in the previous year.[105] State-wide mapping exercises from urban areas of Tamil Nadu, Andhra Pradesh, and Karnataka in 2003–04 estimate the population of male sex workers, including transgenders, to be as high as 25% of the female sex worker population.

Limited reports suggest that men who have sex with men, particularly transgender men and male sex workers, have high HIV and STD prevalence levels and are at substantial risk for acquiring HIV.[25,32–34,49] These data are consistent with findings elsewhere in Asia.[106,107] In India, large proportions of men who have sex with men have regular female sex partners, comprising an important bridge group.[36,48,108–110] A large study of men who have sex with men in Andhra Pradesh found that 51% reported sex with a woman in the past 3 months; reported condom use was 44% and 16%, respectively with last male and female partner.[48] Much more needs to be understood regarding men who have sex with men typologies, sexual networks, and risk behaviours to determine their role in the epidemic and develop effective prevention responses.

Injecting drug users

Injection drug use is a major driver of the epidemic in the northeast states. Recent size estimation data show that injecting drug users could constitute 1·9–2·7% of the adult population in Manipur and Nagaland (table 1). In addition to the known risks of HIV transmission

through sharing injection equipment, sexual transmission is also important. In a sample of injecting drug users in the northeast, 75% were HIV positive, most were under the age of 19 years, two-thirds were sexually active, and 3% reported using condoms.[111] The risk of HIV transmission to sexual partners and wives of injecting drug users has been documented across India.[35,62,63]

Monitoring the intersection and overlap of injecting drug user and sex worker networks is important for programming responses and tracking spread to the general population.[61,112] Mapping exercises of the three northeast states show substantial numbers of female sex workers in urban/valley areas where injecting drug users are also in higher numbers.[26] Data from one voluntary counselling testing centre suggests increasing HIV prevalence in female sex workers in Manipur.[59] Although population mobility between the northeast and the rest of India is limited, most goods travel to the northeast by road. Therefore, more understanding is needed of the sexual and injection networks between truckers, female sex workers, and injecting drug users in the northeast as a potential driver of epidemic spread to other parts of the country.[64]

Injecting drug users are also found in most of the major cities in India outside the northeast (table 1) and HIV prevalence rates ranging between 2% and 44% have been documented among them.[35,38,113–115] Little is known about injecting drug user overlap with other risk groups in states outside the northeast. 80% of NACO-supported prevention interventions for injecting drug users are in Group II states.

Figure 3: **Mobility and migration patterns in truckers and labourers have a key role in spreading the HIV epidemic**

Bridge populations, sexual partnerships, and mixing

The key bridge populations in India are clients of sex workers but also include men who have both male and female partners, and regular partners of sex workers. Compared with information on female sex workers, few studies exist to quantify these men or to understand their patterns of risk behaviour. Behavioural surveys from Tamil Nadu and Karnataka suggest 11–18% of rural men, 10% of factory workers and men in urban slums, and 2% of rural workers report commercial sex partners.[37,41,94] A national sample of male clients of female sex workers found that 3% had sex with a male partner in the previous year.[116] Studies also indicate that about 50–70% of clients of female sex workers are either married or have a regular female partner.[37,40,41,116]

Non-regular partnership (including commercial sex partners) in the general population was reported by 11% of men and 2% of women overall in the 15–49 year age group in a nationally representative behavioural survey.[15] However, substantial regional differences exist. In Andhra Pradesh and Maharashtra, 15–19% of men and 7% of women reported having non-regular partners in the past year compared with 4–5% of men and 0·5–1% of women in Orissa, Rajasthan, and West Bengal.[15] More in-depth study of partnership patterns in India is needed, particularly of partner concurrency in the context of heightened infectivity during acute stages of HIV infection and the effect on spread in the general population.[117–120] Truckers are another important bridge population recognised early in India.

Mobility and migration

Data from the region and in Africa suggest mobility and migration separates people from their social support structures, creating a social milieu in which they are more likely to engage in risky behaviour, in turn leading to their having a key role in spreading the HIV epidemic in other areas.[121–126] Large scale population mobility occurs in India, primarily in the form of male migrant labour. Although interstate migration reflects only 15% of all migrants, the absolute magnitude of interstate migration is still large.[127]

Mumbai (formerly Bombay), a key destination for single male migrants, assumes special importance for the spread of HIV in India. The percentage contribution of migration to the population growth of Mumbai between 1951 and 2001 has averaged 50%, with migrant men coming from as far as Uttar Pradesh, Bihar, and southern Tamil Nadu.[128] A 1999–2000 study estimated net interstate out-migration to be 3·9 million people from Bihar and Uttar Pradesh combined, with Mumbai as the single largest destination. HIV prevalence rates of 40% or more have been documented in the female sex worker population in Mumbai for over a decade; other studies point to Mumbai as the source of HIV for returning migrants to Nepal.[5,124,129]

Truckers are a special case of mobile men with a well-defined mobility pattern due to their organisation by

	Coverage of high-risk groups		Care and treatment				Funding*
	Number of TIs for FSW, MSM, IDU[16]†	% coverage all interventions (mean [range])‡	Estimated HIV infections 2004[137]	PMTC sites, VCTC sites, and VCTC client load, 2005[138]	Reported AIDS cases, 2005[138]	ART availability and patients on ART in government clinics, 2005[138]	Funds allocated for HIV/AIDS 2002, 2003, 2004 in US$ million, (per capita)[139,140]
Group I	FSW: 98 MSM: 15 IDU: 4 Other TIs: 252§	FSW: 72% (51–95%) MSM: 37% (8–63%) IDU: Not clear, likely low	3 488 360	PMTC sites: 395 VCTC sites: 510 VCTC clients: 524 249	91 589	29 centres 15 550 patients	2002: $12·8 million ($0·09) 2003: $12·27 million ($0·08) 2004: $18·95 million ($0·13)
Group II	FSW: 13 MSM: 1 IDU: 69 Other TIs: 17	FSW: Not clear MSM: Not clear, likely low IDU: 71–76% (excluding Mizoram)	63 521	PMTC sites: 19 VCTC sites: 64 VCTC clients: 9786	3708	3 centres 1577 patients	2002: $4·11 million ($1·43) 2003: $5·30 million ($1·84) 2004: $8·30 million ($2·89)
Group III	FSW: 36 MSM: 12 IDU: 7 Other TIs: 206	Not clear FSW likely to be in excess of 50% (West Bengal is higher) MSM: Likely low IDU: Likely low	597 505	PMTC sites: 38 VCTC sites: 169 VCTC clients: 161 522	14 137	11 centres 4978 patients	2002: $6·94 million ($0·07) 2003: $7·65 million ($0·08) 2004: $10·09 million ($0·11)
Group IV	FSW: 38 MSM: 3 IDU: 6 Other TIs: 188	Coverage numbers unclear	970 721	PMTC sites: 33 VCTC sites: 371 VCTC clients: 275 416	8282	9 centres 2306 patients	2002: $15·35 million ($0·05) 2003: $12·87 million ($0·04) 2004: $21·62 million ($0·08)

ART=antiretroviral therapy, FSW=female sex worker, IDU=injecting drug user, MSM=men who have sex with men. PMTC=prevention of parental to child transmission, TI=targeted intervention, VCTC=voluntary counselling and testing centres. *Excludes funding under the Bill & Melinda Gates Foundation Avahan—India AIDS Initiative. †This list of targeted interventions includes those being run under NACP-2 but does not include interventions funded by Avahan in Tamil Nadu, Maharashtra, Karnataka, Andhra Pradesh, Manipur, and Nagaland. ‡Coverage calculated by estimated number of beneficiaries served through NACO-funded TI programmes and, where applicable, Avahan supported interventions over the total size estimation of the population subgroup in the state. Where estimates were considered unreliable or coverage numbers not available, no coverage estimates were made. Judgments of low coverage are based on the small number of funded TIs to cover the high-risk group. §Other TIs include truckers, migrant workers/slum, street children, prisons, and composite (eg, multiple high-risk groups covered together in one intervention to meet minimum numbers of population served under costing guidelines).

Table 2: **HIV/AIDS programming by categories of states**

specific routes. There are about 3 million trucks, often with both a driver and younger male helper, plying the roads in India (figure 3).[130] Approximately 40–50% of truckers work on long distance routes, staying away from home for a month or more. Surveys in truckers indicate that they are more likely to be clients of female sex workers than men in the general population, with 24–34% reporting commercial sex in the previous year.[37,40,41,116] Estimates of HIV prevalence in truckers range from 4% to 11%.[39,131–133] Some studies suggest that male to male sexual activity between truck drivers and helpers also occurs.[131,132]

There are limited formal studies of the patterns of sex worker mobility and migration. However, programme experience suggests female sex workers are highly mobile within and between districts and states. Drivers of female sex worker mobility include both a historical reputation for sex work in women in certain source districts and their consequent demand elsewhere (eg, from certain coastal districts in Andhra Pradesh to Mumbai and Goa), and more recently, poverty and economic opportunity (eg, from northern Karnataka to southern Maharashtra or from West Bengal to Mumbai).[43,134–136]

The magnitude and general patterns of mobility and migration in India indicate potential for HIV spread, particularly in the north and central states. However, without coincident presence of local high-risk sexual networks in the source communities, returning migrants might not be sufficient to spark locally self-sustaining HIV transmission. This situation underscores the need for detailed mapping and understanding of risk behaviours of high-risk and bridge groups in these states.

Current national response to the epidemic

Table 2 provides a snapshot of select data related to HIV/AIDS programming in India. In 1992, the first Indian National AIDS Control Project (NACP-1) was launched under World Bank funding.[3,28] The project succeeded in establishing state AIDS control cells in all states and union territories but, due to substantial variations in state capacity and commitment, the resources were spent disproportionately by a few states—eg, Tamil Nadu, Maharashtra, and West Bengal.[28] Over the next few years, more state and national level programmes were launched under funding from other major donors.[28] NACP-2 was launched in 1999.[3] Tamil Nadu and West Bengal have shown clear, early success, although the record is less clear for other states.[28,72,73,77,141]

The estimated total amount spent on HIV/AIDS in India in 2004 was US$79 million (including Avahan funds) or about $0·15 per capita of the adult population. This spending compares with an estimated $1·74 per capita for Thailand or $0·28 per capita for China during the same period, but must be seen against the backdrop

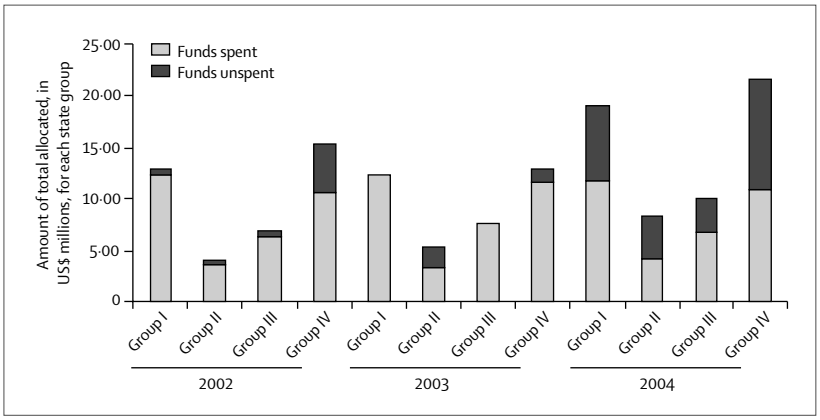

Figure 4: **Use of allocated funds under NACP-2 in 2002, 2003, and 2004 by state groupings[139,140]**

of overall low general government expenditure on health in India of $7 per capita.[142–144] This allocation was not uniform across the state categories and more importantly, use of funds as evidenced from expenditure versus allocation of funds under NACP-2 is distinctly variable across different regions—from 51% to over 90% (figure 4).[139,140]

Status of existing HIV prevention programmes

Under NACP-2, the Indian government has been supporting interventions that focus on high-risk groups appropriate to the epidemiology of HIV in India. The package, called targeted interventions, has five basic elements shown globally to be effective: behaviour change communication/peer education, STD treatment, condom promotion/provision, enabling environment, and community mobilisation (figure 5).[145,146]

In August 2005 there were 965 targeted interventions covering female sex workers, men who have sex with men (including transgenders), and injecting drug users as well as migrant workers in slums, street children, prisoners, truckers, and mixtures of the target groups in all but two states.[16] Of these, only 31% focused on female sex workers, men who have sex with men, or injecting drug users. Independent assessments of these programmes done in 2002 and 2003 identified some shortcomings.[28,147] These shortcomings included rigidity of financing mechanisms and flow of funding that limited flexibility on the ground, resulting in under-use of funds in some regions, lack of a coordinated state-level strategy, limited focus on coverage, and diffused programming with substantial interventions in non-priority groups. With respect to targeted interventions, the reports identified the current primary focus on behaviour change communication and free condom distribution with limited options for quality STD treatment, especially for women, as areas for improvement. In particular, the reports noted a need to mount structural interventions that could substantially change environmental factors increasing risk (eg, violence faced by sex workers) to organically foster a strong community-led response.[148–150] The reports also suggested that there was inadequate focus on male clients, and limited evaluation of effectiveness.

Figure 5: **Education and communication display on HIV/AIDS at an interstate border checkpoint**

Large-scale programmes covering high-risk groups in more than four or five districts per state are no more than 7 years old, even in some Group I states.[28] In 2003, at the inception of the Avahan programme, coverage of female sex workers by current programmes was 12% in Karnataka and 40% in Andhra Pradesh.[4] Even a state as mature as Tamil Nadu had about 40% coverage, with low coverage in its western districts despite large numbers of high-risk group members. Programming for men who have sex with men was also limited—31 of 965 targeted interventions in August 2005 were for such individuals.[16] Given that mapping and size estimation data is not comprehensive for many of the states in the rest of India, it is difficult to make estimates of coverage in those states but it is likely to be much lower than the high prevalence states in Groups I and II where most interventions have been mounted.

Finally, sales of socially marketed condoms, which can help corroborate the impact of HIV interventions, has grown slowly at an annual rate of 6% between 1999 and 2004 (figure 6).[151,152] This is in the context of an already low use of condoms as a family planning method.[7]

Status of current care and treatment programming

Against a background of an estimated 5·2 million HIV infections in 2005, between 600 000 to 700 000 people were projected to have AIDS in India.[153,154] Officially, 17 716 AIDS cases were reported to NACO at the end of 2005.[138] NACO had supported a limited number of testing centres since 1997 but began scaling up substantially from 2002. By the end of 2005, over 1110 were operational.[3,138] These testing centres served over 970 000 clients in 2005.[138]

At the end of 2005 there were 52 NACO supported antiretroviral therapy centres providing care to 24 301 AIDS patients.[138] An additional 10 333 patients received care through centres supported by the Global Fund to Fight AIDS, Tuberculosis and Malaria through government hospitals, non-governmental organisations, intersectoral partners, and private hospitals.[155] The initial establishment of antiretroviral therapy services focused on tertiary care centres and was not linked to on-going prevention efforts. Group I states with the greatest HIV burden have a disproportionately low number of centres (table 2). In addition to antiretroviral therapy service expansion, more support is planned for management of opportunistic infections, home-based and palliative care, and addressing children.

Potential impact of the epidemic

The epidemic in India is difficult to classify given its scale and geographic diversity. Moreover, given the limited sources of systematic data, it is difficult to assess either the big picture or local epidemic patterns accurately. Minimum data required to realistically estimate past and current HIV infections, AIDS cases and deaths, or to project epidemic trends, are typically not available in most places in India.[156] A recent analysis of aggregated antenatal clinic data across sites suggests that HIV incidence in Group I states might be declining, as measured by trends in HIV prevalence in young women aged 15–24 years.[157] However, the same study also shows that, when disaggregated by state, the possible pattern of declining incidence does not hold in at least two of the four states in the analysis, Andhra Pradesh and Karnataka. The hypothesis of declining incidence in these states needs much closer scrutiny given the limitations of the antenatal clinic data upon which the analysis is based, and the obscuring of local patterns resulting from aggregation of data over epidemiologically diverse areas. Ideally these data should be reanalysed in light of geographic variation and varied intervention responses. Such analyses could help to better explain the continuing high levels of HIV infection in female sex workers reported by some studies, and possible stabilisation where there have been long-standing interventions.[30]

Studies suggest that even a low level epidemic in perhaps one-eighth of India's 593 districts would have a disproportionate socioeconomic impact.[158,159] About 80% of India's health-care spending is private spending, and a single catastrophic illness puts a household into debt for perpetuity.[160] The social fallout and the devastation to an already fragile public-health system would be huge, even if AIDS were to affect only a few sections of some states. Finally, because AIDS in India affects the poor disproportionately, there could be a major impact on the Millennium Development Goals. An Asian Development Bank/UNAIDS report estimates that AIDS could slow poverty reduction goals by 23% between 2003–15.[158]

Ultimately the most obvious impact will be on mortality. WHO estimated that in 2002 AIDS accounted for 3% of all deaths and 9% of all infectious disease deaths in India. AIDS is projected to account for 17% of all deaths and 40% of all infectious disease deaths by 2033, making it the largest killer among infectious diseases in India.[161,162] The incidence of tuberculosis in India, the source of 20% of all new tuberculosis cases globally, is projected to increase by 12% between 1990 and 2015 as a result of HIV.[163]

Ensuring an effective national response

Implementing an effective response to HIV in India presents extraordinarily complex challenges, due to the country's scale; the diversity, size, and mobility of the populations at risk; and the highly stigmatised nature of HIV. To mount a response capable of bringing HIV under control, India must address high-priority gaps in national HIV efforts, by (1) increasing prevention coverage of high-risk populations,[164] (2) enhancing access and uptake of care and treatment services linked to these prevention services, (3) ensuring commitment to evidence-based HIV programming and investing in strategic knowledge building, and (4) building technical and managerial capacity.

In mid-2005, NACO and an advisory committee embarked on a nationwide, participative process to develop the NACP-3 strategy and implementation plan. NACP-3 implementation is scheduled to begin in 2006 and will continue to place appropriate and substantial resources into prevention through focused programmes for high-risk and bridge groups, as well as decentralising and expanding infrastructure for care and support.[165] The strategic collection, synthesis, and use of data to inform programme planning, and the need for state level capacity building have also gained increased attention in the design of NACP-3.[166] India's challenge is to ensure that this programme is rapidly brought to scale and implemented with quality, which will require strategic knowledge building, scalable approaches to prevention, and resources for capacity building.[24]

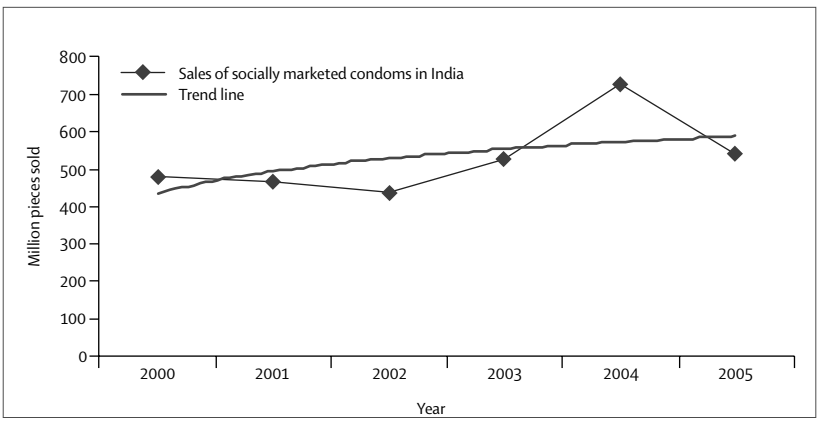

Figure 6: **Socially marketed condom sales for all India, 2001–05**[151,152]

Strategic knowledge building

Given India's scale, and the diversity and mobility of the populations at risk, combining prioritised data collection with active programme management is critical for staging an effective response to the evolving HIV epidemic.[167]

Knowledge building and data gathering efforts will need to be tailored to the epidemic and programme needs on a state or regional level. The concentrated and truncated nature of the epidemic, in most areas of the country, suggests sentinel surveillance of high-risk groups—eg, female sex workers, men who have sex with men, and injecting drug users—might be more informative about the epidemic's progress and programme effectiveness than reliance primarily on antenatal clinic data.[14] Such surveillance ultimately requires comprehensive mapping and size estimation of populations of female sex workers, men who have sex with men, and injecting drug users, at least in urban centres across India and in particular in the northern and central states, although for areas with little experience or data, rapid assessments followed by interventions would be a first step.[14]

Beyond better mapping, size estimation, and surveillance, research is needed to understand the profile of recent infections in different regions and the social contexts and patterns of sexual networking between female sex workers, injecting drug users, men who have sex with men, and male clients. This research will provide insight into transmission dynamics and the proximate determinants of infection that can be addressed through prevention programmes.[168] The ability to profile and segment high-risk groups by degree of risk and focusing efforts on its most vulnerable members will enhance the effectiveness of programmes with limited resources.

Scalable approaches to prevention with high-risk groups

Saturated coverage of high-risk groups with focused prevention programmes remains a key strategy for the Group I and II states and must now be comprehensively implemented in the rest of India. Given the sheer size and scale of India, it is essential to supplement the one-to-one service delivery approaches that characterise current models of targeted interventions with more efficient, scalable methods. Such methods should include (1) leveraging existing social networks and community structures for reaching large numbers of individuals, (2) reducing vulnerability of marginalised groups by addressing structural barriers, and (3) catalysing changes in social norms and environmental conditions.[148,169–173]

Explicit attention should be paid towards facilitating the use of peers to access communities, and to fostering community identity and cohesion in marginalised groups to help create social norm change around safe behaviour and self-efficacy in collectively handling barriers related to power structures. Enabling marginalised groups to access existing government health services and schemes such as ration cards and micro loans, appropriate sensitisation and training of health-care personnel, and advocacy leading to legal and policy changes can reduce vulnerability, raise self-efficacy, address sex inequities, and also extend prevention programme resources.[174] High-level advocacy with police, media, and celebrity advocates to create a prevention-friendly environment and address HIV and sexual health-related stigmatisation is essential.[101] Finally, aggressive condom promotion campaigns to normalise condom use to supplement social marketing and targeting to high-risk groups should be an essential part of the intervention package in every state.

Prevention programmes gain effectiveness and sustainability when implemented in the context of a strong public-health system and linkages to other programmes. Government services for STDs and basic HIV care require more resources for training and sensitisation of personnel to meet the needs of female sex workers, men who have sex with men, injecting drug users, and people living with HIV/AIDS. In certain settings, providing specialised STD and HIV testing services customised to meet the specific needs of communities may be warranted. In a context of limited, affordable antiretroviral treatment, improving access and ensuring marginalised groups are not discriminated against becomes critical. Ensuring HIV and tuberculosis programming receives attention from broad efforts to strengthen and integrate public sector health services—eg, the National Rural Health Mission in India and the Revised National TB Programme—requires strong national leadership.[160,175,176]

Search strategy and selection criteria

We did a complete search of the National Library of Medicine for journal articles and abstracts for the year 1995 to the present using broad search terms such as "HIV", "India", "female sex workers", "MSM", "IDU", and "migrant men". We identified additional sources through a Google and Google Scholar search using the same terms and through review of reference lists of relevant publications. We obtained HIV/AIDS/STI surveillance reports from the Indian National Government or State Government offices either through website access (http://www.nacoonline.org, http://www.indiastat.com) or on personal requests. We also scanned the websites of international agencies involved in interventions or research projects on HIV/AIDS. Finally, we obtained unpublished field reports through personal contacts with HIV programme personnel in India. We considered references from 2000 onwards for inclusion unless an older publication was the only relevant one identified. In addition, we avoided conference abstracts unless they were the only source of information. We restricted the search strategy to English language publications.

Human capacity building

Management and technical capacity within government and the non-governmental organisation sector to implement effective programmes remains an area that requires renewed focus for India to execute the scaled effort required to contain the country's epidemic. Enhanced management skills are required to prioritise action, optimise service delivery mechanisms, and to use data to monitor achievements towards set objectives. Limited technical expertise in general, and in data analysis in particular, especially at state and local levels, restricts the country's ability to adjust programming and anticipate emerging areas of need. Building these capabilities will entail flexible recruitment, a network approach to training and on-site support, and tapping resources outside the government sector.

Looking ahead

India's national political leadership has made a strong commitment to a robust HIV/AIDS response. The process for developing NACP-3 has been transparent and collaborative, and the strategy appropriately puts prevention programmes for high-risk populations at the forefront. There are, however, substantial hurdles ahead for India if it is to mount a truly effective response. Rallying political will at the state and district level to address the challenges, especially in the northern states, remains one of the biggest obstacles to a nationwide response. Ensuring adequate resources and efficient use and flow of funds is critical. Technical and especially management capabilities and systems must be enhanced at all levels. As India's epidemic matures there will be increasing demands on HIV/AIDS money to address the widening needs from prevention to care to treatment. India must keep the focus on the unfinished HIV prevention agenda in the country.[177,178]

Conflicts of interest

We declare that we have no conflicts of interest.

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Changing Epidemiology of HIV in Mumbai: An Application of the Asian Epidemic Model

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Abstract

Background: Mumbai is one of the most populous and high HIV prevalence cities in India. It has witnessed substantial changes in HIV-risk behaviors and a decline in HIV prevalence among high-risk groups during the past decade. **Aim:** To examine the changing pattern in the number of new HIV infections by transmission routes in Mumbai during 2000-2017. **Methods:** We used the Asian Epidemic Model by dividing the adult population (aged 15 and above) into seven subgroups: brothel-based and non-brothel based female sex workers (FSWs), heterosexual clients of FSWs, men who have sex with men/transgendered people (MSM), injecting drug users (IDUs), general women and general men. The MSM subgroup included homosexual and bisexual men. **Results:** New HIV infections among adults reduced by 86% during 2000-2010. The highest decline was among FSWs and their heterosexual clients (95%-98%), followed by MSM (82%), general women (77%), IDUs (51%) and general men (42%). Most new HIV infections during 2011-2017 are expected to occur among general women (1666) and general men (977) followed by MSM (715). Bisexual men were estimated to contribute about 14% of the new HIV infections among general women in 2010 and this proportion was estimated to increase to 19% in 2017. **Discussion:** HIV prevention programs for MSM and the general population need to be strengthened. Ensuring early detection of HIV, and higher levels of consistent condom use by HIV-infected men and women are essential to prevent new HIV infections in future.

Keywords: Asian Epidemic Model, Human Immunodeficiency Virus, Mumbai

1. Introduction

Mumbai is the capital of Maharashtra, which is one of the six high HIV prevalence states in India (National AIDS Control Organization, 2010). Mumbai is one of the most populous cities in the country, housing over 12 million people in 2011 (Registrar General of India, 2011). Since the inception of the HIV epidemic in the country, Mumbai has received extensive attention from epidemiologists, public health experts, social scientists and policy makers due to high HIV prevalence among both high-risk groups including female sex workers (FSWs), injecting drug users (IDUs), and men who have sex with men/ transgendered people (MSM) and low-risk women attending antenatal clinics (hereafter referred to as ANC women) (India Health Action Trust, 2010; Jain, John, & Keusch, 1994). Being the financial hub of the country, Mumbai has been a preferred destination for employment for thousands of young men from low HIV prevalence states (Jain et al., 1994; Saggurti, Verma, Jain, Achyut, & Ramarao, 2008; Singh, 2006). Many of these migrant men stay alone in the city away from their family, and a substantial proportion visit FSWs (Saggurti, Schensul, & Verma, 2009; Saggurti et al., 2008; Verma, Saggurti, Singh, & Swain, 2010). Research suggests that men with a non-resident wife practice high HIV risk behaviors in Mumbai and hence constitute an important bridge population to transfer the epidemic from high HIV prevalence areas to low HIV prevalence areas of the country (Saggurti et al., 2009; Verma et al., 2010). Mumbai also has major halt points where a large number of truckers wait for their consignments for a considerable period of time. The high-risk sexual behaviors of truckers in Mumbai has also been documented (Churi & Anjenaya, 2010; Zahiruddina, Gaidhanea, Shanbhagb, & Zodpeyb, 2011). Further, more than half of Mumbai's population lives in slums (Singh, 2006) where men's high-risk behavior has been reported (Saggurti et al., 2009; Schensul et al., 2006).

As in many places in India, the HIV epidemic in Mumbai is also believed to be largely driven by unprotected sex with FSWs; however, the presence of several high-risk groups in Mumbai has resulted in a more complex local HIV epidemic than elsewhere in the country (Avert Society, 2004, 2009; Family Health International, 2001; India Health Action Trust, 2010). This was reflected in the national response to the epidemic by setting up an autonomous society for implementing HIV prevention programs in Mumbai while in other parts of the country such programs are implemented by corresponding State AIDS Control Societies (National AIDS Control Organization, 2006a). Intensive HIV prevention interventions in Mumbai are being implemented by both government and non-government organizations. The intervention strategies include peer-led outreach for safe-sex counseling, distribution of condoms (free as well as socially marketed), treatment of sexually transmitted diseases (STD), needle and syringe exchange, community empowerment, and building a health enabling environment (Bill & Melinda Gates Foundation, 2008a; National AIDS Control Organization, 2006a; The Humsafar Trust, 2012). In Mumbai HIV prevention programs have been condom-centric and have focused primarily on FSWs, MSM, and truckers as most of the infections in India, apart from the north-eastern states, occur through the sexual route (Bill & Melinda Gates Foundation, 2008a, 2008b; National AIDS Control Organization, 2006a). The government provides treatment and care services to those infected with HIV, which are equally accessible to all individuals (National AIDS Control Organization, 2006a, 2010).

The major data sources to monitor the HIV epidemic in Mumbai are the annual HIV sentinel surveillance, facility-based data {National program for the prevention of parent-to-child transmission, National program for integrated counseling and testing centers, National program for antiretroviral therapy (ART)}, behavioral surveys, integrated behavioral and biological surveys, and size estimation and mapping data (India Health Action Trust, 2010; Sgaier et al., 2012). These data sources provide information on trends in the number of people in high-risk groups, HIV risk behaviors among high-risk and low-risk groups, and STD/ HIV prevalence among selected subgroups including FSWs, MSM, IDUs, and ANC women, and the number of people living with HIV who are receiving ART. Insights from these data sources suggest that during the past decade Mumbai has witnessed substantial changes in behavioral, social, cultural, and structural factors, which may affect the epidemiology of the HIV epidemic in the city. These changes include increase in consistent condom use by FSWs with clients from 62% in 2003 (Avert Society, 2004) to over 90% in 2009 (Avert Society, 2009; Indian Council of Medical Research & Family Health International, 2011), increase in consistent condom use by MSM in anal sex with men/ transgendered people from about 56% in 2001 (National AIDS Control Organization, 2006c) to about 80% in 2009 (Avert Society, 2009), decrease in the proportion of brothel-based FSWs from about 48% in 2001 (Family Health International, 2001) to about 30% in 2008 (India Health Action Trust, 2010), sharp decline in HIV prevalence among FSWs from over 50% in 2002 to less than 10% in 2008 (India Health Action Trust, 2010) and the introduction ART in 2004 (India Health Action Trust, 2010). The program monitoring data suggest that till April 2009, about 19500 people had ever started ART and 14604 were continuing on ART (India Health Action Trust, 2010).

Although the available data sources provide information on trends in HIV prevalence among FSWs, MSM, IDUs, and ANC women, they do not provide estimates of the number of new HIV infections in various subgroups, which is much more sensitive to the changing dynamics of disease transmission and a more accurate measure to detect program impact. Further, the distribution of new HIV infections by routes of transmission among various subgroups cannot be estimated and projected directly from the available information. This information, if available, could be of great value to policy makers in designing effective HIV prevention interventions and for the allocation of resources.

Mathematical models are often used to overcome the limitations of existing data sources by extracting such information from them. This paper uses the Asian Epidemic Model (AEM) to assess the changing epidemiology of HIV in Mumbai during 2000 to 2017 by: (1) estimating and projecting the number of new HIV infections among subgroups including brothel-based and non-brothel-based FSWs and their clients, MSM, IDUs, low-risk men and low-risk women, and (2) estimating the trend in distribution of new HIV infections among various subgroups by routes of transmission.

2. Methods

2.1 The Model

The AEM was developed by the East-West Center with support from USAID, UNAIDS, Family Health International, World Health Organization, and World Bank (Brown & Peerapatanapokin, 2004). The model considers HIV transmission among men and women aged 15 years or older (hereafter referred to as adults). People enter the population at age 15 and depart as a result of either AIDS-related or non-AIDS related death.

The model allows the entire population to be divided into several subgroups according to their relevance to the socio-cultural setting and the nature of the local epidemic. It then mathematically replicates key processes driving HIV transmission among the defined subgroups.

We divided the adult women's population into following three subgroups: (1) brothel-based FSWs (defined as FSWs who usually solicit from brothels); (2) non-brothel based FSWs (defined as FSWs who usually solicit from places other than brothels, such as streets, parks, lodges, home, and hotels); and (3) general women (defined as women who are not FSWs). FSWs were subdivided in two groups mainly because the sex work industry in Mumbai has changed substantially during the past decade. The adult men's population was divided into the following four subgroups: (1) heterosexual clients (defined as heterosexual men who visit FSWs); (2) IDUs (defined as men who inject drugs); (3) MSM (defined as men who have sex with other men/ transgendered people); and (4) general men (defined as low-risk men who are not heterosexual clients, IDUs, or MSM). We did not consider women who inject drugs as most of the IDUs in India, except those in north-eastern states, are assumed to be men (Bill & Melinda Gates Foundation, 2009; Sarna et al., 2012; Solomon & Solomon, 2011). Moreover, women who have sex with women were not considered in the model because it is believed that this subgroup is almost nonexistent, at least in terms of its potential to drive the HIV epidemic in India (National AIDS Control Organization, 2006a). The MSM subgroup included homosexual (defined as men who only have sex with men/ transgendered people) and bisexual (defined as men who have sex with both men/transgendered people and women) men. It was necessary to make these distinctions in the MSM subgroup to account for the relatively higher HIV-risk behaviors observed among bisexual men as compared with their heterosexual counterparts in Mumbai (Hernandez et al., 2006).

It was assumed that individuals in the each subgroup interact with individuals in some (or all) of the other subgroups. These interactions defined the routes of transmission for each of the above-mentioned seven subgroups. For instance, HIV infection among FSWs was assumed to occur due to interaction (i.e., unprotected sex) with IDUs, heterosexual clients, and bisexual clients. Similarly, among MSM, HIV infection was assumed to occur as a result of unprotected sex with men/transgendered people or FSWs. The possible routes of transmission for each of the above subgroups considered in the model are presented in Table 1.

Table 1. Sub-groups and corresponding routes of transmission considered in the AEM

Subgroup	**Routes of transmission**
IDUs	IDUs
	Brothel-based FSWs
	Non-brothel based FSWs
FSWs (brothel and non-brothel-based FSWs)	IDUs
	Heterosexual clients
	Bisexual clients
Heterosexual clients	Brothel-based FSWs
	Non-brothel based FSWs
MSM (homosexual and bisexual men)	MSM
	Brothel-based FSWs
	Non-brothel-based FSWs
General women	Heterosexual regular male sexual partners
	Bisexual regular male sexual partner
	Casual male sexual partners (premarital, extramarital)
General men	Regular female sexual partners
	Casual female sexual partners (premarital, extramarital)

FSWs: Female sex workers; IDUs: Injecting drug users; MSM: men who have sex with men/ transgendered people

The key inputs used in the model included population size, sexual behaviors, injecting drug use and needle-sharing practices, prevalence of HIV and STDs, and ART coverage. Using these inputs, the model determined the HIV transmission probabilities (through unprotected vaginal sex, unprotected anal sex, and use of infected needle/ syringe) necessary to fit the observed epidemiological patterns, as seen in HIV sentinel

surveillance data. Corrections in transmission probabilities were made in the presence of STDs or due to lack of male circumcision by adding cofactors that increased the effective transmission probability. The model then calculated the number of new infections in each of the subgroups through pre-defined routes of transmission. For example, the number of new HIV infections among clients infected by brothel-based FSWs during a year 't' was calculated as follows:

$$\text{New HIV infections} = [X_{STD} * F_{STD}(t) + \{1 - F_{STD}(t)\}] * [Y_{cc} * F_{cc}(t) + \{1 - F_{cc}(t)\}] * \{(P_{fm} * S(t)) * (1 - C(t)\} * (HIV_{bbFSW}(t)) \quad (1)$$

Where, X_{STD} represents the correction factor for STDs; $F_{STD}(t)$ is the STD prevalence among brothel-based FSWs in year 't'; Y_{cc} represents the correction factor for circumcision and F_{cc} is the fraction of men who are circumcised in year 't'; P_{fm} is the probability of HIV transmission from female to male per unprotected vaginal sex; S(t) is the average number of sexual contacts with clients for brothel-based FSWs in year 't'; C(t) is consistent condom use by brothel-based FSWs with clients in year 't'; and $HIV_{bbFSW}(t)$ denotes HIV prevalence among brothel-based FSWs in year 't'.

The quantities $F_{STD}(t)$, F_{cc}, S(t), and C(t) were used as inputs and the transmission probabilities and adjustment factors for them (due to presence of STDs, lack of male circumcision) were calculated to get the best fit between the estimated and observed trend in HIV prevalence among various subgroups. The number of new HIV infections in each subgroup by different routes of transmission were similarly calculated. Specific outputs of the model included number of new, current and cumulative HIV infections and the mode of transmission for each of the subgroups specified in the model. A detailed description of the model and its application in other Asian countries is available elsewhere (Brown & Peerapatanapokin, 2004; Family Health International, 2008; Ma et al., 2012).

3.2 Inputs for the model

Inputs were provided for different time-points from 1980 to 2009. Values for the intermediate years for which data were not available were interpolated under assumption of linear change. The populations of men and women aged 15 and above over time were available from the decadal population census and from the district-level projections (Registrar General of India, 2001, 2011; United Nations Population Fund, 2009). Information on sexual behaviors and injecting drugs practices was taken from a series of cross-sectional surveys (Avert Society, 2004, 2009; Indian Council of Medical Research & Family Health International, 2007, 2011; National AIDS Control Organization, 2006b, 2006c). HIV prevalence among FSWs, MSM, IDUs, and ANC women was obtained from the HIV sentinel surveillance in Mumbai (India Health Action Trust, 2010). Based on global evidence that HIV prevalence among ANC women is an overestimate of HIV prevalence among general women (Brookmeyer, 2010; Gouws, Mishra, & Fowler, 2008), the observed HIV prevalence among ANC women was adjusted downward by a factor of 0.8 (Gouws et al., 2008). Key inputs used in the model along with the corresponding references are described in Table 2.

Table 2. Key inputs used in the Model

Indicators	Value (Year)	Reference
Population size		
Population aged 15 and above	5619685 (1981); 6997708 (1991); 8838672 (2001); 10720170 (2011); 11547837 (2016)	(Registrar General of India, 2001, 2011; United Nations Population Fund, 2009)
Sex- ratio (women per 1000 men) in the population aged 15 and above	708 (1981);777 (1991); 778 (2001); 789 (2011); 790 (2016)	(Registrar General of India, 2001, 2011; United Nations Population Fund, 2009)
Women in the age group 15-49 who are FSWs (%)	1.0 % (2001, 2008);	(Family Health International, 2001; India Health Action Trust, 2010)
FSWs who are brothel-based (%)	48% (2001); 32% (2008)	(Family Health International, 2001; India Health Action Trust, 2010)
Men in the age group 15-49 who are clients of FSWs (%)	2% (2006, 2008)	(India Health Action Trust, 2010; National AIDS Control Organization, 2006d)
Men in the age group 15-49 who are IDUs (%)	0.04% (2008)	(India Health Action Trust, 2010)
Men in the age-group 15-49 who are MSM (%)	2% (2008)	(National AIDS Control Organization, 2006d)
Sexual behaviors of FSWs and their clients		
Number of clients per week among brothel-based FSWs	18 (2001); 13 (2006, 2009);	(Family Health International, 2001; Indian Council of Medical Research & Family Health International, 2007, 2011)
Consistent condom use by brothel-based FSWs with clients (%)	71% (2004), 76% (2006), 95% (2009)	(Avert Society, 2004; Indian Council of Medical Research & Family Health International, 2007, 2011)
Average duration of working as an FSW	8 years (2006, 2009)	(Indian Council of Medical Research & Family Health International, 2007, 2011)
Number of clients per week among non-brothel based FSWs	18 (2001); 13 (2006, 2009);	(Family Health International, 2001; Indian Council of Medical Research & Family Health International, 2007, 2011)
Consistent condom use by non-brothel based FSWs with clients (%)	53% (2004), 64% (2006), 98% (2009)	(Avert Society, 2004; Indian Council of Medical Research & Family Health International, 2007, 2011)
Average duration for which men remain clients of FSWs	10 years (2006, 2009)	(Indian Council of Medical Research & Family Health International, 2007, 2011)
Injecting drug practices		
IDUs who share needles (%)	58% (2006); 53% (2009)	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Number of injections used per day	2 (2001); 1 (2006)	(National AIDS Control Organization, 2006c)
Average duration of injecting drug use	15 years (2006)	(National AIDS Control Organization, 2006c)
IDUs who have sex with FSWs (%)	48% (2006, 2009)	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Consistent condom use by IDUs with FSWs (%)	52% (2001); 58% (2006);	(National AIDS Control Organization, 2006c)
Consistent condom use by IDUs spouse or regular partners (%)	8% (2001); 13% (2006)	(National AIDS Control Organization, 2006c)
Sexual behaviors with regular and casual sexual partners		
Men who have sex with casual female partners (%)	9% (2006)	(National AIDS Control Organization, 2006d)
Women who have sex with casual male partners (%)	5% (2006)	(National AIDS Control Organization, 2006d)

Consistent condom use in casual sex (%)	53% (2006)	(National AIDS Control Organization, 2006d)
Consistent condom use in sex with spouse or regular partner (%)	27% (2006)	(National AIDS Control Organization, 2006d)
Sexual behaviors of homosexual and bisexual men		
MSM who have anal sex (%)	73% (2001); 80% (2006); 75% (2009)	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Number of anal sex encounters in last week	2 (2001; 2006; 2009)	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Average duration of same-sex behavior	15 years (2001, 2006; 2009)	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Consistent condom use in anal sex with other MSM (%)	56% (2001), 79% (2006) & 80% (2009).	(Avert Society, 2009; National AIDS Control Organization, 2006c)
MSM who have sex with FSWs (%)	33% (2001), 26% (2006) & 33% (2009).	(Avert Society, 2009; National AIDS Control Organization, 2006c)
Consistent condom use by MSM with FSWs in past one year (%)	59% (2006) & 79% (2009).	(Indian Council of Medical Research & Family Health International, 2007, 2011)
PLHA receiving ART		
PLHA on ART (%)	27% (April, 2009)	(India Health Action Trust, 2010)
HIV Prevalence (%)		
FSWs	55.0% (2002), 54.3% (2003), 44.8% (2004), 30.5% (2005), 17.9% (2006), 19.4% (2007), 10.3% (2008)	(India Health Action Trust, 2010)
IDUs	39.4% (2002), 22.9% (2003), 29.2% (2004), 12.8% (2005), 20.4% (2006), 20.4% (2007), 20.0% (2008)	(India Health Action Trust, 2010)
MSM	16.8% (2002), 18.8% (2003), 9.6% (2004), 6.0% (2005), 7.6% (2006), 8.4% (2007), 9.2% (2008)	(India Health Action Trust, 2010)
ANC women	1.5% (2002), 1.3% (2003), 1.1% (2004), 1.2% (2005), 1.4% (2006), 1.0% (2007), 1.0% (2008)	(India Health Action Trust, 2010)

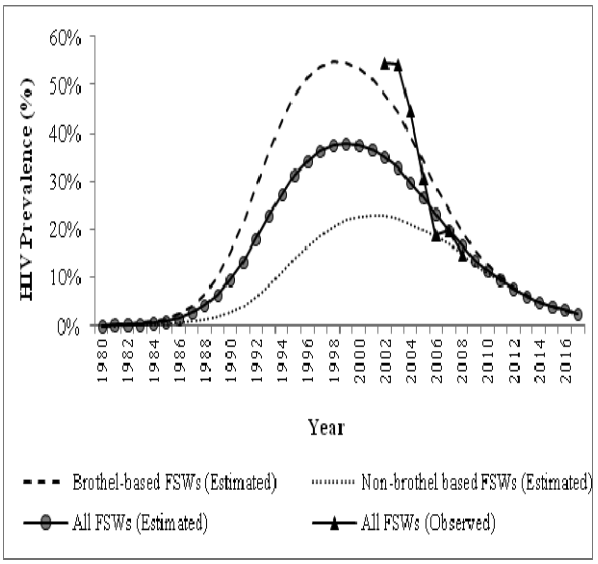
ANC: antenatal care; ART: Antiretroviral therapy FSWs: Female sex workers; IDU: Injecting drug users; MSM: Men who have sex with men/ transgendered people; PLHA: People living with HIV/ AIDS

3. Results

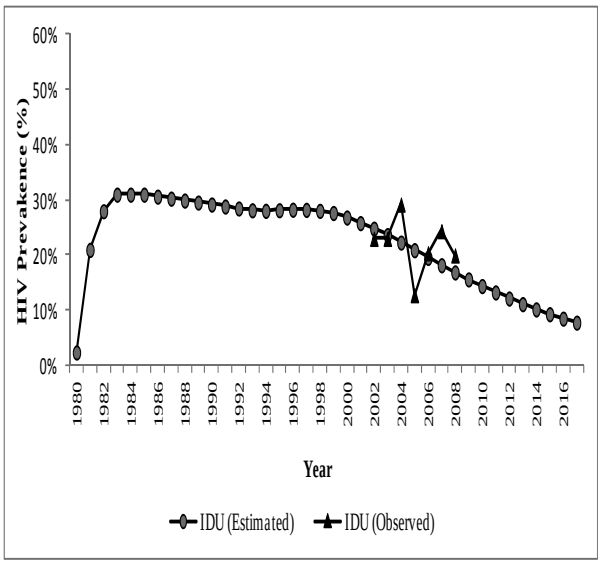
We estimated the probability of transmission for each unprotected vaginal sexual encounter from female to male as 0.12% and male to female as 0.18%; per unprotected anal sex encounter among MSM as 0.41%; and using infected needles/ syringes as 0.69%. The STD cofactor per sexual act for men in vaginal and anal sex was found to be 3.15 and 5.17 respectively, whereas this was estimated at 3.82 for females for vaginal sex. The increase in transmission probability due to lack of circumcision was estimated to be 1.6.

Figure 1 shows the estimated and observed trends in HIV prevalence among FSWs (total, brothel-based and non-brothel-based), IDUs, MSM, and ANC women. Differences between estimated and observed HIV prevalence among FSWs and MSM were high during the early 2000s, but narrowed from 2005 onwards. Prior to 2005, observed HIV prevalence among FSWs was closer to the estimated HIV prevalence among brothel-based FSWs. The estimated HIV prevalence among general women closely matched the calibrated HIV prevalence among ANC women. It may be noted that the scale for the figures for FSWs, MSM and IDUs was identical (ranging from 0% to 60%) whereas the scale for the figure for general women ranged from 0% to 5%. This was done to clearly represent estimated and observed HIV prevalence among general women who had very low HIV prevalence as compared to FSWs, MSM and IDUs.

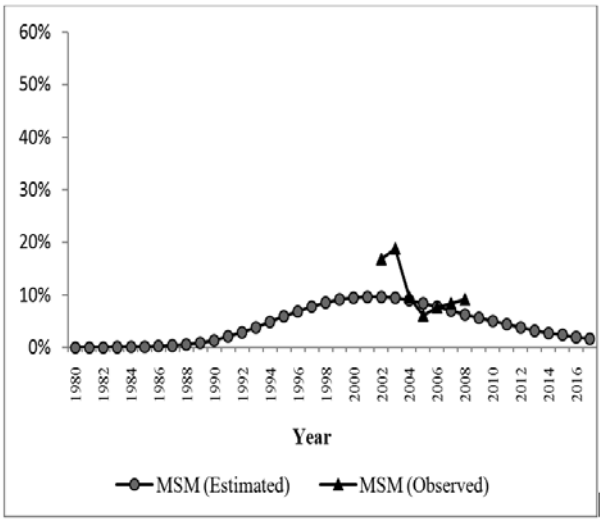
(A) Female Sex Workers (FSWs)



(B) Injecting Drug Users (IDUs)



(C) Men who have sex with men/Transgendered People (MSM)



(D) ANC Women

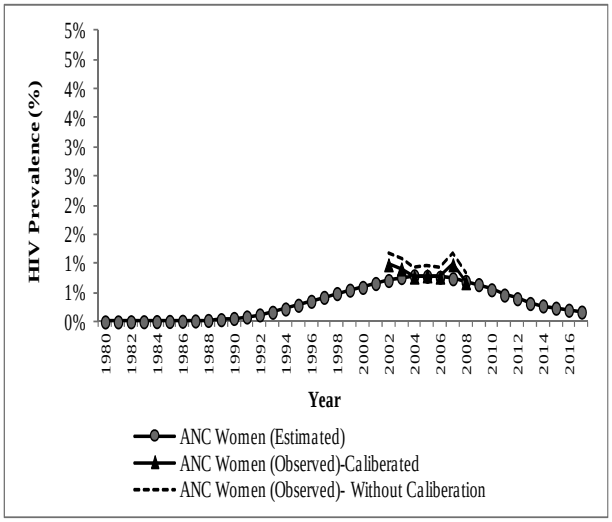


Figure 1. Estimated and observed HIV prevalence among different subgroups, Mumbai, 1980-2017

Table 3 shows the trends in the number of new HIV infections among brothel-based FSWs, non-brothel based FSWs, heterosexual clients, IDUs, MSM, general women and general men from 2000-2017. Overall, the number of new HIV infections among adults was estimated to have reduced by 86% during 2000-2010. The greatest decline was estimated among FSWs and their heterosexual clients (95%-98%), followed by MSM (82%), general women (77%), IDUs (51%) and general men (42%). If HIV prevention efforts are continued with the same intensity, there would be about 4046 new HIV infections among adults during 2011-2017. Most of the new HIV infections would occur among general women (1666) and general men (977). Among the high-risk groups where the interventions are targeted, the maximum number of new HIV infections would occur among MSM (715) followed by heterosexual clients (213) and brothel-based FSWs (211).

Table 3. Estimated and projected number of new HIV infections among subgroups, Mumbai, 2000-2017

Year	Estimated Number of new HIV infections among							Total new HIV infections among adults
	Brothel-based FSWs	Non-brothel based FSWs	Heterosexual clients	IDUs	MSM	General women	General men	
2000	1003	586	2601	39	1004	2228	417	7878
2001	918	573	2313	36	983	2061	420	7304
2002	828	540	2017	34	882	1878	409	6588
2003	720	492	1692	33	758	1676	391	5762
2004	492	394	1128	29	585	1456	371	4455
2005	383	358	860	26	576	1229	346	3678
2006	289	371	631	24	519	1020	320	3174
2007	171	247	382	23	380	888	314	2405
2008	91	143	194	21	280	755	297	1781
2009	60	39	73	20	207	629	270	1298
2010	52	38	61	19	181	514	241	1106
2011	46	34	51	17	156	419	212	935
2012	40	30	42	16	135	338	184	785
2013	34	26	35	15	116	271	158	655
2014	29	23	28	14	98	217	135	544
2015	25	20	23	12	83	173	114	450
2016	20	17	19	12	70	138	95	371
2017	17	14	15	12	59	110	79	306
Reduction in number of new HIV infections (2000-2010) (%)								
	95%	94%	98%	51%	82%	77%	42%	86%
Number of new infections (2011-2017)								
	211	164	213	99	715	1666	977	4046

IDUs: Injecting drug users; FSWs: Female sex workers; MSM: Men who have sex with men/ transgendered people

Table 4 shows the trend in the percentage distribution of new HIV infections in each subgroup by routes of transmission at three points in time - 2000, 2010, and 2017. The proportion of new infections among IDUs and MSM from brothel-based FSWs reduced from nearly half (IDU: 44%; MSM: 54%) in 2000 to nearly one-fifth in 2010 (IDU: 16%; MSM: 20%). Brothel-based FSWs continue to be the source for most new infections among heterosexual clients (87% in 2000; 68% in 2010; 60% in 2017). The proportion of new infections among MSM due to unprotected sex with men and transgendered persons increased from 39% in 2000 to 61% in 2010;and is expected to increase to 75% in 2017. Although heterosexual clients were found to be a major source of infection among general women, bisexual men contributed to about 14% of new infections in this group in 2010; and this proportion is expected to increase to 19% in 2017.

Table 4. Percentage distribution of new HIV infections by routes of transmission among different subgroups at three time-points, Mumbai, 2000-2017

Subgroups and source of new HIV infections	Year		
	2000	2010	2017
New infections among IDUs from:			
IDUs (%)	51	73	83
Brothel-based FSWs (%)	44	16	8
Non-brothel based FSWs (%)	5	11	8
New infections among brothel-based FSWs from:			
IDUs (%)	1	6	12
Heterosexual clients (%)	93	63	47
Bisexual clients (%)	6	31	41
New infections among non-brothel-based FSWs from:			
IDUs (%)	1	8	14
Heterosexual clients (%)	94	42	29
Bisexual clients (%)	5	47	57
New infections among heterosexual clients of FSWs from:			
Brothel-based FSWs (%)	87	69	60
Non-brothel based FSWs (%)	12	25	27
New infections among MSM from:			
MSM (%)	39	63	75
Brothel-based FSWs (%)	54	20	14
Non-brothel-based FSWs (%)	6	17	11
New infections among general women from:			
Heterosexual regular male sexual partners (%)	79	75	67
Bisexual regular male sexual partners (%)	11	14	19
Casual male sexual partners (%)	8	10	11
New infections among general men from:			
Regular female sexual partners (%)	96	98	97
Casual female sexual partners (%)	4	2	3

FSWs: Female sex workers; IDUs: Injecting drug users; MSM: Men who have sex with men/ transgendered people

4. Discussion

This study shows that the number of new HIV infections among adults in Mumbai has reduced substantially during 2000-2010. The reduction has been most among FSWs and their heterosexual clients, followed by MSM, IDUs, general women and general men. Among the high-risk groups where HIV prevention programs in Mumbai are focused, MSM are projected to have the maximum number of new HIV infections during 2011-2017. The proportion of new HIV infections among FSWs and general women from bisexual men has increased during 2000-2010 and is projected to increase further during 2011-2017 if the current situation, in terms of program intensity and HIV risk behaviors of various subgroups, remains the same during this period.

The estimated transmission probabilities and cofactors for STDs and male circumcision are consistent with other studies (Baggaley, White, & Boily, 2010; Boily et al., 2009; Jin F et al., 2010; Kaplan & Heimer, 1992; Ward & Ronn, 2010). The estimated trend in HIV prevalence among FSWs and MSM was closer to the observed trends from 2005 onwards than in the previous years. It may be noted that the number of HIV sentinel surveillance sites among all subgroups dramatically increased across the country in 2005 and in subsequent years (National AIDS Control Organization, 2010), suggesting that observed HIV prevalence from 2005 onwards may be better representative of actual HIV prevalence in the various subgroups. This could be a possible reason for the better agreement in estimated and observed HIV prevalence in recent years. The estimated HIV prevalence among general women matched better with the calibrated values of observed HIV prevalence among ANC women than

the observed values themselves. This was consistent with the fact that the HIV prevalence observed among ANC women tends to overestimate HIV prevalence among general women (Gouws et al., 2008). These results strengthen our hypothesis that the model adequately captured the key processes determining the transmission dynamics of HIV in Mumbai.

The estimated reduction in the number of new HIV infections in the adult population in Mumbai during 2000-2010 (86%) was higher than the reduction in the number of new HIV infections at the national level during 2000-2009 (56%) (National AIDS Control Organization, 2010). This could be explained, to some extent, by the following two reasons. First, the reference period for the two estimates is not exactly same. Second, the estimate of reduction in the number of new HIV infections at the national level represents an 'average reduction', as it includes areas that experienced a greater reduction as well as those that reported a lesser reduction in the number of new HIV infections. As Mumbai received more intensive HIV prevention programs than many other parts of the country (Bill & Melinda Gates Foundation, 2008a; Chandrashekar et al., 2011; India Health Action Trust, 2010), and studies suggest greater success in HIV prevention with higher intensity programs than others (Moses et al., 2008), we argue that reduction in new HIV infections among adults in Mumbai may be higher than that observed at the national level, as seen in this study.

Findings suggest that HIV prevention programs were relatively less successful in preventing new HIV infections among MSM and IDUs than among FSWs and their heterosexual clients. In the case of MSM, this could be explained, at least partly, by the following factors. First, it has been found that as compared to working with FSWs, the HIV prevention program staff in Mumbai took longer to orient themselves on the nature of the MSM community and to build rapport with them (Chandrashekar et al., 2011). Also, the mean cost of delivering the intervention to MSM has been found to be higher than delivering it to FSWs in selected Indian cities, including Mumbai (Chandrashekar, et al., 2011). Additionally, MSM in India often face vulnerabilities such as lack of family acceptance, perceived need to be accepted by the general society, and a sexual identity crisis that are not adequately addressed by HIV prevention programs (Mysore Resettlement and Development Agency, 2010; Thomas et al., 2011). Unlike for other high-risk groups, there was no up-scaled HIV prevention program for IDUs in Mumbai, which could be a possible reason for less successful HIV prevention in this group (Basu, Joy, & Rathod, 2008; Bill & Melinda Gates Foundation, 2008a). Notably, the proportion of new infections among FSWs and general women from bisexual men is estimated to have increased over time. Although this increase is due to the faster decline in new HIV infections among FSWs and general women from heterosexual clients than the decline in the number of new HIV infections from bisexual men, it indicates that HIV prevention programs need to pay MSM special attention in Mumbai, , which will also result in fewer HIV infections among FSWs and general women. It may be noted that we do not intend to suggest a relaxation in HIV prevention program efforts among other high-risk groups, especially FSWs and their heterosexual clients, which have shown great success in the recent past.

Notably, the results of this study indicate a substantial number of new HIV infections among general women and general men despite considerable program success in reducing new HIV infections among high-risk groups. New HIV infections among general women are estimated to occur mainly from heterosexual clients and bisexual men whereas new HIV infections among general men are estimated to occur mainly from casual sexual relationships that are non-commercial in nature. This suggests the need for early detection of HIV infection among men and women in the general population and for ensuring consistent condom use by those who are HIV-positive. With the increasing number of HIV testing and counseling facilities in Mumbai (India Health Action Trust, 2010), it may be possible to prevent many of these infections among general women and men. Efforts to strengthen the network of people living with HIV may also help in mobilizing and reaching HIV-positive men and women and hence to motivate them for greater compliance for consistent condom use.

5. Conclusions

In conclusion, this study shows that HIV prevention programs have reduced the number of new HIV infections substantially among adults in Mumbai. The reduction in the number of new HIV infections has been more among FSWs and their heterosexual clients than that among MSM and IDUs. The tremendous success of the program in preventing new HIV infections among FSWs and their heterosexual clients has resulted in an epidemiological shift in the HIV epidemic in Mumbai. The ability of the HIV prevention program in Mumbai to prevent most of the new HIV infections among FSWs and their heterosexual clients has shifted the focus of the epidemic from FSWs and their heterosexual clients to MSM and the general population. In order to further reduce new HIV infections, the HIV prevention program for FSWs and their heterosexual clients should be continued with the same intensity, and the strategies to prevent new infections among MSM and the general population should be revised and strengthened. HIV prevention efforts among MSM will not only reduce new

HIV infections in the MSM community, but also among brothel-based FSWs and general women. Ensuring early detection of HIV, and increasing the level of consistent condom use by HIV-infected men and women are essential to prevent most of the new HIV infections among adults in Mumbai.

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Decline in unprotected sex & sexually transmitted infections (STIs) among female sex workers from repeated behavioural & biological surveys in three southern States of India

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***Background & objectives*: Since 2003, *Avahan* the India AIDS Initiative, has been working with female sex workers (FSW) in Andhra Pradesh (AP), Maharashtra (MH) and Tamil Nadu (TN) using a package of preventive services. Two rounds (R1 and R2) of Integrated Behavioural and Biological Assessment (IBBA) surveys were done to measure changes in condom use and prevalence of sexually transmitted infections (STIs) among female sex workers (FSWs) in the three Southern States.**

***Methods*: Two rounds of bio-behavioural surveys were conducted among FSWs in selected districts of AP, MH and TN during 2005-2007 and 2009, respectively. Survey districts and methodology were consistent across rounds. Participants were selected through two stage conventional cluster sampling from fixed sites and time-location cluster sampling from floating groups. Information on sexual behaviour was collected by face-to-face interview. Participants provided urine and blood samples for testing of STIs.**

***Results*: At aggregate level, condom use at every sex act with occasional and regular clients, taken as a whole, increased from 66.8 per cent in R1 to 85.2 per cent in R2 (AOR 3.5, *P*<0.001). Levels of HIV and syphilis declined from 14.1 to 11.9 per cent (AOR 0.9, *P*<0.5) and 10.8 to 5.0 per cent (AOR 0.4, *P*<0.001), respectively. Odds of using condom among FSWs who availed *Avahan* services was significantly more than those who did not (*P*<0.01).**

***Interpretation & conclusions*: An increase in consistent condom use along with decrease in STIs was observed among FSWs. The increase in safer sexual practices was more among those exposed to *Avahan* interventions.**

Key words Clients - condom use - female sex workers - IBBA - interventions - sexually transmitted infections

According to National AIDS Control Organization (NACO), in 2007 there were 2.31 million (1.8-2.9 million) people living with HIV/AIDS in India with an estimated adult HIV prevalence of 0.34 per cent (0.25-0.43%)[1]. The overall HIV prevalence among different population groups continues to portray the concentrated epidemic in India, with a high prevalence among high risk groups like injecting drug users (IDUs) (7.26%), men having sex with men (MSM) (7.41%), female sex workers (FSWs) (5.06%) and low prevalence among antenatal clinic attendees (0.51%)[2]. In response, NACO has been co-ordinating and implementing targeted and generalized intervention with these high risk groups and other bridge population since 1992 with focus on prevention[3].

In India, the HIV/AIDS epidemic is largely concentrated in six States namely Andhra Pradesh (AP), Karnataka (KA), Maharashtra (MH) and Tamil Nadu (TN), Nagaland and Manipur which contribute to 63 per cent of the HIV infected persons in India[2]. FSWs and their clients play a prominent role in driving the HIV epidemic in the country. HIV prevalence among the FSWs is highest in MH but has declined from 54.3 to 17.9 per cent from 2003 to 2007. Similar decreasing trend was seen in AP (20 to 9.7%), KA (14.4 to 5.3%), TN (8.8 to 4.7%), and at the country level (10.3 to 5.1%) over these five years[1].

To support and strengthen the NACO's targeted interventions, in 2003, the Bill & Melinda Gates Foundation initiated *Avahan*, the India AIDS Initiative aiming to slow down the spread of HIV epidemic in the country[4]. Based on the epidemiology of HIV in India and available programme coverage data, *Avahan* decided to work in 83 districts of the six States (Nagaland and Manipur in addition to the four southern States). The main objective of *Avahan* is to deliver a rapidly scaled prevention programme to these high risk groups and control the transmission of the HIV epidemic in the target populations.

The *Avahan* programme's main strategies were designed to achieve high coverage (target of 80%) in the selected geographic areas through delivery of a combination package of proven prevention services addressing proximal and distal determinants of HIV risks. The key programme elements were similar to NACO's and included peer based outreach education, clinical services for treatment of STIs, promotion and distribution of condoms and community mobilization[5]. In the four southern States, *Avahan* programme has been implemented in 19 districts in AP, 18 districts of KA, 16 districts of MH and 13 districts of TN.

As part of overall evaluation of *Avahan* programme, two rounds of large scale bio-behavioural surveys were conducted during 2005-2007 and 2009. In the current study, data from these two rounds of IBBA surveys among FSWs were used. The main objectives of the analysis were to access the change in *(i)* characteristics of FSWs and pattern of condom use with commercial and non-commercial partners; *(ii)* prevalence of HIV and STIs; and *(iii)* exposure to *Avahan* programme interventions and their association with condom use behaviour.

Material & Methods

Two rounds of cross-sectional IBBA surveys were conducted as a major component of *Avahan's* monitoring and evaluation strategy which collected information on risk behaviours and biological specimens to test for STIs including HIV. The first round (R1) of IBBA on FSWs was conducted between November 2005 and March 2007, while the second round (R2) was conducted between March and December 2009 in 29 districts where the *Avahan* programme was implemented and covered FSWs and their clients, MSM, transgender and IDUs in the six States. The detail of IBBA methodology is presented elsewhere[6,7].

Survey coverage of IBBA for FSWs: Data for the current analysis have been taken from the two rounds of cross-sectional surveys conducted among FSWs in selected districts of AP (8 districts), MH (6 districts) and TN (5 districts). The data from Karnataka have not been included in the current analysis as already published elsewhere[6]. Of the five districts covered in north-east, only one district had FSW group, thus it was not taken for analysis. FSWs aged 18 yr or older, having had paid sex in the last one month were recruited for the study.

Behavioural and biological assessments: Face-to-face interview was conducted using structured questionnaire covering basic demographic characteristics, patterns of sex work, sexual behaviour, condom use with different partners, knowledge on STIs and HIV and exposure to HIV prevention interventions. Venous blood sample (10 ml) was collected from all respondents to test for HIV and syphilis and urine sample for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infections. Herpes simplex virus type 2 (HSV-2) serology was tested in 10 per cent of random samples, which has not been included in this study.

Seroprevalence of HIV infection was determined by two test algorithms using a screening test of Microlisa HIV and a confirmatory test by Genedia HIV 1/2 ELISA 3.0 (India). Positive syphilis serology detected by rapid plasma reagin (RPR) test was confirmed with *Treponema pallidum* haemagglutination assay (TPHA) and those found positive were deemed as having syphilis. Detection of *N. gonorrhoeae* and *C. trachomatis* in urine samples were performed by nucleic acid amplification test using Gene-Probe APTIMA Combo2 kits (Gene Probe).

Sampling: Respondents were selected using a two stage sampling procedure in both the rounds. Primary sampling units (PSU) were selected using probability proportion to size (PPS) at the first stage from a sampling frame of clusters mapped in each district and then random selection from enlisted respondents available during the fixed time interval specified for the selected cluster at the second stage. FSWs were recruited from public places (street, market, bus stop, cinema hall, *etc*.) using time location cluster sampling and from brothel/home/lodge using conventional cluster sampling. Details of IBBA survey protocol have been published elsewhere[6].

Field work was conducted by field research agencies after a week of intensive training programme on survey protocol, questionnaire assessments and collection and transport of biological samples.

Statistical analysis: Double-data entry was done using Census and Survey Processing System (CS Pro) version 3.3 Software (India). Appropriate sampling weights were calculated for each level of analysis *i.e.*, State and aggregate. Statistical Packages for Social Sciences (SPSS) version 15.0 (India) was used for data analysis. Bivariate analysis was done to compare differences in profile characteristics of participants between the two rounds of survey. Two-sample t-test and Wald Pearson's chi-square test for independence were used to identify significant changes in profile characteristics between R1 and R2. Multivariate logistic regression was used to assess significant changes in exposure to intervention, prevalence of HIV and other STIs, and condom use with different partner types between the rounds. Profile variables that could be associated with the outcome and the explanatory variables, but are not in the causal pathway of relationship were included as covariates in logistic regression models to generate adjusted odds ratios (AOR) for the different outcome variables. Data from both rounds of survey were pooled to assess associations between exposure to interventions and condom use outcomes, controlling for plausible confounders.

Key outcome variables: Exposure to intervention among FSWs was defined as having received one of the following *Avahan* programme core services any time in the past: *(i)* contacted by peer educator/ staff of NGO; *(ii)* visited programme clinic; and *(iii)* received condoms from peer educator/worker of NGO. For changes in behavioural outcomes between the two survey rounds, zero unprotected sex acts (no sex act without condom everytime with occasional and regular clients, taken together), condom use at last sex act and consistent (every time) condom use with different kind of clients/partners were examined using bivariate and multivariate analysis. The different types of partners of FSWs were defined as follows. Paying clients were occasional clients, who had sex once or a few times more but not recognized by FSW, and regular clients, who repeatedly visited FSW and were known/recognized by her. Non paying partner were main regular partner or husband or steady boy friend of FSW.

Ethical clearance for the study protocol was obtained from the ethical review committee of NACO, ICMR institutes and Protection of Human Subjects Committee of FHI 360. Data collection procedures were conducted in privacy following reception of informed written informed consent. As a benefit to participants, test results for syphilis (using RPR) and treatment for those reactive was provided free of charge through a network of referral clinics in each district.

Results

A total of 7828 FSWs in R1 and 7806 in R2, participated in the IBBA conducted in the three States of India. On an average, participation rates ranged from 66 to 86 per cent in R1 whereas in R2 it varied from 58 to 76 per cent with highest participation in MH and lowest in AP.

Profile characteristics: Overall, the mean age of FSWs increased from 31.0 years in R1 to 31.5 in R2 ($P<0.001$), the increase was also observed in AP and TN (Table I). Literacy has improved in the second survey (37.8% in R1 vs 46.3% in R2, $P<0.001$). Of the three States, more literate respondents were seen in AP and TN in R2 as compared to R1 ($P<0.001$). More than 90 per cent of the FSWs were married in both rounds. At aggregate level, more than half of the respondents

Table I. Socio-demographic and sex work characteristics of FSWs at State and aggregate level in round 1 (R1) and round 2 (R2) IBBA

Profile characteristics	Andhra Pradesh		Maharashtra		Tamil Nadu		Total		
	R1 (n=3271)	R2 (n=3225)	R1 (n=2525)	R2 (n=2575)	R1 (n=2032)	R2 (n=2006)	R1 (n=7828)	R2 (n=7806)	*P* value
Current age (yr)									
<25	21.5	20.1	20.9	23.1	13.6	10.2*	17.7	16.4	0.2
≥25-29	26.3	28.1	28.4	26.2	22.0	19.4	24.7	24.4	
30-34	21.5	20.1	22.1	20.8	22.3	20.5	21.9	20.3	
35-39	20.6	19.8	12.9	14.9	25.8	27.4	21.7	22.3	
≥40	10.1	12.0	15.8	15.1	16.3	22.6	14.0	16.6	
Mean	29.8	30.1**	30.0	30.0	32.3	33.7*	31.0	31.5	<0.001
Literacy	30.6	41.0**	24.4	25.8	48.4	58.4**	37.8	46.3	<0.001
Ever married	91.4	90.7	79.2	81.4	96.8	95.4	91.7	91.6	0.9
Additional income	41.0	51.7**	6.6	7.6	58.9	76.5**	49.7	55.2	0.008
Local residency	92.8	75.7**	98.1	92.6**	90.2	91.6	92.5	49.1	<0.001
Age started sex work (yr)									
<20	23.7	21.0	31.9	27.8*	9.5	6.8	18.6	16.0	0.05
20-24	32.7	32.6	34.6	34.9	25.1	24.1	29.5	29.4	
25-29	27.0	24.3	21.2	19.2	29.2	28.6	27.0	25.5	
≥30	16.6	22.1	12.2	18.2	36.3	40.4	25.0	29.0	
Mean	23.6	24.8**	22.7	23.8**	27.2	27.8	25.1	25.9	0.03
Duration sex work (yr)									
0-1	12.5	16.1**	18.0	18.6	17.3	12.2**	15.7	14.8	0.2
2-3	25.2	26.3	17.7	20.9	33.9	29.0	27.9	26.8	
4-9	37.8	38.6	32.5	31.3	30.7	36.0	33.6	36.7	
≥10	24.6	18.7	31.5	28.6	18.0	22.8	22.7	21.4	
Mean	6.2	5.4	7.4	6.2**	5.1	5.9**	5.9	5.7	0.09
Street based FSW	55.7	74.3**	31.1	30.7	91.3	95.7*	67.9	78.1	<0.001
Usual place of entertaining clients									
Home	67.2	53.7**	26.7	33.1*	86.1	86.1	68.8	64.4	<0.001
Brothel/lodge/*dhaba*	16.1	4.9	72.5	66.6	0.9	3.1	18.9	10.9	
Public places	16.8	41.4	0.9	0.3	13.0	10.8	12.2	24.6	
Number of clients per week									
0-4	27.5	11.3**	18.7	14.8	36.0	35.8	29.9	21.5	<0.001
5-9	37.8	37.3	33.7	31.8	44.5	48.9	40.2	41.3	
≥10	34.7	51.5	47.6	53.4	19.6	15.3	29.9	37.1	
Mean	8.6	11.5**	11.9	16.7**	6.6	5.8**	8.2	9.7	<0.001
Currently having a regular partner	77.9	71.6**	31.4	49.5**	76.7	75.2	69.2	70.6	0.4

*P<0.05, **<0.01. Values are expressed as percentages

were having other sources of income in addition to sex work; however, only six to eight per cent FSWs in MH had any additional income. Overall, 92.5 per cent of the participants belonged to the place of interview in the first survey round whereas in the second round nearly half of the FSWs interviewed were non-localites (P<0.001). Similar pattern was observed in AP (92.8% in R1 vs 75.7% in R2, P<0.01) and MH (98.1% in R1 vs 92.6% in R2, P<0.01).

Mean age of starting commercial sex was around 25 years with a little increase in R2 (P<0.03); similar change was observed at State level as well (Table I). With commercial sex starting earliest among MH sex

workers, mean duration of selling sex was longest in MH in both the rounds (7.4 yr in R1 and 6.2 yr in R2). The proportion of FSWs who were selling sex for more than 10 years decreased in all the States except TN where the proportion increased (18.0% in R1 vs 22.8% in R2). The typology of FSWs and place of entertaining clients had undergone significant transitions between the two IBBA rounds. Majority of FSWs solicited clients on streets and entertained them at home except in MH, where they were brothel based (Table I). The proportion of street based sex worker has increased at overall level (67.9% in R1 and 78.1% in R2, $P<0.001$) and in States of AP (55.7% in R1 and 74.3% in R2, $P<0.001$) and TN (91.3% in R1 and 95.7% in R2, $P<0.05$) and remained unchanged in MH. Weekly client volume of FSWs increased from R1 to R2; sharp increase was observed in AP (8.6 in R1 to 11.5 in R2, $P<0.01$) and MH (11.9 in R1 to 16.7 in R2, $P<0.01$). Majority of FSWs had regular partner in both the survey rounds; the proportion increased in MH (31.4% in R1 to 49.5% in R2, $P<0.01$).

Exposure to Avahan programme interventions: Multivariate analysis revealed that at aggregate level, more FSWs were contacted by peer educator/staff of *Avahan* supported NGOs and received condom from them in R2 as compared to R1 ($P<0.001$) (Table II). More than 50 per cent of them were contacted by peer educator/staff, received condom from them and visited NGO clinic as gathered from R2 data. The increase in exposure to the *Avahan* programme services was evident in all the survey States except AP, where there was significant decrease to nearly one-third level in all the three programme indicators (Table II). The exposure decreased for non-*Avahan* programme as well (data not shown). The increase from R1 to R2 was reported maximum from TN and the levels of exposure reached were also highest there (more than 85% for all the programme indicators in R2) (Table II).

Condom use with different types of partners: Both at aggregate and State levels, self reported condom use with occasional and regular clients increased substantially, even though the estimates were already high in R1 (Table II). The levels of condom use was reported maximum from FSWs in MH, reaching 95 per cent and above in all condom use indicators with clients in the second round. Overall, less than 15 per cent of sex acts with occasional and regular clients, taken collectively, were unprotected and the proportion has decreased than before (zero unprotected sex acts with clients: R1 66.8% to R2 85.2%, AOR 3.5, $P<0.001$). However, consistent condom use with regular partners showed no significant improvement and remained below 20 per cent in all the States in R2 (Table II).

STIs and HIV: Though there was a decline in the overall HIV prevalence from 14.1 per cent in R1 to 11.9 per cent in R2, it was not statistically significant. Except for AP (R1: 17.7%, R2: 13.2%, AOR 0.6, $P<0.01$) there was no significant change in HIV prevalence in MH and TN between the two survey rounds (Table II). The prevalence of HIV among FSWs was more in MH as compared with other States; more than one-fourth of them were HIV positive. Syphilis decreased by more than 50 per cent in the aggregate analysis between R1 and R2 (AOR 0.4, $P<0.001$). The decrease in syphilis prevalence was also evident in all the States (Table II). High titre (1:8 or more) syphilis was low and decreased further in R2 after controlling for profile variables (R1: 2.1%, R2: 2.1%, AOR 0.6, $P<0.003$). The prevalence of both *N. gonorrhoeae* and *C. trachomatis* infection was below five per cent in the studied FSW population (at aggregate level). On controlling confounding variables, the fall in prevalence of these two STIs was evident in MH ($P<0.05$), the change remained insignificant in other States and at overall level (Table II).

Effect of Avahan interventions on condom use: Independent multiple logistic regression models were built to assess the association of having received prevention services from *Avahan* including ever been contacted by peer educator/staff, having ever received condom from peer educator/NGO worker, and having ever visited programme clinic, on condom use with various type of partners. At aggregate level condom use with paying clients and regular partners was higher among service users than non-users, for all the three *Avahan* services investigated (AOR>1.5, $P<0.001$ for all condom use indicators). On analysis at State level, in AP, interventions showed improved condom use with clients (AOR>1, $P<0.01$ for all condom use indicators), but have little to do with regular partners (Fig. 1). In MH, there was no obvious difference between those exposed and non-exposed to *Avahan* interventions in their condom use behaviour. Both clinic visit and peer/staff contact showed no statistical significant effect on most of the condom use indicators (Fig. 2). However, the effect of *Avahan* interventions among FSWs was highest in TN, where in those who availed services, the likelihood of using condoms with clients and regular partner was two to four times more than who did not (Fig. 3).

Table II. Univariate and multivariate analysis[a] of Avahan programme exposure, condom use and STI prevalence among FSWs at State and aggregate level in round 2 (R2) with reference to round1 (R1) IBBA

Outcome variable	Andhra Pradesh R1%, R2% AOR (95% CI)	Maharashtra R1%, R2% AOR (95% CI)	Tamil Nadu R1%, R2% AOR (95% CI)	Total R1%, R2% AOR (95% CI)	*P* value
Programmatic exposure					
Contacted by a peer educator/ NGO staff	50.3, 33.5 0.5** (0.4 - 0.7)	32.0, 52.7 1.9** (1.5 - 2.4)	57.2, 86.9 4.8** (2.8 - 8.3)	47.6, 56.6 1.5 (1.3 - 1.8)	<0.001
Visited programme clinic	49.3, 30.2 0.4** (0.3 - 0.5)	27.8, 44.8 1.7** (1.3 - 2.1)	56.0, 85.1 4.0** (2.3 - 6.9)	48.6, 53.9 1.0 (0.8 - 1.2)	0.8
Received condom from peer educator/NGO worker	47.2, 33.4 0.6* (0.5 - 0.8)	28.9, 47.3 1.7** (1.4 - 2.2)	54.3, 86.0 4.7** (2.8 - 8.0)	47.3, 56.1 1.4 (1.2 - 1.7)	<0.001
Condom use					
Last condom use with occasional clients	91.1, 97.8 4.3** (2.9 - 6.1)	96.8, 99.7 8.0** (3.4 - 19.2)	92.8, 97.9 3.8** (1.9 - 7.8)	92.9, 98.0 4.5 (3.3 - 6.1)	<0.001
Consistent condom use with occasional clients	70.8, 83.7 2.0** (1.6 - 2.5)	83.3, 96.5 5.0** (3.1 - 8.1)	74.0, 92.7 8.1** (5.2 - 12.8)	74.5, 88.7 2.9 (2.4 - 3.5)	<0.001
Last condom use with regular clients	84.9, 95.8 4.1** (2.8 - 5.9)	94.9, 99.1 3.9** (2.2 - 7.0)	89.9, 95.9 4.1** (1.9 - 8.8)	88.7, 96.2 3.6 (2.6 - 5.1)	<0.001
Consistent condom use with regular clients	63.4, 83.4 2.8** (2.2 - 3.5)	78.3, 94.5 4.6** (3.0 - 6.9)	69.9, 88.5 6.8** (4.5 - 10.2)	68.7, 86.9 3.4 (2.8 - 4.1)	<0.001
Zero unprotected sex with clients	59.4, 81.8 3.1** (2.5 - 3.8)	76.2, 94.6 4.8** (3.3 - 7.1)	68.9, 86.7 6.1** (4.1 - 8.9)	66.8, 85.2 3.5 (2.9 - 4.1)	<0.001
Consistent condom use with regular partner	8.9, 8.5 0.8 (0.5 - 1.2)	21.2, 13.7 0.6** (0.4 - 0.9)	11.5, 16.1 1.3 (0.8 - 2.2)	11.3, 12.1 0.9 (0.7 - 1.2)	0.6
STI prevalence					
HIV	17.7, 13.2 0.8** (0.51 - 0.9)	25.8, 27.5 1.2 (0.9 - 1.6)	6.1, 6.1 1.4 (0.8 - 2.4)	14.1, 11.9 0.9 (0.7 - 1.1)	0.5
Syphilis	10.8, 6.1 0.4** (0.3 - 0.6)	15.8, 10.8 0.5** (0.4 - 0.7)	9.7, 2.2 0.2** (0.1 - 0.3)	10.8, 5.0 0.4 (0.3 - 0.5)	<0.001
Syphilis - high titre	3.2, 3.1 0.5** (0.2 - 0.9)	4.2, 3.4 0.5** (0.3 - 0.8)	1.1, 0.5 0.7 (0.2 - 3.1)	2.1, 2.1 0.6 (0.4 - 0.8)	0.003
Neisseria gonorrhoeae	2.2, 2.8 1.2 (0.7 - 2.2)	7.4, 3.9 0.6* (0.4 - 0.9)	0.5, 0.2 0.5 (0.2 - 1.2)	2.3, 1.8 0.9 (0.7 - 1.3)	0.8
Chlamydia trachomatis	3.5, 3.5 0.9 (0.6 - 1.5)	8.0, 6.2 0.7* (0.5 - 0.9)	2.0, 1.4 0.5 (0.09 - 2.8)	3.5, 3.0 0.9 (0.7 - 1.2)	0.3

*P<0.05, **<0.01. AOR, adjusted odds ratio

[a]Controlled variables: district, current age, literacy, marital status, having additional source of income, residency status, duration in sex work, age at first commercial sex, usual place of solicitation

Discussion

Significant change was observed between the two rounds in the mean age, literacy, proportion reporting having additional source of income, residency status, age of starting sex work, typology, place of entertaining clients and weekly clientele. Both at overall and State levels these changes between the two rounds of IBBA survey are suggestive of the dynamics of the changing universe of the FSW population. Not having additional source of income make FSWs more vulnerable[7,8] and in Maharashtra it was observed that majority of FSWs were brothel based and very few of them reported having additional source of income. The increasing proportion of public places as solicitation site and home as place of entertaining clients, reaching them

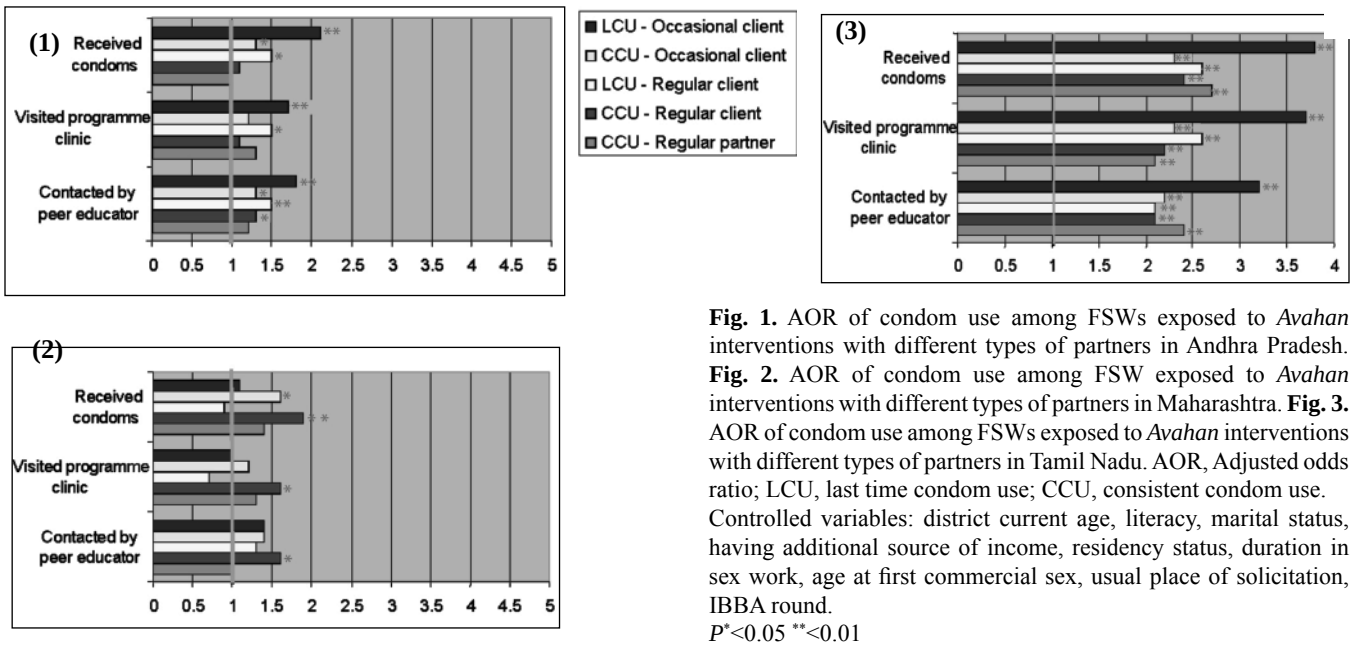

Fig. 1. AOR of condom use among FSWs exposed to *Avahan* interventions with different types of partners in Andhra Pradesh. **Fig. 2.** AOR of condom use among FSW exposed to *Avahan* interventions with different types of partners in Maharashtra. **Fig. 3.** AOR of condom use among FSWs exposed to *Avahan* interventions with different types of partners in Tamil Nadu. AOR, Adjusted odds ratio; LCU, last time condom use; CCU, consistent condom use. Controlled variables: district current age, literacy, marital status, having additional source of income, residency status, duration in sex work, age at first commercial sex, usual place of solicitation, IBBA round.
$P^{*}<0.05$ $^{**}<0.01$

by programme staff is more challenging and strategy for one to one contact becomes more imperative. The group norm characteristic of brothel which help in negotiating condom use with clients would also be lacking among the street based FSWs[9]. As the number of clients entertained by FSWs in a week has increased over time, it becomes more important to ensure that condoms are used consistently.

A substantial increase was seen in consistent condom use and last time condom use with all types of commercial partners. High level of condom use among FSWs in high HIV prevalent States is also suggested by United Nations General Assembly Special Session (UNGASS) report for 2010[10]. The low condom use among regular partners may be due to the fact that there is a greater degree of trust, honesty and commitment with the spouse, boy friend, lover or living-in partner and the negotiation of using condom would be difficult with them[11].

The exposure to intervention shows that uptake of services has increased significantly in R2 as compared to R1 but still there were more than 40 per cent of sampled sex workers not covered by the intervention. Of the three surveyed States, TN showed high programme coverage in terms of proportion of FSW receiving *Avahan* HIV prevention services. Decrease in exposure to *Avahan* and other interventions in AP is a matter of concern necessitating detailed investigation. One plausible reason of the low exposure reporting could be due to the difference in the branding of the intervention by different implementing partners in the State. Further investigation of the exposure data is required to understand the low level of reported coverage in case of AP.

The aggregate level analysis on the pooled data of both rounds (R1 and R2) supports the argument that contact by peer educators/NGO staff, visiting *Avahan* programme clinics or receiving condoms from peer educators/NGO workers are likely to have increased consistent condom use among FSWs. Similar results were also seen in a study in Kenya which showed that peer-mediated interventions were associated with an increase in protected sex[12]. Association between *Avahan* interventions and condom use was also evident in TN, which was supported by evidence of increased programme coverage and condom use in the State. In AP, in spite of declined coverage by *Avahan* programme, there was an increase in reported condom use. Since there is a scope for scaling up of coverage in AP, further increase in condom use and decrease in STIs and HIV can be expected[13]. In MH, despite that *Avahan* has reached to only half of the sampled population, condom use rates were very high irrespective of their exposure to interventions. This might be due to intervention by any other NGO, external factors like socio-economic development and exposure to mass media, or biased responses or measurement error of exposure. Since *Avahan*

rventions had not much effect on condom use with regular partners, interventions should be re-strategize to improve condom use with them.

The State level estimate of HIV detected in IBBA was higher than the NACO's HIV sentinel surveillance (HSS) 2007 data[1], which may be due to difference in methodology, representativeness and coverage of both types of surveys. Both IBBA and HSS demonstrated that HIV prevalence among FSWs was highest in MH. Studies on IBBA have shown that the high prevalence of HIV among the FSWs in MH was mainly due to the high prevalence in specifically two district of the State *viz.* Mumbai and Thane[14]. Both at the aggregate and State levels, prevalence of HIV was not changed significantly. On the other hand, level of syphilis has come down remarkably in all the States and aggregate to half or less. Even high titre syphilis, chlamydial and gonorrheal infections which are better markers of recent sexual behaviour, decreased after controlling for profile variables in MH and at aggregate level (significant only for high titre syphilis) suggesting that sexual health promotion programmes and services might have reached the targeted group, and increased condom use and better health seeking practices, might have contributed to reductions in transmission of STIs and HIV. Sentinel surveillance data also showed among FSWs, a decline in south Indian States reflecting the impact of interventions[2].

The IBBA survey and the comparison of the two rounds had several limitations. The mobile and dynamic nature of the population made the comparison of two rounds extremely difficult; this has been addressed this by controlling for changes in socio-demographic and sexual behaviour variables. This is a usual problem with serial cross-sectional surveys of such a dynamic population[15]. We have not included any non-*Avahan* district as a control group for assessing effectiveness of *Avahan* interventions, which could have measured the difference more accurately. Since the behavioural and exposure indicators were self-reported responses on face, the role of social desirability bias could not be ruled out[16,17]. Also, round 1 of the IBBA was not a true baseline for evaluation as programme started almost a year before the round 1 survey was conducted.

In conclusion, the two rounds of IBBA reflected an increase in the proportion of FSWs reporting consistent use of condoms coupled with decline in prevalence of STIs. Evidence from the assessment is suggestive that a comprehensive HIV prevention programme among FSWs can lead to an increase in condom use with commercial clients, and a decrease or at least stabilize STIs and HIV prevalence among them. However, improved strategies are required to increase condom use with regular partners of FSWs. HIV prevention and control programmes should be scaled up to cover the unexposed FSW populations in these States. Concerted efforts which targets the high risk populations must continue and be strengthened.

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HIV prevention: Towards a "structural-plus" approach

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ABSTRACT

Lack of integration and coordination between HIV prevention programmes and developmental programmes explain why many countries have not been able to halt the epidemic, and others still have unacceptably high prevalence. A framework is presented here with supporting evidence to argue that existing structural interventions may be unsustainable in the long run because they do not address core developmental issues or the "structural plus factors". This problem emanates from the almost total administrative and intellectual disconnect between policies that address development issues and those that address HIV prevention. Usual prevention packages may result only in short term benefits. To get the most out of limited global resources on prevention, it is critical that planners recognize and understand that parallel policies for AIDS prevention and development are not going to be cost-effective and sustainable, and the only option is to approach prevention as well as development in an integrated manner.

Keywords: HIV; Prevention; Structural Factors; Development

1. INTRODUCTION

The last two decades of HIV/AIDS prevention and control have shown mixed effectiveness across situations. As such, new infections have stabilized in many parts of the world but the incidence continues to rise in parts of Eastern Europe, Central Asia, Oceania, Middle-East and North Africa [1]. Besides, sustained prevalence among African nations continues to dominate the international scenario. Such inconsistency in effectiveness is arguably associated with limited contextualisation of prevention efforts across "diverse settings" (Bertozzi *et al*., 2008, Piot *et al*., 2009) often conceived in terms of the class of epidemic: low-level concentrated, generalized, or hyper-endemic [2]. Moreover, from a programme perspective, the developmental context is treated as the operational environment consisting of critical but non-changeable factors that impinge on behaviour and make for differential impact of HIV interventions [3]. As a consequence, the structural determinants of risk behaviour do not usually include diverse developmental factors that might explain the variation in prevalence levels across countries. This also translates into an administrative and intellectual separation between prevention policies and developmental policies that often result in unsustainable interventions for HIV prevention. This paper revisits the notion of "structural factors" in HIV interventions, examines the possibility of expanding the set comprising structural factors and analyzes the scope for integration with conventional behavioural interventions.

2. RELEVANCE OF STRUCTURAL FACTORS: A REVIEW

Successful prevention strategies are well-documented as "best-practices" in HIV prevention [4] and various taxonomies are available to classify such interventions. For instance, recent studies use the following three-way classification (**Table 1**): behavioural interventions, biomedical interventions, and structural interventions [5,6]. To elaborate, behavioural change interventions are supposed to reduce risk of HIV infection by influencing behaviour through knowledge, awareness and improved access to services. This comprises a range of educational, motivational, peer-group based, skills-building and community normative approaches [7]. Behavioural barriers to access critical services such as condom distribution and counselling are specifically addressed through such interventions. Biomedical interventions comprise medical interventions that help to prevent infection, reduce infectiousness, and minimize the risk of transmission and acquisition of HIV/AIDS. The goal is to moderate the

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Table 1. Classification of standard HIV prevention interventions: Some examples.

Biomedical Interventions	Behavioural Interventions	Structural Interventions
Voluntary counselling and testing (VCT)	Information, education and communication (IEC)	Transformational processes like women's empowerment
Condom promotion and distribution	Abstinence education	Microcredit programs like self-help and support groups
Antiretroviral treatment/therapy (ART)	Peer education	Legal processes influencing laws related to HIV prevalence through policies
Mother-to-child HIV transmission (MTCT) interventions	School-based education	Needle availability; Syringe exchange
Sexually transmitted infection (STI) treatment ("positive prevention")	Condom social marketing (CSM)	Condom availability
Needle exchange		Mass media campaign
Post-exposure prophylaxis		Political support
Blood safety		Institutional participation
Male circumcision		Peer-based programs
Drug substitution		

influence of biological or physiological factors that may increase infectiousness or susceptibility to HIV and prevent infection from progressing after actual exposure [8]. Structural interventions like women's empowerment and awareness-building through mass media campaigns assume importance because of the recognition that broader social, economic, political and environmental issues influence individual risk and vulnerability to HIV/AIDS, and are critical for effective prevention [9]. These factors, in turn, are closely related to the regional patterns of growth and development and generally lie outside the purview of targeted HIV/AIDS interventions.

While conventional behavioural and biomedical strategies remain at the heart of most interventions, the structural approach was relatively a more recent addition to the burgeoning literature around effective and sustainable prevention strategies [10,11]. Undeniably, the performance of behavioural change interventions to a greater extent is determined by the presence (or absence) of facilitating structural environments. For example, advocacy and training are more effective under conditions where the societal perspective is not stigmatizing and the legal environment is protective of the risk groups. In fact, advocacy and training is more effective if the structural vulnerabilities like income deprivations of risk groups are minimal. In this context, examples relating to market for unprotected commercial sex indicate that a segment of sex workers are willing to take the risk if premium clients have an inherent preference for condom-free sex [12-14]. Therefore, it follows that despite information and availability of HIV prevention strategies, it is likely that a significant amount of unprotected commercial sex will continue to occur, albeit at a higher price [13]. In a nutshell, the broader implications of these results are that interventions focusing merely on the supply side might not be very effective.

Structural interventions locate the source of health problems in factors relating to availability, acceptability, or accessibility, and are targeted at the individual, organizational, or environmental levels [15]. Such an integrated approach that considers all types of interventions together as a package is now seen as the most effective way forward for HIV prevention [7,9,16]. The efficacy of biomedical interventions depends on the context, especially structural barriers, and the extent of success of behavioural interventions that attempt to alter such barriers. Risk factors are often seen to be influenced by structural factors such as the type and level of economic growth and development, cultural practices, social norms, legal and policy environment, and the socio-economic profile of the region [11,17]. Clearly, there are multiple ways in which the underlying structural factors can manifest themselves as risk in different settings and at different times [18,19]. For instance, low potential for female labour market earnings is often taken to be an important reason why women go into prostitution [20]. Similarly, interventions with high risk population groups and bridge population alone may not be sufficient to guarantee reversal of the AIDS epidemic [21,22].

Broadening the scope of the term "structural" to include socioeconomic parameters that operate at a more macro level of the economy can help in a deeper understanding of what works in HIV prevention, where it works and why it works. Generally, development and socio-economic issues are discussed in the context of vulnerabilities of population groups to HIV and its subsequent impact, especially within developing countries [23,24], as has been done by several Human Development Reports (HDRs) with HIV/AIDS theme. There is almost total consensus that HIV programmes should be integrated or "mainstreamed" within developmental planning instruments like poverty reduction strategies, through multisectoral coordination. It has been contended that poverty on its own cannot be viewed simplistically as a driver of the HIV epidemic but as a multidimensional facilitator that influences mobility, social and economic inequalities and social capital [24,25]. A good example is of migration, which is seen as a key factor in the spread of HIV in

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developing countries [21,26-29]. Governance and administrative factors, political commitment, infrastructure, and human resource requirements are also seen as important variables in making interventions effective [25, 30-34].

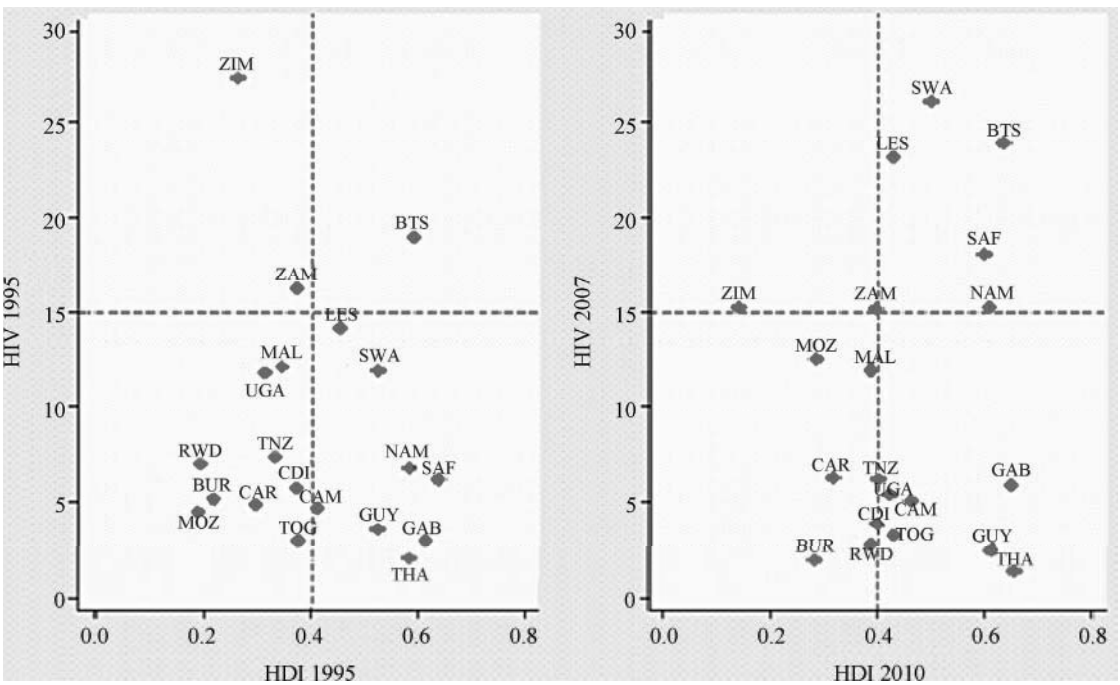
This review indicates that there is an inherent recognition of these broader socioeconomic correlates of HIV; our contention is that this recognition has not translated into designs of prevention programmes, which continue to only recognize the traditional structural factors. For sustainable behaviour change beyond the short term, the investment seen as "structural" may have to be augmented by investing on strategies that pertain to larger macro and developmental concerns of a country. We call such factors are called "structural plus" factors and analyze how investment in these factors can help create an "enabling environment" and can enhance the effectiveness of usual structural or behaviours interventions.

3. "STRUCTURAL-PLUS" FACTORS AND HIV PREVALENCE

Human development and governance has received less analytical and programmatic attention. As such, it has a significant bearing on HIV prevalence and its implications can be discerned by some elementary analysis. For example, **Figure 1** plots UNDP's Human Development Index (HDI) values for 20 high HIV prevalence countries for the years 1995 and 2010, and reveals a negative association between HIV prevalence and human development. It is worth highlighting that these high-prevalence countries have performed differently over the years in terms of HDI as well as HIV prevalence. It is evident that HDI and HIV do not necessarily move together as indicated by the experience of Swaziland, Botswana, Lesotho, South Africa and Namibia that demonstrate dwindling prevention effectiveness despite considerable gain in HDI. Uganda is often cited as an example for successfully containing infection rates following an "ABC" (abstinence, be-faithful and condom) prevention approach during 1990s [35]. However, these effects have faded gradually due to shortage of condoms, shifts from abstinence based prevention policy and changed perceptions about risk due to availability and access to treatment [36].

Clearly, HDI is a simple aggregation of three factors that have both intrinsic and instrumental values; however, sustained improvements in HIV prevalence requires further developmental assistance, particularly in the field of economic livelihood, women empowerment, human rights, institutions and governance. Thus, for instance, if livelihood issues and lack of functioning educational institutions are critical in adolescent risk-taking behaviour, then additional and parallel investments in employment generating activities and education are indispensable. We validate this argument by presenting some cross-sectional evidence based on data from 100 countries.

In particular, we study the association between HIV



Source: [37,38]. Note: The 20 countries are: ZIM, Zimbabwe; BTS, Botswana; ZAM, Zambia; LES, Lesotho; MAL, Malawi; SWA, Swaziland; UGA, Uganda; TNZ Tanzania; RWD, Rwanda; NAM, Namibia; SAF, South Africa; CDI, Cote d'Ivoire; BUR, Burundi; CAR, Central African Republic; CAM, Cameroon; MOZ, Mozambique; GUY, Guyana; GAB, Gabon; TOG, Togo; THA, Thailand.

Figure 1. HDI and HIV prevalence for 20 high prevalence countries in 1995 & 2010.

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prevalence and key developmental factors such as HDI, gender inequality, rate of growth of GDP, Gini coefficient of income inequality, and corruption index for good governance. The ordinary least squares regression results are presented in **Table 2** which suggests that apart from HDI, income inequality and governance are the three most important correlates of HIV prevalence across countries. The rate at which income grows is insignificant, which is not surprising, because the quality (or composition)—rather than quantity—of growth is an important determinant of risk factors and vulnerability to HIV. Gender inequality also has expected direction of improvement (though statistically insignificant) indicating that gender equity is a desirable component of an ideal structural environment.

Furthermore, we focus on the bivariate association between HIV prevalence across countries and Gross Domestic Product (GDP), GDP per capita, GDP growth rate, public spending on health and education as a percentage of GDP, and proportion of vulnerable employment defined as unpaid family workers and own-account workers as a percentage of total employment. For analytical purposes, the World Development Indicators data for 164 countries and four different time points 1990, 1995, 2000 and 2005 is used.

The concentration index (CI) is used to examine the association between key developmental indicators and HIV prevalence [39]. HIV prevalence is defined as a dichotomous variable and countries with adult HIV prevalence exceeding one percent are defined as high prevalence countries. As such, the CI ranges between +1 and −1 and in this instance provides a measure of the extent of association in prevalence that is systematically associated with developmental indicators. If high HIV prevalence is concentrated among countries with low developmental indicators then the concentration index would be negative. The larger the value of the CI the greater is the strength of the association.

Table 3 presents the CI estimates for the association between high HIV prevalence (exceeding one percent) and various developmental indicators. The negative CI coefficients for the associations between HIV and GDP across four time points indicate that high HIV prevalence is heavily concentrated among countries ranking low in terms of GDP. For instance, we find a CI value of −0.246 in the year 1990, which gradually increases to −0.313 by 2005. The negative association between income and HIV further intensifies when GDP is adjusted for population size and defined as GDP per capita. The CI value of −0.455 for the year 1990 continues to be on the higher side throughout the decade of 1990s and is computed to be −0.388 for the year 2005.

Table 2. Cross-section regression of "structural plus" factors on HIV prevalence.

Dependent variable: prevalence of HIV among adults in 2009	Coefficient	t-statistic
Human Development Index (HDI), 2010	−14.05**	−3.01
Income Gini Coefficient	0.20**	3.75
Corruption Perception Index (CPI), 2010	0.79*	2.34
Growth rate of GDP, 2009	−0.10	−0.94
Gender Inequality Index (GII), 2008	−0.33	−0.06
Constant	−0.10	−0.02
R-squared	0.29	
N	100	

Note: *significant at 5 percent; **significant at 1 percent. The data has been obtained from World Development Indicators 2010, Human Development Report 2010, and Transparency International 2010.

Table 3. Concentration Index for association between HIV prevalence and development, with Standard Error.

Associations	1990	1995	2000	2005
CI (HIV and GDP)	−0.246 [0.099]	−0.299 [0.076]	−0.309 [0.068]	−0.313 [0.068]
% countries with HIV prevalence above 1% (N)	20% (158)	29% (162)	33% (163)	33% (163)
CI (HIV and GDP per capita)	−0.455 [0.109]	−0.422 [0.078]	−0.389 [0.068]	−0.388 [0.069]
% countries with HIV prevalence above 1% (N)	20% (158)	29% (162)	33% (163)	33% (163)
CI (HIV and GDP growth)	0.007 [0.091]	0.087 [0.071]	−0.168 [0.065]	−0.072 [0.064]
% countries with HIV prevalence above 1% (N)	21% (151)	29% (163)	34% (164)	33% (165)
CI (HIV and Public expenditure on health)	-	−0.282 [0.075]	−0.272 [0.066]	−0.211 [0.066]
% countries with HIV prevalence above 1% (N)	-	29% (164)	33% (165)	33% (164)
CI (HIV and Public expenditure on education)	-	-	−0.121 [0.074]	−0.069 [0.083]
% countries with HIV prevalence above 1% (N)	-	-	34% (124)	31% (108)
CI (HIV and vulnerable employment)	-	-	0.481 [0.227]	0.331 [0.184]
% countries with HIV prevalence above 1% (N)	-	-	12% (76)	13% (82)

Source: Estimated using WDI indicators (1990, 1995, 2000 and 2005). Note: (.) indicates number of countries (N); [.] indicates standard error [s.e].

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There is an interesting relationship between HIV prevalence and GDP growth rate: at the beginning of the 1990s there was no systematic association between growth rate and HIV prevalence (CI = 0.007) but by the end of the 1990s HIV prevalence displayed significant concentration among countries with negative or low GDP growth rates (CI −0.168 in 2000). Perhaps, a lack of concentration in 1990 can be attributed to the widespread emergence of the epidemic across contexts but subsequently countries with better growth and development were able to reduce their prevalence. The situation in the last decade suggests that countries with poor growth performance are the ones sustaining a high prevalence rate. Undeniably, public expenditure on health and education are critical components of the structural-plus matrix and the analysis suggests that HIV prevalence shares a negative association with these developmental correlates as well. Specifically, countries with relatively high public expenditure are seen to share less of the burden then compared to countries with low public health expenditure. Public expenditure on education also shares a similar relationship but because of data limitations for several countries the effects are not captured fully. Finally, a vital perspective that we observe pertains to the high proportion of vulnerable employment in an economy and its significant association with HIV prevalence. The high CI values of 0.48 for the year 2000 suggests that HIV epidemic had mostly affected countries with large share of population in vulnerable employment. This association is sustained over the decade and therefore interventions seeking to reverse the epidemic should consider quality of employment and growth as key structural-plus factors.

4. DISCUSSION AND CONCLUSION

This review and analysis indicates the centrality of "structural plus" factors in the HIV epidemic. Despite this, there has not been much integration of HIV/AIDS prevention efforts with other developmental investment across countries. One key reason is that investment decisions on vital "structural-plus" factors are not under the purview of institutions implementing National AIDS Control Programmes (NACP), and there exists an administrative as well as intellectual separation between the two streams in policymaking. NACPs have neither the mandate nor the resources to invest on activities that may have a sustainable impact on HIV prevention. Despite efforts at mainstreaming HIV/AIDS interventions into planning, budgeting and implementation, it has not been possible to really harmonize and integrate development and HIV/AIDS prevention strategies with development strategies in most countries [40].

The recent rise in infections in Eastern Europe and Central Asia indicate very clearly that mere economic growth is not sufficient to dampen the spread of the infection. This region has had fairly robust growth, but despite that it is witness to the most rapidly spreading HIV epidemic. The vulnerabilities in this region has to do with injecting drug use that developed in the mid-1990s during the socioeconomic crisis that followed the break-up of the Soviet Union [41]. The affected groups remain the economically and socially weaker sections of the population with a strong association with unemployment [41].

Table 4 summarizes the key arguments of this paper and illustrates why a "structural-plus" approach might need more focus than the standard efforts at mainstreaming. As can be seen, countries with high adult HIV prevalence also have low HDI rank, high poverty, high income inequality and high corruption. The GDP growth rate, however, varies from negative to fairly high, with Botswana, Namibia and Mozambique displaying moderate to high rates of GDP growth.

Table 4. Selected "structural plus" indicators in 10 countries with highest HIV prevalence.

Country	Adult HIV prevalence	HDI rank	Poverty Headcount	Income Gini Coefficient	GDP growth rate (2001-2006)	Corruption Perception Index
Swaziland	26.1	121	41.1	50.7	2.5	3.2
Botswana	23.9	98	NA	61	5.2	5.8
Lesotho	23.2	141	48.1	52.5	3	3.5
South Africa	18.1	110	3.1	57.8	4.3	4.5
Namibia	15.3	105	39.6	74.3	5.3	4.4
Zimbabwe	15.3	169	38.5	50.1	5	2.4
Zambia	15.2	150	63.7	50.7	−5.2	3
Mozambique	12.5	165	79.8	47.1	8.7	2.7
Malawi	11.9	153	72.3	39	2.3	3.4
Central African Republic	6.3	159	86.4	43.6	−0.3	2.1

Source: The data on adult HIV prevalence is from UNAIDS, 2010. GDP growth rate, poverty headcount and Gini coefficient has been obtained from World Development Indicators 2010, Indicators for rank of countries as per human development index (HDI) is from Human Development Report 2010, and corruption perception index is obtained from Transparency International 2010.

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Botswana also has better corruption indicator than the other countries, but very high inequality. Apparently, in almost all these countries, the mining sector is the key driver of GDP, exports and employment and its linkages with HIV/AIDS are well established. For instance, in a different context [21] have contended that the mining sector does not lead to a growth pattern that is consistent with human development and such patterns of growth tend to throw up a whole nexus of vulnerabilities that are conducive to a rapid spread of HIV.

Our conclusions are that prevention programmes may not be sustainable in the long run if not complemented with, and accompanied by, fundamental investment in human development that reduce poverty and inequalities on the one hand, and provide a conducive legal, political and administrative framework that permit good governance on the other. These factors go beyond the usual structural interventions that are often added to prevention programmes to make these more effective. For example, in areas with high school and college drop outs and low employment opportunities, structural interventions like syringe exchange programme or condom availability would only have limited effectiveness. Similarly, rehabilitation of sex workers would require not only political and legal interventions but also solutions where employment generation for vulnerable women has to be a key part of any package of intervention meant for sex workers.

Schemes that use peers or offer micro credit are important but not sustainable unless quantum jump that are sustainable over time are made in the economic and social status of sex workers.

The foregoing arguments are even more convincing in the context of new infections. While usual structural interventions can work at a point in time, the prevention of new infections requires continuous funding of such programmes on a long term basis to specifically address the needs of new entrants into the vulnerable pool, and may soon meet administrative and financial roadblocks, especially in developing countries. Clearly, engaging with growth that is inconsistent with human development, negatively impact on HIV prevention efforts, and result in misallocation of global funding for prevention. The most effective and sustainable prevention of HIV would continue to be an equitable growth strategy that is consistent with all round human development; only this can act as a true "enabling environment" for the usual structural factors to perform their functions. Any other option would only end up wasting global scarce resources for HIV prevention.

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II Programmatic interventions

Community mobilization interventions for female sex workers

Community mobilization interventions for female sex workers

RESEARCH HIGHLIGHTS

- Evaluating the impact of community mobilization programs on HIV and other health outcomes could be challenging. As part of the Avahan program's community mobilization evaluation, a conceptual framework was designed to evaluate the theory of community change and its effect on outcome indicators. The theory and relevant key research questions for the evaluation of community mobilization interventions are discussed in the paper by Galavotti et al. (2012).

While community mobilization of female sex workers is challenging and depends on many factors (e.g. typology of sex work), the evidence shows that stronger mobilization leads to several positive outcomes and responds rapidly to HIV prevention efforts.

- Evidence suggests that mobilizing marginalized populations to form community-based organizations is a complex process, which is influenced by a number of factors such as the wide geographies, dispersed groups and multiple vulnerabilities of sex workers, and the different typologies of sex work (Chakravarthy et al., 2012).
- Programs with high demonstration of collective efficacy have shown sex workers' increased self-efficacy and self-confidence to negotiate condom use with occasional and regular partners, to support fellow sex workers in a crisis, to receive help from other sex workers when a client/partner is violent, and to stand up to the police and other troublesome stakeholders in a crisis (Gaikwad et al., 2012). Hence, the process of collectivization is key.
- Sex workers greatly benefit if they have community advocacy groups linked to their community-based organizations. Evidence in this regard indicates that sex workers from areas with active community advocacy groups have acquired social benefits such as ration cards and bank accounts, and received a fair response from the police (Punyam et al., 2012).
- Community mobilization helps in promoting the utilization of government health facilities for HIV-related and other health services. For example, the publication by Parimi et al. (2012) suggests that sex workers from areas with higher strength of community mobilization have reported greater use of government health centers for treatment of sexually transmitted infection than others.

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Research report

Navigating the swampy lowland: a framework for evaluating the effect of community mobilisation in female sex workers in Avahan, the India AIDS Initiative

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ABSTRACT

Background Few models of how community mobilisation works have been elaborated in the scientific literature, and evaluation of the impact of these programmes on HIV and other health outcomes is extremely limited. Avahan, the India AIDS Initiative, has been implementing community mobilisation as part of its prevention programming with groups of high-risk individuals across six states since 2005.

Purpose To articulate a programme theory and evaluation framework for evaluation of Avahan's approach to community mobilisation among female sex workers in four southern states in India.

Methods The authors use a goal-based evaluation approach to describe the programme goals and an underlying programme theory that specifies how the programme is expected to work. Using multilevel structural equation modelling with propensity score matching, the evaluation will compare what is observed in the data with the predicted relationships specified by the model.

Results The Avahan model of community mobilisation posits that meaningful participation in high-risk group intervention, structural intervention and organisational development activities leads to identification, collectivisation and ownership, which in turn leads to improved programme outcomes. Strong community groups and an enabling environment reinforce social norm and behaviour change outcomes and lead to sustained impact.

Discussion Specifying an explicit programme theory can aid in the evaluation of complex interventions, especially when the evaluation design is observational. In addition to articulating Avahan's community mobilisation approach in a model that can be tested, we recommend some specific measures and methods that could be used to improve evaluation efforts in the future.

> There is a high, hard ground where practitioners can make effective use of research-based theory and technique, and there is a swampy lowland where situations are confusing "messes" incapable of technical solution. The difficulty is that the problems of the high ground, however great their technical interest, are often relatively unimportant to clients or to the larger society, while in the swamp are the problems of greatest human concern.
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Community mobilisation, broadly defined, has been implemented by health and development organisations across the globe. Few models of how community mobilisation works have been elaborated in the scientific literature, however, and evaluation of the impact of these programmes on HIV and other health outcomes is extremely limited. Avahan, the India AIDS Initiative, has been implementing community mobilisation as part of its prevention programming with groups of high-risk individuals across six states since 2005[1] and thus provides a unique opportunity to understand and evaluate the effect of community mobilisation on HIV prevention behaviours. Because of the scale of Avahan and the complexity of the community mobilisation process (CMP) itself, however, evaluation is extremely challenging. Furthermore, although significant resources were directed towards impact evaluation of the overall initiative, understanding how the community mobilisation component of the programme contributed to prevention outcomes was not included in the original evaluation design since this component was introduced later in the life cycle of the programme.[2] In this paper, we describe Avahan's approach to community mobilisation among female sex workers (FSWs) in four southern states in India and outline the programme theory and framework for an evaluation of the programme's impact on HIV prevention outcomes.

BACKGROUND

Community mobilisation

Community mobilisation has been defined and operationalised in a variety of ways and incorporates concepts from a range of traditions, including Freirean liberatory adult education,[3] participatory development[4] and community psychology.[5] Much of the work around community mobilisation in health uses an empowerment framework with the central idea that expanding participation of communities in programme efforts leads to empowerment and greater capacity to influence, control and sustain conditions that affect their lives. Avahan describes community mobilisation as the process by which high-risk group members "…utilize their intimate knowledge of vulnerability to overcome the barriers they face and realize reduced HIV risk and greater self-reliance through their collective action."[1]

Community mobilisation has been employed as an intervention strategy to address a variety of health outcomes around the world,[6–8] and evaluations have shown promise. Two major cluster-randomised controlled trials of facilitated participatory action cycles among community groups showed significant reductions in neonatal mortality rates in the intervention clusters compared with control clusters.[9 10] One quasi-experimental study of community support systems for birth planning, funding of emergency transportation in Bangladesh increased knowledge of obstetric danger signs substantially more in the intervention community than in the comparison or control communities.[11] In Nigeria, a quasi-experimental study of a combined community mobilisation, advocacy and mass media intervention showed positive changes in knowledge, attitudes and intentions towards eliminating female genital cutting in intervention versus control communities.[12] On the other hand, a quasi-experimental study of community mobilisation for schistosomiasis control in Brazil was unable to attribute differences between the intervention and comparison villages to the community mobilisation intervention (CMI).[13] Of note, some studies reporting positive outcomes combined community mobilisation with other intervention activities, such as mass media campaigns[12] or healthcare facility upgrades,[11] making it difficult to isolate the contribution of community mobilisation on outcomes.

Interventions with sex workers

Studies of peer HIV education interventions with sex workers have reported increased HIV knowledge[14] and condom use[15] as well as decreased prevalence of STDs[14 15] and HIV.[16] Increasingly, community mobilisation is a central tenet within comprehensive sex worker programmes,[17] as in Avahan.[2 18 19] One of the earliest examples, the Sonagachi Project,[20] used a model called 'community-led structural interventions' (CLSI). A controlled trial replicating the CLSI model in two communities of West Bengal, India, found that the intervention increased consistent condom use in the intervention community,[21] as well as built social networks and addressed environmental barriers to economic vulnerability, relative to the comparison community.[22] The Sonagachi Project's CLSI model was a major contributor to the Avahan approach, as it combines elements of community participation and engagement with structural interventions (SI) to create an environment that supports social norm and behavioural change.

Avahan—the India AIDS Initiative

Avahan was launched in late 2003.[1] The goal was to halt the HIV epidemic in India by rapidly building a scaled HIV prevention programme for core and bridge population groups across four southern states and two north-eastern states in India (combined population of 300 million) representing over 80% of the HIV cases in India in 2002.[2] Through seven lead implementing NGO partners, who subgrant to 116 local Indian NGOs, the programme had reached over 350 000 FSWs and 100 000 high-risk men who have sex with men and transgenders (HR-MSM/TG) with outreach services by December 2008, and over 75% of both groups were being contacted monthly by the programme.[23] A recent study published in *the Lancet* concluded that over 100 000 HIV infections were averted at the population level as a result of this first phase of Avahan (2003–2008).[24]

For core groups (FSW, HR-MSM/TG and injection drug users), Avahan supports a package of interventions including peer-led outreach and education, treatment of sexually transmitted infections (STI), referrals for HIV and tuberculosis testing and care, and distribution of free prevention commodities (condoms and needle/syringe exchange). In addition to these interventions, Avahan supports interventions to change the structural environment of core group members' lives, and organisational development (OD) activities to build capacity and encourage participation, leadership and ownership of community-based groups and networks.

EVALUATION FRAMEWORK

The challenges to evaluating Avahan's community mobilisation approach are substantial and consistent with those facing other large-scale public health programmes.[25 26] In particular, Avahan was designed for scale: the explicit intent was to 'saturate coverage' of high-risk individuals in the designated high prevalence districts in India, filling gaps in areas where other government and NGO efforts were in place, and providing intervention services in areas where there were no other HIV prevention programmes operating. This was among several reasons why there were no planned control or comparison sites and no data collection in sites where Avahan was not operating, and why data collection was focused on coverage and HIV impact measures.[2] With this design, it is not possible to draw strong causal attributions: we cannot 'prove' that the CMI caused the prevention outcomes.

One commonly accepted evaluation strategy when experimental or quasi-experimental designs are not possible is 'goal-based evaluation', which uses a predetermined set of programme goals and an underlying programme theory, usually outlined in a logic model, to describe how the programme is expected to work.[27] If these relationships and outcomes are observed in the data, and other alternative explanations can be reasonably eliminated, this provides plausible confirmation that the programme was successful. Figure 1 depicts several scenarios that might be observed.

SPECIFYING THE MODEL

It is not unusual when there are multiple stakeholders in a programme to have varying theories about how the programme will produce the desired effects. Realistic evaluation[25] suggests that the first and most important step in an evaluation is to elicit these theories and formalise a model that can be tested in various contexts. Therefore, developing the model of how we expected community mobilisation in Avahan to work was the first step in designing an evaluation of the programme.

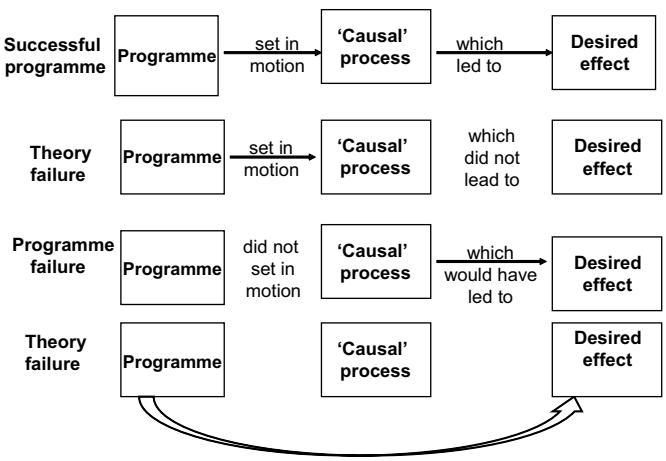

Figure 1 Understanding evaluation results using a goal-based evaluation framework. Adapted from Weiss.[28]

A basic assumption underlying the development of the model is that we are evaluating a *single* programme. This does not mean that the intervention was implemented uniformly or that the context was the same across Avahan. In fact, it was not. Rather, the model describes the overall conceptual underpinnings, the programme theory, behind Avahan's community mobilisation approach. This model can then be tested in multiple contexts, and with other groups of high-risk individuals, and further refined. Throughout this paper, the term 'community' is synonymous with 'groups of FSWs who come together in programme areas', and the model we propose is specific to FSWs. While certain elements of the model may be applicable to the other high-risk communities served by Avahan, we developed the model with FSW interventions in mind.

COMMUNITY MOBILISATION: DEFINING THE PROGRAMME INTERVENTION AND MECHANISMS OF EFFECT

There are two ways we refer to community mobilisation in this paper: the first corresponds to the 'programme' and the second to the 'causal processes' specified in the hypothetical model in figure 1.

First, the programme we wish to evaluate is the CMI—this is what the programme does to actively solicit and support full and meaningful participation of the high-risk population in the intervention activities. Measures of the type and level of community participation in intervention activities are what we use to assess successful implementation and 'dose' of the CMI (described later and shown in table 1).

The second is the CMP—these are things that occur as a result of the CMI (ie, as a result of participation in the intervention activities). These are the causal processes we believe the programme sets in motion, and it is these processes that we believe lead to the desired programme outcomes.

The CMI

Avahan supports a package of intervention activities that have been roughly grouped into three categories: high-risk group interventions (HRGI) that focus on individual risk reduction (eg, condom distribution), SI that focus on vulnerability reduction (eg, crisis response teams organised to support sex workers when arrested or subjected to violence) and OD activities that focus on building the capacity of the community to lead and own the programme. In theory, these activities could be delivered by the implementing NGOs with little or no involvement of the community. What distinguishes the community mobilisation component of the Avahan intervention from a more standard HIV prevention intervention package is the intentional engagement of the community in these activities as actors, rather than simply as recipients of services or as paid staff.[29 30] Although not implemented in a strict sequence across all Avahan districts, as the intervention unfolds, sex workers are provided support and opportunities to participate in increasingly transformational ways,[31] from conducting community mapping and outreach (micro-planning), and participating in project committees, to facilitating the management of crisis response teams and taking leadership roles in formal community-based organisations.

The CMP

The goal of community participation is to mobilise the community of sex workers so that they can increasingly make decisions, influence their environment and shape their lives in ways that support their health and well-being. We characterise this process by three overlapping and mutually reinforcing stages that reflect the expanding interpersonal, social and political space that sex workers inhabit as mobilisation unfolds.

Table 1 Measures to assess the strength of the community mobilisation intervention at the cluster level*

Activities	Measures of community participation†
High-risk group intervention	
Programme penetration	Number of HRIs registered under project/number of HRIs registered as CBO members
Programme participation	Proportion of *unpaid* HRIs in cluster who participate in programme activities‡
	Proportion of *paid* HRIs in cluster who participate in programme activities
	Categorisation of the cluster as having low, medium or high participation among unpaid and paid HRIs
Micro-planning: peer-led outreach	Ratios of unpaid and paid HRIs to all participating
	Whether any HRI takes the lead role in *organising* the micro-planning activity
	Whether any HRI takes the lead role in *analysing* the micro-planning data
Structural intervention	
Facilitating access to entitlements	Total number of entitlements the programme focuses on in the cluster
	Unmet need for entitlements within the cluster
Functional committees§	Proportion of *paid* HRI to total number of committee members from cluster who participate on committees
	Proportion of *unpaid* HRI to total number of committee members from cluster who participate on committees
Crisis response	Proportion of *paid* HRIs who serve as main person responding to crises to total number of those responding
	Proportion of *unpaid* HRIs who serve as main person responding to crises to total number of those responding
Organised collective action	Total number of collective events organised by cluster members
	Ratio of *paid* and *unpaid* HRIs who participate in collective action events to total number of HRIs registered in cluster
Organisational development	
Leadership and ownership by CBOs	Existence of cluster representative on leadership team or governing body
	Categorisation of cluster as having low, medium, high or highest level of participation by *paid* and *unpaid* HRIs in the nomination process
	Proportion of *paid* HRIs on the leadership team
	Proportion of *unpaid* HRIs on the leadership team
	Proportion of *unpaid* to paid HRIs on the leadership team

*'Cluster' is a geographic unit at the subdistrict level that represents approximately 250 female sex workers served by the programme.
†All measures obtained from the cluster-level community participation sheet (CLCPS).
‡Programme activities include: outreach, advocacy, crisis response and clinic.
§Committees include: outreach, drop-in center (DIC) management, STI clinic management, crisis response, advocacy and condom.
CBO, community-based organisation; HRI, high-risk individual; STI, sexually transmitted infections.

Stage 1: identification with others

The process of community mobilisation begins when sex workers see themselves as part of a community.[32] In the early stage of the programme, Avahan provided a 'safe space' for sex workers to gather. The provision of safe space plays an important role in the process of mobilisation through the creation of both physical and social space for meeting, discourse and the development of a shared identity.[33] Through identification with others, a sex worker begins to form relationships and social ties: she begins to feel "I am not alone". This is the beginning of empowerment and may affect sex workers' other relationships: an increasing sense of individual agency and self-confidence may lead to greater exercise of decision-making and power in relationships with clients and other partners.[18]

Stage 2: collectivisation

As social cohesion and connectedness grow, sex workers begin to see themselves not just as a loosely connected aggregate of individual sex workers but as a group that faces common concerns, experiences and needs.[34] A strong sense of collective identity is vital to participants' willingness to invest emotionally in the larger entity[32] and helps drive participation in mobilisation efforts.[35] With support from Avahan, this is the point when sex workers begin to work together to identify issues that they can tackle as a collective and to exercise power as a group to influence other actors and processes in the wider community. If the groups' actions benefit sex workers, others in the community may see participation in the group as something worthwhile, further building a sense of collective efficacy.[36] Sex workers who are either not willing, or not able, to join the group may also experience benefits as a result of the community's collective action; for example, less violence against sex workers, or more accessible services.

Stage 3: ownership

Because identification and collectivisation do not automatically lead to engagement, leadership and ownership,[37] Avahan's OD activities specifically support formalisation and ownership of community groups and networks. Community-owned organisations and networks give sex workers greater power and influence: community ownership is a common factor across successful case studies of community mobilisation for HIV prevention.[38] Furthermore, strong collectives support and reinforce changes in the environment that facilitate a higher quality of life for sex workers and build organisational resilience to threats such as loss of funding, police action and discrimination by health workers, leading to sustainability of programme activities and outcomes.

Expected programme outputs

The model specifies a number of programme outputs that are expected to be enhanced by the participation and mobilisation of the community, and these enhancements may in turn increase programme success. For example, greater community participation in outreach activities is expected to lead to greater coverage of the population, and more community participation in programme oversight is expected to lead to higher quality services. Other outputs include greater capacity to manage and direct programme activities, to advocate on behalf of the community and to lead community groups.

Expected programme outcomes

The primary HIV prevention behavioural outcomes established for the first 5-year phase of Avahan are consistent condom use with clients, regular STI service utilisation and increased behavioural norms for safer sex. It is hypothesised that these primary behavioural outcomes are reinforced by achievement of additional social and environmental outcomes, in particular, the presence of an enabling environment and strong community groups. As a result of all these factors, we expect longer term changes in the environment that reduce risk and vulnerability (eg, reductions in discrimination in public places, police harassment, violence against sex workers) and help sustain community organisations (eg, organisational processes that support good governance, resource mobilisation and linkages between community organisations and larger networks of sex workers).

Taken as a whole, the model depicted in figure 2 describes the following programme theory:

Meaningful participation in HRGI, SI and OD activities leads to identification, collectivisation and ownership, which are

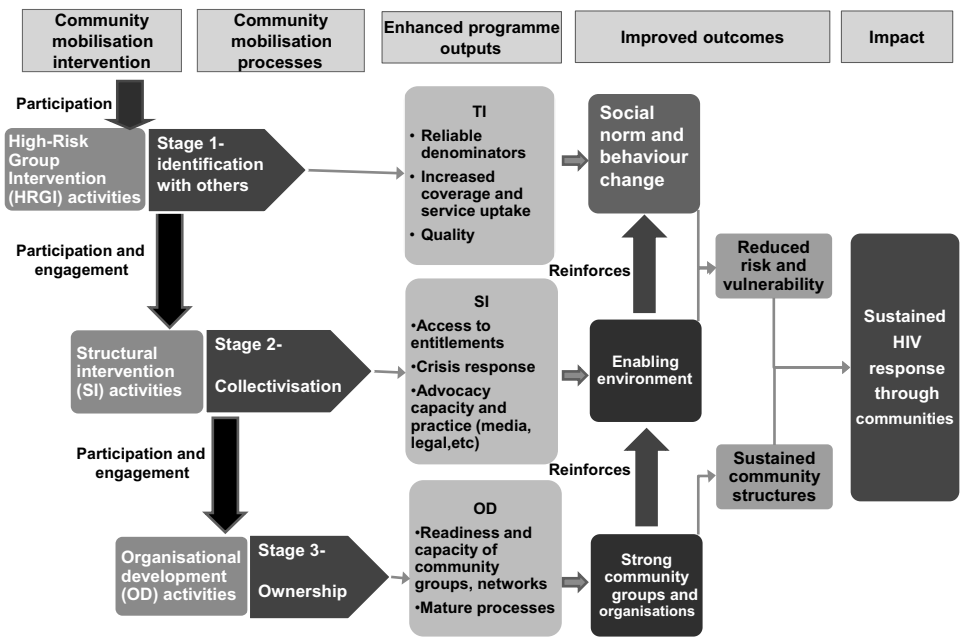

Figure 2 Model of Avahan's programme theory for community mobilisation.

associated with increased service coverage and quality, vulnerability reduction, capacity of community groups and improved programme outcomes. Strong community groups and an enabling environment reinforce social norm and behaviour change outcomes and lead to sustained HIV prevention impact.

THE PLANNED EVALUATION

We plan to first test the programme theory model in one state, Andhra Pradesh (AP). AP was chosen for the initial evaluation in part because the two Avahan implementing partners working there (India HIV/AIDS Alliance and Hindustan Latex Family Planning Promotion Trust) were willing to conduct additional data collection. We will first evaluate the model using data from the Alliance districts, then, if the model is supported by the data, we will replicate the evaluation in the other districts. AP has the second highest estimated adult HIV prevalence rate in India and the highest among the four southern states in which Avahan works. Like the other southern states, infection is due largely to sexual contact.

This initial test of the programme theory will focus on three main components of the model: the CMI, the CMP and the primary behavioural outcomes for the first 5-year phase of Avahan. Figure 3 depicts our main hypothesis: higher levels of community participation lead to greater mobilisation (identification, collectivisation and ownership), which increases the likelihood of positive programme outcomes. This dose–response relationship via mediating factors will be analysed within a Multilevel Structural Equation Model framework.[39] Due to the non-randomised nature of these observational data, we will adjust the model using propensity scores to reduce the effects of selection bias.[40 41]

We limit the initial evaluation to these key components of the model for several reasons. First, a parsimonious model focused on the main question—does greater community mobilisation improve HIV prevention outcomes—is most likely to be useful to programme planners who are pressed to justify the additional time and resources associated with community mobilisation. Second, we did not include outputs in the evaluation since the type, quality and availability of the output measures varied greatly across programme components (HRGI, SI and OD) and across sites. For example, some of the output measures were collected through routine programme monitoring (eg, condoms distributed, entitlements obtained), while others were collected through extensive qualitative data collection only in selected sites (eg, capacity of community groups, organisational processes). Finally, the longer term outcomes (eg, reduced risk and vulnerability, sustained community structures and sustained HIV response) have yet to be fully realised and thus cannot be evaluated at this time.

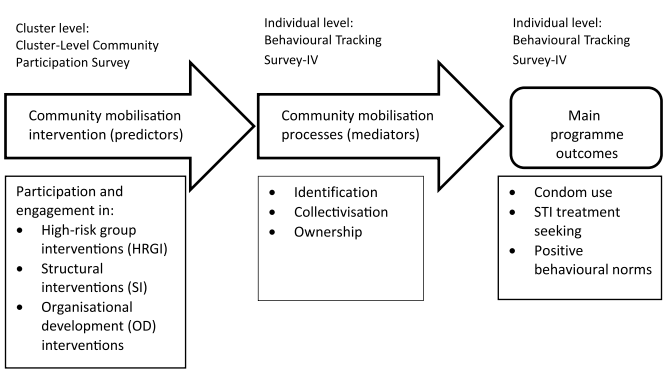

Figure 3 Relationship between the programme theory and the focus of the planned evaluation: key concepts, measures, level and source of data. STI, sexually transmitted infections.

We use two sources of data for this evaluation: the Cluster-Level Community Participation Survey (CLCPS) and the Behavioural Tracking Survey Version IV (BTS-IV). Both were cross-sectional assessments conducted between December 2010 and July 2011 in nine of 22 districts in AP, comprising all the districts in which the two Avahan partners work. For the initial evaluation, data from the five districts served by Alliance will be used. This will reduce variability in the intervention due to a difference in implementing partners, as well as provide an opportunity to validate the model in the other districts as a second step.

Community-level measurement of strength of the intervention: the CLCPS

Table 1 describes the measures we used to assess strength of the CMI. Although the BTS-IV included self-reported measures of exposure to, and participation in, the programme, to adequately address our main evaluation question (ie, Did a greater level of community mobilisation lead to improved programme outcomes?), it was important to have an independent measure of 'strength of the intervention'. An independent measure of intervention strength at the community level will allow us to move beyond an individual level only analysis of the effect of self-reported exposure to the intervention on outcomes. We define 'strength' as the type and level of participation of the community in the CMI, and we measured it with the CLCPS, a tool based on a much longer qualitative measure of the nature, scope and character of community mobilisation and organisation.[42]

The CLCPS provides a profile of community participation in the CMI at a subdistrict level, a geographic area we describe as a 'cluster'. The 'cluster area' was defined at the level of the NGO Staff Outreach Worker (ORW), who is responsible for implementation and monitoring of the programme in one or several small geographical units within each designated district of AP. The ORW supports the work of five high-risk group peer ORWs (peers) who each serve an average of 50 FSWs. In each cluster, the ORWs were interviewed using a series of questions to measure community participation in programme implementation, management, decision-making and activities including crisis response. The information provided by the ORWs was validated by structured interviews and detailed reviews of organisational documents. There were a total of 104 clusters in the five Alliance districts.

Data from the CLCPS captured the degree of autonomous community planning, implementation and oversight of programme activities and the quality of governance processes, leadership and ownership. These variables served as the basis for constructing a quantitative composite intervention exposure variable, which characterises the type and level of community participation by subdistrict cluster: we created average scores for each item in each geographic cluster, and these scores were then combined across several domains to represent the 'strength of the intervention' in that cluster. The cluster-level scores will allow us to look at the relationship between the strength of the intervention and the outcomes (eg, condom use), as well as the relationship between the strength of the intervention and the CMPs that we expect to mediate the relationship with outcomes.

Individual-level measurement: the BTS-IV

Table 2 (supplementary file) provides details on the measures of the CMP, all derived from individual-level self-reported data

collected by the BTS-IV survey. These measures capture the process of becoming empowered, developing a sense of community and perceived solidarity, social cohesion and collective ownership.

The BTS included measures of demographics, socioeconomic situation, perceived stigma and discrimination, sex work history, condom use, perceived individual and collective agency, participation in FSW organisations and events and exposure to the local CMI programme.[18] For the BTS-IV, we added time since first exposed to the CMI programme, self-efficacy scales for condom use and for service utilisation, contraceptive use, a social cohesion scale (validated for use with sex workers)[43] and a mental health (depression) measure.[44]

The primary outcome measures to be used for this evaluation are also derived from the BTS-IV and include self-reported condom use with clients (regular and one-time), STI service utilisation and increased behavioural norms for safer sex. Behavioural norms are measured by frequency of turning away clients when they refuse to use condoms, whether any clients in past 7 days did not use a condom, and the proportion of new entrants to sex work (<1 year) who report consistent condom use or refusing sex because of a client not having, or refusing to use, a condom.

From the same set of subdistrict clusters defined for the CLCPS, we randomly sampled individual FSWs for the BTS-IV using a two-stage sampling procedure. In the first stage, a fixed number of hot spots within each cluster were selected using the probability proportional to size procedure.[45] In the second stage, we selected participants using either systematic sampling from non-public places (eg, brothels) or time–location cluster sampling from public places (eg, streets, parks, highways). A total of 1986 FSWs participated in the survey in the five Alliance districts.

This unique approach to measuring the strength of the intervention by subdistrict cluster, in conjunction with an independent survey of sex workers in the cluster, will allow us to explore the relationship between the strength of the CMI in the cluster and the individual-level measures of the CMPs and outcomes captured in the BTS-IV.

CHALLENGES FOR EVALUATION

Avahan awarded grants to seven state lead partners, who then provided subgrants, management and technical support to local NGOs.[1] This resulted in dozens of local NGOs implementing the programme. NGOs varied with respect to skills, experience and length of engagement with the high-risk communities; some were more comfortable than others with the community leading and taking ownership of the programme. This variation, in part, will be reflected in our measure of strength of the CMI and thus will enable us to explore different 'doses' of the intervention. Other factors that may have affected programme implementation are not measured, however.

There is also significant geographic and demographic variation across Avahan, as well as variation in other features of the environment that could have influenced how the programme was implemented as well as the likelihood of programme success. These threats to validity of the findings are somewhat mitigated in this initial evaluation since we have confined it to one state. To the extent possible, contextual variables will be explicitly modelled or controlled for in analyses, including variables such as frequency of travel for sex work, location of sex work, debt, other sources of income, density of sex workers and duration of the intervention in the cluster.

Despite the many challenges with this evaluation, a complex theory-based meditational model, such as the one we propose, tends to reduce the likelihood of chance results compared with simpler models since the researcher makes a riskier 'prediction' about the specific relationships. Finally, because this is essentially an observational study, self-selection bias poses a major threat to drawing valid inferences. We use propensity score analysis to address this threat, as this method has been shown to remove about 90% of the bias resulting from non-randomised selection.[40]

DISCUSSION

The planned evaluation is an attempt to articulate some of the key features of a large-scale investment in community mobilisation, and how it may work to expand FSWs ability to overcome barriers they face and realise reduced HIV risk. We do so understanding that our methods are limited as much by the complex nature of the programme and the mobilisation processes themselves as by the design and the data available. Our model is a greatly simplified rendering of that complex system and set of relationships; we have tried to capture the key principles at work in that system and elucidate a few critical connections between events and outcomes, so that, if confirmed, it might serve a practical purpose. A more nuanced understanding of community mobilisation and how specific contexts facilitate or constrain programme implementation and CMP will require approaches and methods beyond what is proposed for this evaluation.

We hope by articulating a model of community mobilisation and developing measures that build on both previous research

What is already known on this subject

- Community mobilisation has been used as an intervention strategy to address a variety of health outcomes around the world.
- Few models of community mobilisation have been elaborated in the literature, and evaluation of the impact of community mobilisation on health outcomes is extremely limited.
- Community mobilisation may take many years and can be difficult and resource intensive, and thus, understanding what the most critical components of community mobilisation are and evaluating community mobilisation's relative contribution to programme outcomes are important to many stakeholders.

What this study adds

- We describe Avahan's approach to community mobilisation among FSWs in India.
- We articulate a programme theory that elaborates on how participation in the intervention is expected to lead to community mobilisation and ultimately to improved programme outcomes.
- We further outline an evaluation framework for the evaluation of this large-scale CMI and describe the methods and measures that will be used to assess outcomes.
- Finally, we note the challenges associated with evaluation of complex, dynamic community interventions.

and programme experience, we offer some guidance for others. At a minimum, we strongly recommend that programmes document community participation in the programme (level, scope and nature) from the beginning and aggregate that data at a meaningful level to assess strength of the intervention in the community over time. Baseline and follow-up surveys of intended programme beneficiaries collected in those same areas using a multistage sampling approach would then provide a stronger evaluation of how, and if, the CMI works to improve programme results. While cluster-randomised controlled trials of CMIs may be feasible and appropriate in some instances, CMIs are by their very nature complex, dynamic evolving systems that disrupt and reshape individual, social and institutional relationships in the settings in which they are introduced, and thus, we believe that more innovative methods of evaluation are needed. To generate evidence that will support the development and sustainability of better programmes, we may need to leave the hard high ground of the experimental paradigm and learn to navigate the swampy lowland.

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Contributors CG, TW, ASK, UK and GD contributed to the articulation of the model of community mobilisation. TW, UK and GD were responsible for overseeing development and implementation of the community mobilisation intervention in India for the BMGF. CG, ASK, TW, NS and PN contributed to development of the measures of key constructs, and NS and PN oversaw data collection. CG and ASK wrote the paper with significant contributions from TW and GD. CG takes full responsibility for this manuscript.

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Competing interests None.

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Research report

Community mobilisation programme for female sex workers in coastal Andhra Pradesh, India: processes and their effects

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ABSTRACT

Background This paper describes the process of setting up community-based organisations (CBOs) of sex workers during the 5-year community mobilisation initiative of the Swagati project, an HIV prevention programme in nine coastal districts of Andhra Pradesh.

Method The Swagati project facilitated the formation of 11 CBOs through partnerships with local non-governmental organisations and meetings with groups of sex workers. Activities included peer-led outreach, information campaigns, institution building through community committees and capacity building for organisational development.

Results In 2010, a Community Ownership and Preparedness Index tool assessed the CBOs in terms of leadership, democratic governance, decision making and others qualities. All except two CBOs scored in the 'promising' category. One of these CBOs moved to promising stage by the year 2011 indicating good progress, considering how recently they were established. The Community Ownership and Preparedness Index assessments of organisational strengths showed wide variations among the CBOs, despite the essentially similar organisational steps taken by the Swagati programme. A Behavioural Tracking Survey (2010) of individual CBO members also showed district-level differences in sex workers' expressions of confidence in collective action, participation in organisational activities and other indicators.

Conclusion Mobilising marginalised populations such as sex workers to form CBOs is a complex process and can be affected by many influences, including the qualities of CBO leadership. Although the CBOs have not yet reached full 'maturity', they have made significant improvements in terms of collectivisation and its translation into collective action as reported by individual sex workers.

INTRODUCTION

Community-based programmes using participatory techniques, if scaled up, can provide a cost-effective and sustainable approach to HIV prevention.[1] Several studies document diverse community mobilisation strategies and models to prevent HIV and sexually transmitted infection (STI) in developing countries, for example, involving local community groups in designing and implementing programmes for improved STI prevention, community-based condom distribution and peer education,[2] enhancing the 'AIDS competence' of marginalised communities by building their HIV-related skills and knowledge and supporting partnerships between marginalised communities and outside agencies[3] and promoting community ownership, reliance on group consensus and the use of 'gatekeepers' to access communities to reduce the risk of HIV transmission.[4]

Different models of community participation have resulted in notable examples of HIV risk reduction and sustainability, as well as instances of disorganisation and failure. Asthana and Oostvogels describe an early HIV/AIDS programme in the state of Tamil Nadu (India), which attempted to develop a system of community participation among female sex workers (FSWs) in Chennai (formerly Madras).[5] Although the intervention did succeed in increasing condom use in the targeted area, there was very little innovation of any new features to develop sustainability: 'Having already lost its momentum, the programme was irreparably damaged in October 1993, when a police crackdown on prostitution in the intervention area caused most of the brothels in the area either to close or relocate to other areas of the city'.[5]

Instead of re-organising the 7-month-old intervention effort, the programme abandoned the community participation component and re-focused on awareness raising in the general population. The authors presented a number of probable 'causes' for programme failure; two key factors were the complexity of the sex work system in Chennai and high stigma about sex work and programmers' lack of knowledge about community-based organising.[5]

Many different environmental and organisational problems can undermine well-intentioned efforts to develop sustained community participation. Cornish and Campbell[6] have described another example of a failed community participation effort in a South African mining town and made systematic comparisons between this unsuccessful programme and the contrasting success story of the project in Kolkata in India. The programme environment in the mining town was far worse than the situation in Chennai described by Asthana and Oostvogels.[5] As in the Chennai example, the sex worker networks in the mining town constituted a disorganised semi-lawless environment, with few supportive features.

These failed programmes stand out in sharp contrast to the highly successful and widely publicised Sonagachi project in Kolkata, also initiated in the early 1990s. The Sonagachi intervention became the 'model to be emulated,' and community mobilisation programmes in Andhra Pradesh and elsewhere in India owe much to the exemplary features of that programme. Unlike the failed Chennai project, the Sonagachi intervention began

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to develop innovative organisational features at the same time that a system of 'peer educators' was started. One important component of the programme was the introduction of a system of committees, including mechanisms for resolving disputes with brothel madams, problems with the police and dealing with violent clients. Cornish and Ghosh[7] described the central philosophy of the programme, quoting from Sonagachi programme materials: 'Project documentation describes its philosophy in terms of 3 R's: Respect, Recognition and Reliance. That is respect of sex workers and their profession; recognising their profession, and their rights; and reliance on their understanding and capability'.

The phrase 'recognising their profession' may appear to be a relatively innocuous idea, but it is a powerful declaration and runs counter to the beliefs of many social service-oriented people in India, as considerable numbers of NGO leaders and workers take the view that sex work is not 'legitimate work', as most FSWs are 'trafficked' or coerced into this activity.[8]

Another significant component in the Sonagachi approach has been the development of systematic communications with important stakeholders in the Kolkata brothel area. Particularly central are the brothel madams, who have the power to bar Sonagachi programme people from entering the places of sex work, explaining that the programme is in no way intended to undermine their powers and roles.[7 8]

The Sonagachi sex workers established the Durban Mahjila Samanwaya Committee, an organisation 'which organises weekly and monthly problem-solving meetings, and promotes sex workers' social and political awareness through critical discussions of the stigma attached to sex work, and the value of collective action'.[7]

Cornish and Ghosh[7] noted that many theoretical writings about 'community participation' have presented a 'Utopian discourse' about how involving the sex workers (or other marginalised groups) directly in the organisation of health interventions will bring about remarkable results, thus creating unrealistic optimistic expectations. The studies of the Sonagachi programme show that successful community participation is a complex slow-moving process in which many obstacles can block the progress towards 'sex worker empowerment' and weaken the effects of community-based organisation (CBOs).

This paper is intended to present a detailed description of a full-fledged programme of community mobilisation in an HIV/AIDS intervention programme in Andhra Pradesh. In India, the model for this kind of community mobilisation is largely derived from the widely cited Sonagachi project in brothel-based sex work settings in the city of Kolkata. Literature towards understanding the formation and functioning of community mobilisation and assessing its strength from an upscaled intervention within different typologies of sex work is scarce.

The HIV prevention programme in Andhra Pradesh (known as the Swagati project), which we describe in this paper, has drawn heavily on the lessons learnt in the Sonagachi project. The Sonagachi project designers and organisers made several recommendations on community mobilisation, which was largely unplanned and atheoretical at its inception.[9] However, the description of programme activities and structures by several researchers over time show that a framework of community mobilisation and supporting structures gradually evolved, from which a coherent theoretical system could be formulated. This includes changes that take place at individual levels of behaviours, to FSWs' engagement as peer educators, to systems of capacity building, the gradual incorporation of the community into intervention operations and the formation of an association, supported with problem-solving structures and committees.[7 9 10] The Swagati programme, which we describe in this paper, adopted this framework to up-scale community mobilisation intervention activities through principles accustomed to local contexts and implemented among FSWs belonging to different cultural and contextual backgrounds. This paper fills the gap in the literature on strategies for scaling up strong community mobilisation initiatives that can evolve into manageable CBOs.[11] The specific objectives of the paper are to describe the step-by-step development of the community mobilisation process in Andhra Pradesh, in order to show how the key features of the Sonagachi model were adapted to the different social and economic environments of the sex workers and to examine the evidence concerning the progress of the programme in developing the CBOs and empowering FSWs to play an active role in their local and district-wide organisations.

STUDY SETTING

Community mobilisation and structural intervention strategies have been an integral component of the Avahan initiative for HIV prevention efforts in four southern states of India.[12] These initiatives have incorporated the main lessons from the Sonagachi experience, so that these programmes, including our project, can be looked on as further testing of the applicability of the Sonagachi model. The Swagati project was initiated in 2004 in nine districts of coastal Andhra Pradesh state in southern India (see figure 1). Most of the sex worker areas in these districts are quite different from the Kolkata environment, as there are very few concentrated brothel areas, so some of the distinctive environmental challenges to community mobilisation exist in coastal Andhra Pradesh. In most of the sex work locations, home-based and street-based sex workers are far more numerous than brothel-based FSWs.

Seven of the nine project districts have been categorised by the National AIDS Control Organisation as high HIV prevalence districts, as HIV prevalence among antenatal clinic attendees is more than 1% and among FSWs, it is more than 15 times that of the general population.[13] These coastal districts have flourishing agricultural, industrial and business sectors that have also attracted large numbers of FSWs to both urban and rural areas. The main focus of the Swagati project was in rural and tribal locations with an estimated 25 500 FSWs and 10 000 men who have sex with men/transgenders.

THE SWAGATI PROJECT

To implement large-scale community mobilisation activities, the following teams were set up: a Project Monitoring team and a Technical Support team. Details of the overall Avahan strategy for the development and evaluation of the community mobilisation programme are discussed in the paper by Galavotti *et al*[14] in this volume. The implementation strategy that Swagati adopted is presented in detail in this paper.

Involving NGOs: participatory site assessment

At the start of the project, eight local non-governmental organisation (NGO) partners were selected in the districts (one NGO worked in two districts). These NGOs were provided funds and given training on HIV prevention activities.

The first task in the partnership between Swagati and the identified NGOs was to conduct participatory site assessments in all the intended project locations. The study identified the 'hotspots' of sex work activity and made an inventory of types of FSWs, clients and other key persons in the sex work networks. In each district, FSWs who were familiar with local

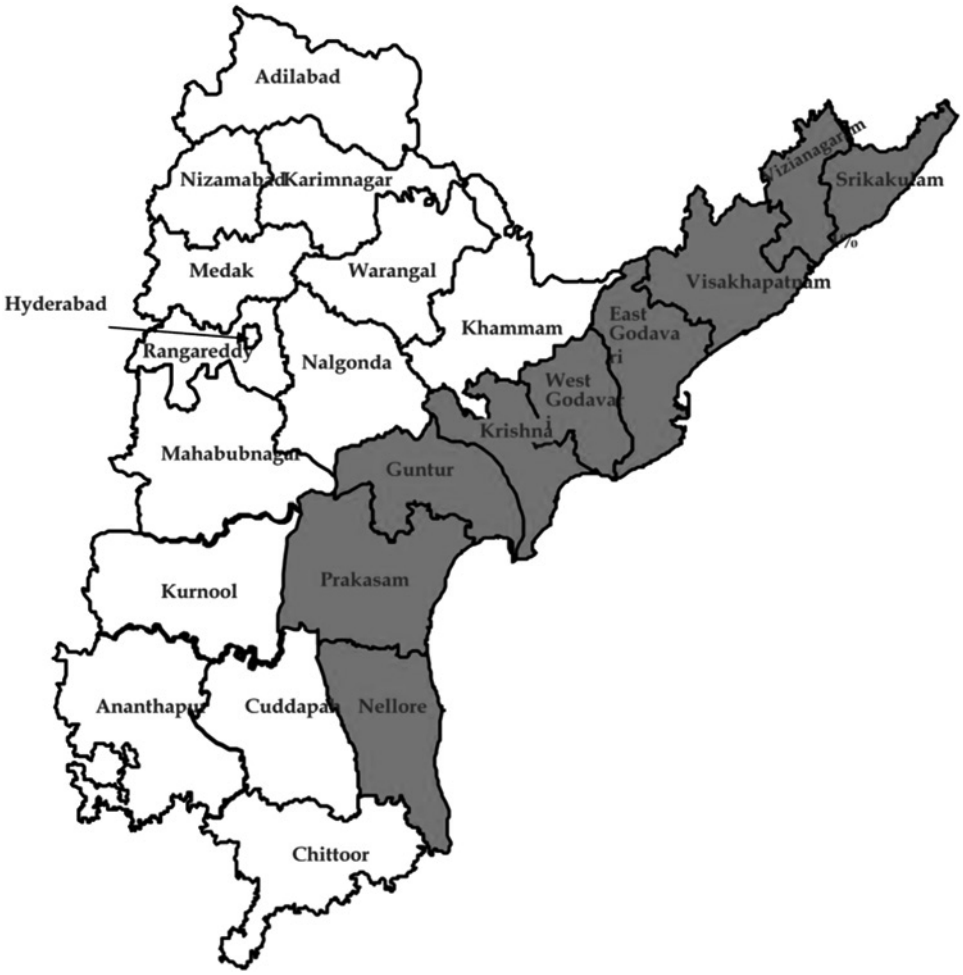

Figure 1 Swagati project districts (highlighted) in the state of Andhra Pradesh, India.

conditions were identified and trained to carry out mapping of the project areas, in order to initiate the participatory engagement of the community. The findings of the site assessments indicated that although the majority of FSWs and their clients were aware of the importance of condom use, most did not use condoms during sexual encounters.

Implementation of the upscaled community mobilisation programme

Recruiting and training community guides

One of the first tasks of the partner NGOs was to identify and recruit FSWs to be trained as community guides (peer educators) to do the outreach activities in the programme. These community guides were active sex workers, selected because of their knowledge of the hotspots in their local areas and their understanding of sex workers' problems. Additionally, they were well connected in their community and well accepted by fellow FSWs. Community guides received a monthly honorarium of Indian rupees 1500 (approximately US$35) for outreach activities and informational contacts with their peers. Each community guide was required to work with at least 50 FSWs. By March 2006, the NGOs under the Swagati project had recruited 443 community guides and later (2008) increased to 584.

The NGOs, in partnership with the Swagati project of HLFPPT, trained the community guides on project objectives, their roles and responsibilities, social network analysis and basic communication skills. As part of their responsibilities, community guides encouraged FSWs to seek health check-ups at least once every 2–3 months as well as to seek follow-up services at project-operated clinics. They also conducted demonstration sessions on condom use, monitored condom use among their peers and planned community activities at drop-in centres (DICs).

NGO staff used the DICs to conduct awareness building and training sessions for community guides on health-seeking behaviour and behaviour change communication. Many events such as Sex Workers Day, World AIDS Day and Women's Day were celebrated at these centres, which helped to create a sense of community among the sex workers and enhanced their self-esteem.

Small group formation (hotspot groups)

In April 2006, as a first step towards developing CBOs, sex workers at the hotspot level were formed into small groups. In the same year, three types of community committees were formed in all 11 project sites in the districts. The committees were Community Mobilisation Committees, Community Resource Persons and Community Cultural Groups. Community Mobilisation Committees were responsible for forming the hotspot groups. Community Resource Persons conducted trainings for group members on the objectives and functioning of hotspot groups. Cultural groups, known as Jagruti Kala Brundams, conducted awareness building programmes for group members. Each of these three committees consisted of FSWs (7–10 members) at each targeted intervention level. Each member of the committee worked for 6 days in a month and received an incentive of Indian rupees 750 per month.

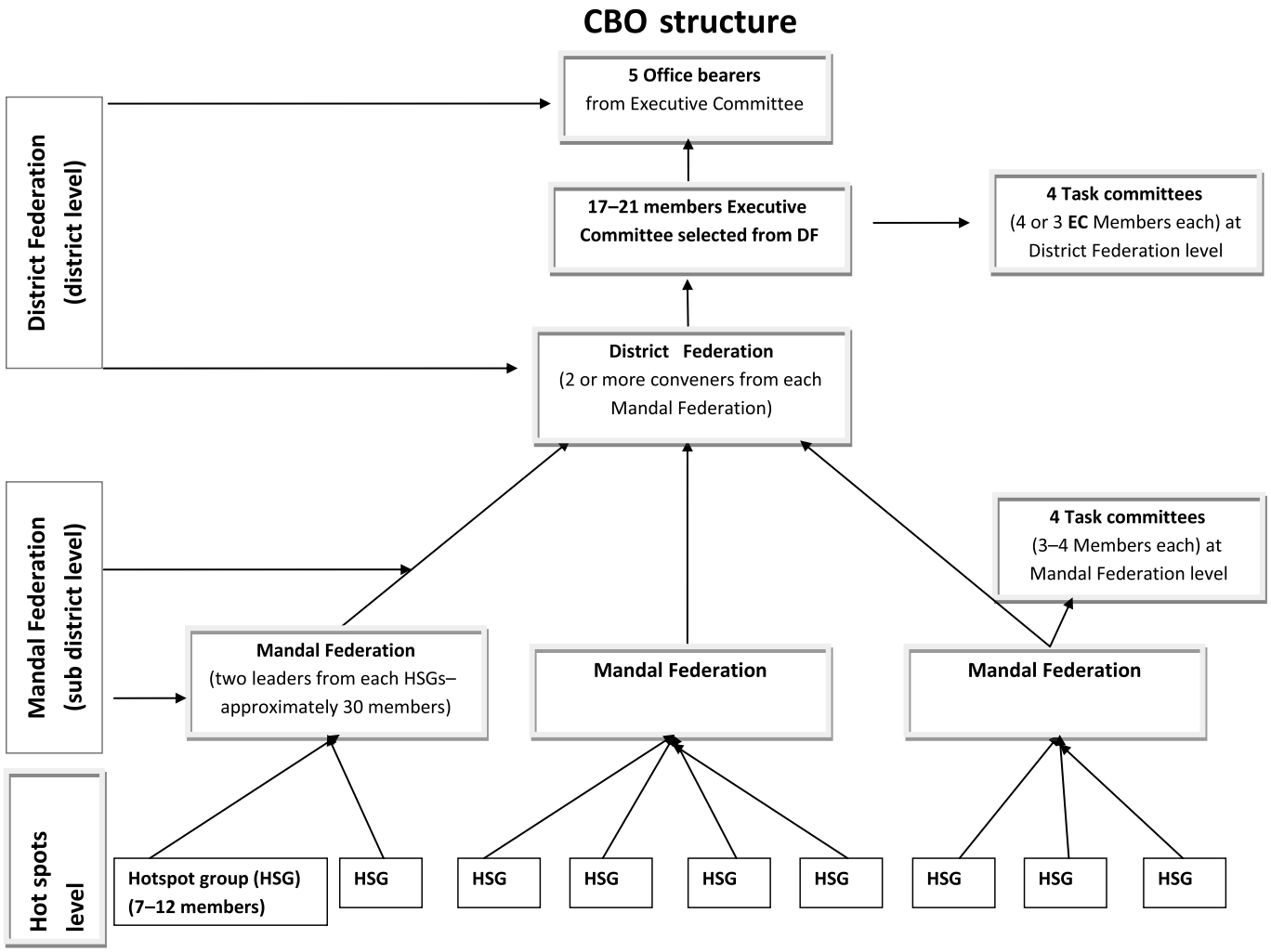

Figure 2 Structure of community mobilisation in Swagati Project, Andhra Pradesh, India.

Mandal (subdistrict) Federations

Community Mobilisation Committees in the 11 intervention areas formed Mandal Federations during 2007 (see figure 2). Mandal Federations are composed of 15 or more hotspot groups, each of which is represented by two group leaders. These federations have members from either a single mandal or a cluster of mandals. Each Mandal Federation elects or nominates two or more of its representatives, called Conveners, to the District Federation. From the remaining members, four task committees are formed. These committees are Outreach Committee, Condom Promotion and Social Marketing Committee, Clinic Services Committee and the Advocacy Committee. Monthly Mandal Federation meetings are held to discuss the hotspot group members' problems brought by their leaders. Those that are within the purview of the mandal are addressed at the Mandal Federation level through regular interactions with government officials. Issues that are not resolved at the mandal level are referred to the District Federation for further representation and action. The proceedings of all meetings are recorded in written minutes.

District Federations

Conveners nominated from the Mandal Federations comprise the District Federations. District Federation members elect an Executive Committee, including five office bearers (President, Vice-President, Secretary, Joint Secretary and Treasurer). These federations meet once a month to discuss the issues forwarded by the Mandal Federations and take decisions on solving the problems of the members and obstructive matters.

Eleven CBOs had been formed by 2007–2008, and all the CBOs were registered under the Societies Registration Act in the nine intervention districts (two CBOs each in Prakasam and West Godavari). Through these activities, 17 724 FSWs were organised into 1821 hotspot groups and 93 Mandal Federations, as integral subgroups of the 11 CBOs. Seven CBOs were organised for men who have sex with men, but they are not included in this discussion.

Capacity building activities

After the formation of all the CBOs during 2007–2008, community leaders at all levels were provided training in community participatory procedures, effective CBO functioning, leadership skills, conducting meetings and aspects of legal compliance. Orientation workshops were conducted for NGO staff on the conceptualisation, functioning and development of CBOs, so that NGO staff could provide mentoring to CBOs. Resource persons carried out training on the CBO structure and democratic functioning for CBO leaders at each of the levels.

CBO mentoring by NGOs

Since 2008, partner NGOs have provided day-to-day mentoring to CBOs on regular meeting practices at the hotspots

(fortnightly) and the Mandal Federation, District Federation and Executive Committee levels (monthly). NGOs have ensured that the CBOs have sound administrative and financial systems and democratic decision-making processes.

Transition preparedness

The ultimate goal of the Swagati project is to prepare CBOs for transition to autonomous status, when CBOs will independently function and implement the HIV prevention programme. Over a period of time (approximately 4–5 years after the formation of the groups), the CBOs will function independently without the help of programmes like Swagati and mentoring by NGOs. Each CBO has entered into a Memorandum of Understanding to implement selected project activities in their respective districts. The activities implemented by CBOs will include trainings and reviews, organising events and campaigns, DIC maintenance, social marketing of condoms and monitoring and documentation of project activities.

DATA AND METHODS

A Community Ownership and Preparedness Index (COPI) tool-based study and a Behavioural Tracking Survey (BTS) were carried out to assess the levels of preparedness of the CBOs and their members.[15]

The COPI study is an in-depth assessment of the strength of CBOs in terms of demonstrated leadership capacity, degree of community participation in project planning, decision making and other organisational features. The COPI study is conducted annually, and this paper reports data from the first round obtained during May to June 2010. In each district, interviews were held with Executive Committee members, selected FSWs and representatives of partner NGOs using tools that included questions on all aspects of measuring the strength and programme management preparedness by the CBO. From those data, an index was developed to indicate the organisations' strength and readiness for transition. The overall index scores calculated determined the strength of community mobilisation, and the scores were grouped into a series of 'bands' labelled Basic (0–14), Foundation (15–29), Promising I (30–43), Promising II (44–57), Promising III (58–72), Vibrant I (73–87) and Vibrant II (88–100). Details of the interview tools, calculation of index scores and interpretation of the series of bands are discussed in the article by Thomas *et al*[15] in this volume.

This paper also presents data from the BTS, which surveyed individual sex workers' behaviours and perceptions concerning participation in group activities, beliefs about collective action, safe sex practices and STI treatment seeking. The survey was conducted in four selected districts. At the time of survey in 2011, only two (Krishna and Vijayanagaram districts) of the four districts where BTS was conducted were under the administrative control of the Swagati project. In the remaining two districts, the programme had been transitioned to the government. For this reason and because the aim of this paper is to present the perception of beneficiaries about collective action as a result of community mobilisation, the data related to only these two districts are presented in this paper.

A sample size of 400 FSWs was calculated for each district. FSWs in each area of the district were recruited through a two-stage sampling procedure. For FSWs based in non-public places (brothels, hotels, lodges, roadside eating establishments and homes), the conventional cluster sampling approach was used by selecting hotspots. For FSWs based in public places (streets, market areas, highways and cinema halls), time-location cluster sampling was used.[16 17] In the second stage, within each selected hotspot, respondents were randomly selected. The procedures in BTS sampling and recruitment of participants are discussed in detail in the paper by Swarup *et al*[18] in this volume.

Key measures

The key output anticipated with community mobilisation was the evidence on collectivisation of the community in case of need for services. We measured three distinct dimensions of collectivisation using BTS: collective efficacy, collective agency and collective action. Table 3 shows the key items in these measures and their coding.

Collective efficacy is the belief of the affected community in its power to work together to effect change. Among FSWs, it was measured based on responses to the question: how confident are you that in your community can work together to achieve the following goals: (1) keep each other safe from harm, (2) increase condom use with clients, (3) speak up for your rights and (4) improve your lives? Responses to these questions included not at all (coded as 1), somewhat (coded as 2), very (coded as 3) and completely confident (coded as 4).

Collective agency is the choice, control and power that poor or marginalised groups have to act for themselves to claim their rights (whether civil, political, economic, social or cultural) and to hold others accountable for these rights.

Collective action refers to the strategic and organised activities by mobilised community members to increase the community's visibility in wider society and present or enact its agenda for

Table 1 Overall strength (score) of nine female sex worker CBOs for transition readiness in Andhra Pradesh, India: assessed using the COPI tool, 2010–2011

District	Name of CBO	Date intervention started in the area	Date CBO registered	Score in	
				Round 1 (2010)	Round 2 (2011)
Srikakulam	Swagati Mahila Sangham	May 2004	19 February 2007	20.83	27.23
Visakhapatnam	Swagati Sneha Sangham	September 2004	19 February 2008	28.57	39.17
East Godavari	Nari Saksham	April 2006	17 May 2006	35.23	40.41
West Godavari	Swetcha Mahila Sangham	September 2004	20 February 2008	42.11	44.28
West Godavari	Sneha Mahila Abhyudaya Sangham	September 2004	18 March 2008	33.80	43.47
Guntur	Siri Mahila Sadhikaratha Society	May 2004	18 March 2008	35.19	–
Prakasam	Swetha Mahila Sangham	September 2004	5 May 2008	27.43	35.86
Prakasam	Vennela Mahila Abhyudaya Sangham	September 2004	7 June 2009	37.43	43.75
Nellore	Simhapuri Swagati Mahila Abhyudaya Sangham	April 2006	27 December 2007	46.76	53.51
Krishna	Krishna Vennela Mahila Sangham	September 2004	31 December 2007	40.35	50.58
Vizianagaram	Kiranam Mahila Samakhya Sangham	September 2004	27 March 2008	40.59	48.92

Interpretation of overall CBO score using series of bands: Basic (0–14), Foundation (15–29), Promising I (30–43), Promising II (44–57), Promising III (58–72), Vibrant I (73–87) and Vibrant II (88–100). A detailed description of the procedures in weighting and the determination of bands is given in the article by Thomas *et al*[15] in this issue.

Table 2 Strength (score) of female sex worker CBOs in Krishna and Vizianagaram districts, Andhra Pradesh, India: assessed using the COPI tool, 2010

		Krishna district				Vijayanagaram district			
		Round 1 (2010)		Round 2 (2011)		Round 1 (2010)		Round 2 (2011)	
Parameters and Indicators	Maximum score	Individual indicator score	Mean score	Individual indicator score	Mean score	Individual indicator score	Mean score	Individual indicator score	Mean score
Leadership	12		7.45		9.11		6.06		8.05
Leadership has demonstrated capacity to adopt a solidarity role during crises faced by FSWs	4	3.00		2.50		2.00		2.00	
Leadership has demonstrated the ability to mobilise FSWs to assert their identity and to engage with issues through collective action	4	1.45		3.27		0.73		2.55	
Leadership team is capable of setting its own agenda	4	3.00		3.33		3.33		3.50	
Governance	20		7.34		9.75		8.63		8.73
Selection process of the leadership is participatory	7	1.58		4.72		2.30		3.61	
System of accountability of leaders to community members in place	10	3.96		3.83		5.10		3.92	
FSWs included in the leadership	3	1.80		1.20		1.20		1.20	
Decision making	9		4.39		4.86		5.29		6.29
A well-defined decision-making system for operational matters in place, with the CBO being the decision maker	3	1.64		2.79		1.93		2.71	
System in place to promote community involvement in strategic decision making	3	0.71		0.57		1.00		0.57	
Committees for crisis response and advocacy have been formed and are meeting regularly	3	2.04		1.50		2.36		3.00	
Resource mobilisation	10	1.91	1.91	2.34	2.34	3.62	3.62	0.00	0.00
Community collective network	11		1.56		3.02		1.90		5.15
Increasing engagement of FSWs with CBOs from other locations	5	1.00		1.83		1.33		3.17	
Networking with State AIDS Control Societies and government bodies	3	0.56		0.19		0.56		1.31	
Networking, collaboration with other solidarity groups and advocacy initiatives	3	0.00		1.00		0.00		0.67	
Project, financial and legal risk management	10		3.68		5.03		4.55		3.78
Leadership has demonstrated the capacity to manage strong financial, accounting and administrative systems	5	1.80		1.40		2.30		4.00	1.40
Leadership is competent and confident of contributing to project processes	5	1.88		3.63		2.55		3.27	2.38
FSWs' engagement with the state	16		8.80		11.56		8.36		10.00
Awareness of rights and entitlements, especially with respect to dealing with arrests and violence	4	2.91		3.27		2.91		4.00	
Demonstrated collective action in utilising and creating spaces for negotiation with state bodies	6	2.07		4.47		1.09		3.27	
Demonstrated capability in successfully claiming and realising FSWs' rights and entitlements	6	3.82		3.82		4.36		2.73	
Engagement with key influencers	12		5.21		4.92		2.19		6.94
Able to make itself visible to diverse influential stakeholders as collective agency of FSWs	5	2.71		2.60		1.25		3.13	
Demonstrated collective action in engaging with diverse non-state stakeholders in asserting the identity of FSWs	7	2.50		2.31		0.94		3.81	
Overall CBO score (based on all the above indicators)			40.35		50.58		40.59		48.92

Leadership includes CBO executive committee members, which consists of 17–21 members, of which five are office bearers and 12–16 task committee members. Resource mobilisation includes both internal (fee or voluntary contributions from members) and external resources (funds, donations and contributions from individuals, government agencies and NGOs) mobilised by the CBO. Key influencers includes (1) rowdies, pimps, lodge/brothel owners, drivers, husbands/regular partners; (2) advocates, doctors and solidarity group members and (3) faith leaders, members of the neighbourhood community, local clubs and the media. Interpretation of overall CBO score using series of bands: Basic (0–14), Foundation (15–29), Promising I (30–43), Promising II (44–57), Promising III (58–72), Vibrant I (73–87) and Vibrant II (88–100). A detailed description of the procedures in weighting and the determination of bands is given in the article by Thomas *et al* in this issue.[15]
FSW, female sex workers.

change (eg, through rallies, demonstrations or meetings with stakeholders). This was measured based on responses to seven questions, asking whether community members come together to demand/ask help for the following: (1) ration card, (2) voter card, (3) bank account, (4) free education for children, (5) health insurance, (6) representation in government forums and (7) better health services from the government. A separate question was asked for each of the above social entitlements and services with the possible binary response categories 'Yes' (coded as 1) and 'No' (coded as 0).

Statistical analysis

The COPI study was analysed, and the index scores were calculated using the analytical tool developed by Praxis and published in this volume.[15] The percentage distributions from an independent FSWs survey conducted in the select districts were calculated

Table 3 Perceptions and experiences of collectivisation reported by female sex workers in Krishna and Vizianagaram districts, Andhra Pradesh, India: results from the behavioural tracking survey, 2010–2011

Indictors (%)	Krishna district (N=400)	Vizianagaram district (N=395)	p Value*
Index of collective efficacy			
Low	18.2	4.6	<0.001
Moderate	55.2	34.9	
High	26.7	60.5	
Collective efficacy			
Perceive that FSWs would come together in case of a problem that may affect the community	57.2 (N=400)	48.6 (N=395)	0.015
Collective agency			
Negotiated with key stakeholders to help fellow sex workers in the past 6 months	37.7 (N=400)	28.8 (N=395)	0.008
Collective action			
Perceive that the community comes together to demand social entitlements/services	5.5 (N=400)	21.5 (N=395)	<0.001
Sex workers helped when respondent was last arrested by the police†	22.1 (N=182)	53.5 (N=82)	<0.001
Sex workers helped when respondent was last blackmailed/threatened by stringers (the media)‡	20.1 (N=174)	50.1 (N=76)	<0.001
Sex workers helped when respondent last had a violent client/partner§	5.1 (N=222)	24.4 (N=77)	<0.001

Collective efficacy is the belief of the affected community in its power to work together to effect change. Among both FSWs, it was measured based on responses to the question: how confident are you that in your community can work together to achieve the following goals: (1) keep each other safe from harm, (2) increase condom use with clients, (3) speak up for your rights and (4) improve your lives? Responses to these questions included not at all (coded as 1), somewhat (coded as 2), very (coded as 3) and completely confident (coded as 4). These responses were combined to calculate an index with values ranging from 1 to 4 (Cronbach's α =0.928). The index values were divided into three categories: low (scale range: 1–1.999), medium (scale range: 2.0–2.999) and high (3.0–4). Additionally, the direct question assessing whether FSWs in the community would come together in case of a problem that may affect the community (Yes=1, No=0) was presented as a measure of collective efficacy.

Collective agency is the choice, control and power that poor or marginalised groups have to act for themselves to claim their rights (whether civil, political, economic, social or cultural) and to hold others accountable for these rights. It was measured based on responses to the question: in the past 6 months, have you negotiated with or stood up against the following stakeholders (police, madam/broker, local goon (gang member), clients or any other sexual partner) in order to help a fellow sex worker or to help fellow sex workers? FSWs who responded that they negotiated with any of the key stakeholders to help fellow sex workers were categorised as 'Yes' (coded as 1) else categorised as 'No' (coded as 0), and this measure is named collective agency.

Collective action is the strategic and organised activity by mobilised community members to increase the community's visibility in wider society and present or enact its agenda for change (eg, through rallies, demonstrations or meetings with stakeholders). It was measured based on responses to seven questions, asking whether the community members come together to demand/ask help for the following: (1) ration card, (2) voter card, (3) bank account, (4) free education for children, (5) health insurance, (6) representation in government forums and (7) better health services from the government. A separate question was asked for each of the above social entitlements and services with the possible binary response categories 'Yes' (coded as 1) and 'No' (coded as 0). A composite dichotomous index (Yes=1, No=0) was constructed that represented FSWs' ability to come together to demand at least one of the above-mentioned social entitlements and services (Cronbach's α =0.899). The second indicator was derived from a direct question asking whether the FSW received help from other FSWs in the community when she was last arrested by the police (Yes=1, No=0). The third indicator was derived from a question asking whether the FSW had received help from other community members when she was last blackmailed/threatened by the media (Yes=1, No=0). Similarly, the fourth indicator was derived from a direct question asked to assess whether the FSW had received help from the community when a client or partner was violent (Yes=1, No=0).

*Differences between the districts were tested using χ^2 test.

†Among those who were ever arrested by police.

‡Among those who were ever blackmailed/threatened by stringers (media).

§Among those who ever had a violent client/partner.

FSW, female sex workers.

for each measure of collective efficacy, collective agency and collective action. Tests for association and significance of differences in the percentages across districts were done using the χ^2 statistic. The BTS data were analysed using STATA (V.11.1).

RESULTS

The COPI information presented in table 1 shows the scores of all 11 CBOs assessed in the years 2010 and 2011. Although community mobilisation started around the same time in all the districts, results on the strength of CBOs (overall score) show considerable variations among the districts. Of the total 11 CBOs assessed from nine districts in 2010, three CBOs were in the foundation stage, seven were in the first phase of the promising stage and one was in the second phase of the promising stage. By 2011, two CBOs that were in the Foundation stage in 2010 had moved into Promising I stage and five CBOs that were in the Promising I stage in 2010 moved into the Promising II stage showing progress towards becoming stronger as organisations.

Table 2 presents the scores on different indicators that measured the strength of CBOs in two of the nine districts, Krishna and Vizianagaram. The overall scores of both these CBOs were in the Promising I stage in 2010 and moved into Promising II stage by 2011. Although the overall score is similar in both districts, the CBO in Krishna district scored far higher in terms of leadership, governance and FSWs' engagement with the state and other key influencers, while the CBO in Vizianagaram district scored far higher in terms of decision making, community collective network, resource mobilisation and financial, project, legal and risk management.

Community collectivisation

In order to understand the perceptions of FSWs about community mobilisation, data from the BTS on key dimensions of collectivisation are presented in table 3. The data show that despite the overall similarities in the COPI scores of the CBOs in the Krishna and Vizianagaram districts, individual FSWs perceive collectivisation differently in the two districts. Overall, women in Vizianagaram district reported significantly higher levels of collective efficacy and collective action than their counterparts in Krishna district.

DISCUSSION

The step-by-step process of community mobilisation, leading to the formation of CBOs of sex workers in the districts of the Swagati programme, has closely followed the theoretical model for structural intervention that emerged from the Sonagachi project in Kolkata. By the time, the Swagati programme was launched (2004), and other programmes of the Avahan initiative were developed in four states in southern India, several studies of the Sonagachi project had been carried out[19–21] and the

lessons learnt in that intervention were explicitly adopted by the Avahan initiative planners.[22]

Taking these lessons, the Swagati project facilitated community mobilisation initiatives through its NGO partners, from the local hotspot level to the subdistrict and district levels in the nine districts. The key objective of the Swagati programme was to ensure that through the formation and strengthening of CBOs, sex workers would be capable of carrying out HIV prevention activities. At the same time, CBOs were intended to provide a framework within which FSWs can acquire the knowledge and skills to empower themselves and improve their lives.

Although the sex workers in the CBO structures have made impressive progress in learning the complexities of governance, the monitoring results suggest that these recently developed structures still need to work towards better resource management, democratic functioning and other components of collective action. It is evident from the data that some CBOs do better in leadership, governance and advocacy with key influencers; others are good in programme management, resource mobilisation and risk management. These variations from one district to another point to the need for further research to understand the varied environmental factors that influence the development of successful sex worker organisations.

The differences noted in the results among the districts—at both organisational (CBO) and individual levels—could be attributed to several factors: differences in types of sex work structures (street based, home based and brothel based, etc), differences in the social and political environments of the districts (including the extent to which local governmental offices and other organisations support the community mobilisation programme) and differences in implementation by the NGOs. Several studies in India support our findings on the differences in terms of social cohesion, social capital and other aspects of empowerment that are largely explained by the nature and typology of sex work.[23 24] Research indicates that street-based sex workers' perceptions of social support and group cohesion are much lower than those of home-based sex workers in Andhra Pradesh.[24] Our study also indicates that Krishna district, unlike Vizianagaram, has high percentages of street-based sex workers, and this pattern alone could account for a large part of the differences between the two districts in selected outcome indicators.

Despite the evident variations, these community mobilisation interventions have resulted in increased empowerment of FSWs in terms of accessing services from government and non-government sources. Within the CBOs, the social cohesion among the sex workers has been enhanced, and their capacity increased to address local barriers to safe sex practices. There is increasing evidence from other areas of India that the collectivisation of sex workers contributes to improvements in HIV prevention. Halli *et al*[25] found positive correlations between individual 'collectivisation scores' and safer sex practices among FSWs in HIV programmes in the state of Karnataka. 'The results indicate that a higher degree of collectivization was associated with increased knowledge and higher reported condom use…Collectivization seems to have a positive impact in increasing knowledge and in empowering FSWs in Karnataka to adopt safer sex practices, particularly with commercial clients'.

Another study in Andhra Pradesh reports the positive effects of 'social capital' on sex workers' safe sex practices. According to Samuels and colleagues,[24] '76 % of FSWs who had the greatest belief in the benefits of group cohesion had used condoms with their last three clients, compared to only 33 %t of those who had the lowest belief in the benefits of groups'. The experiences of the Swagati community mobilisation programme in Andhra Pradesh show that the Sonagachi model of structural intervention, through building up of sex worker organisations and gradually involving them in all aspects of HIV/AIDS prevention activities, is an effective approach to combating the spread of HIV and STI infections. The data also indicate that this model of community mobilisation can be effective in varied social and political environments.

What is already known on this subject

- FSWs in brothel-based and/or concentrated areas can be mobilised into formal organisations, as demonstrated by the Sonagachi programme in Kolkata in India.
- Continuous efforts and institutional mechanisms can build the capacity of FSWs to manage their organisations.
- Empowering FSWs will lead to successful HIV prevention intervention initiatives and build self-esteem among women in accessing other services and entitlements.

What this study adds

- Upscaling interventions such as CBO development is a complex process given the wide geographies, multiple sites and multiple typologies of FSWs; however, it is possible following the basic principles of community mobilisation and interventions accustomed to local contexts.
- Although the mentoring of FSWs may be more or less standard, responses of leadership and the successful management of CBOs may vary across geographical areas.
- Given an ideal situation of effective and motivated FSWs groups, CBOs can independently function without the support of promoting agencies and are capable of networking, converging and forging relations with government and NGO stakeholders at the district and state level.

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How effective is community mobilisation in HIV prevention among highly diverse sex workers in urban settings? The Aastha intervention experience in Mumbai and Thane districts, India

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ABSTRACT

Background This paper examines the association between degree of confidence in collective efficacy and self-efficacy for condom use and empowerment among heterogeneous female sex workers (FSWs) in two metropolitan Indian cities with high HIV prevalence.

Methods The study utilises data from the Behavioural Tracking Survey, a cross-sectional behavioural study with 2106 FSWs recruited from 411 intervention sites in Mumbai and Thane. The key independent measures used determine the degree of confidence in collective efficacy (belief in the power to achieve goals and address problems together) and outcome measures included: self-efficacy for condom use with occasional clients and condom use with regular partners, self-confidence in handling a crisis situation and public speaking ability. Univariate and multivariate statistical methods were used to examine the study objectives.

Results Of the analytical sample of 2106 FSWs, 532 (25.3%) reported high degree of collective efficacy for achieving certain goals and 1534 (72.8%) reported collective efficacy for addressing specific problems. FSWs reporting a higher collective efficacy as compared with those reporting lower collective efficacy were as follows: more likely to negotiate condom use with occasional clients (60.3% vs 19.7%; adjusted OR (AOR) =6.3, 95% CI 4.8 to 8.4) as well as regular partners (62.8% vs 20.2%; AOR =6.4, 95% CI 4.9 to 8.4); confident in facing troublesome stakeholders (73.5% vs 38.8%; AOR =4.3, 95% CI 3.3 to 5.6), confident in supporting fellow FSWs in a crisis (76.1% vs 49.6%; AOR =2.9, 95% CI 2.2 to 3.7), received help from other FSWs when a client or partner was violent (73.9% vs 46.3%; AOR =3.5, 95% CI 2.7 to 4.5) and had stood up to the police or madams/brokers to help fellow FSWs in the past 1 year (5.8% vs 3.3%; AOR =2.7, 95% CI 1.5 to 4.9).

Conclusion The results suggest that the strategy of collectivisation in HIV prevention programme has much broader benefits than merely the promotion of safer sex practices. Future HIV prevention interventions in India and elsewhere may include collectivisation as the core strategy within HIV prevention programmes.

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INTRODUCTION

Recent studies reflect a shift in the focus of HIV/AIDS prevention efforts from models aimed at individual risk behaviour change to models aimed at community mobilisation and empowerment as a result of growing awareness of the complex social, cultural, political and economic forces shaping the HIV epidemic.[1–3] While literature has shown that interventions that build community collectives can empower vulnerable populations to negotiate safe sex practices,[4] little is known about the effect of collective efficacy on self-efficacy and the confidence of female sex workers (FSWs) in times of crisis and related condom usage.[1 5 6]

The Sonagachi programme in Kolkata, India, for example, organised FSWs into a community-based organisation (CBO) and involved them in implementing HIV prevention activities.[4] In addition to raising FSWs' social and economic status, the programme empowered them over time, resulting in improved negotiation for condom use and more equitable relationships with clients, reduced police brutality and reduced prevalence of HIV.[4 6–11]

Over the time, the Sonagachi sex workers established a CBO, the Durbar Mahila Samanwaya Committee (DMSC) 'which organises weekly and monthly problem-solving meetings, and promotes sex workers' social and political awareness through critical discussions of the stigma attached to sex work, and the value of collective action'.[12] (p.499) DMSC showed that involving FSWs directly in organisational activities and empowerment strategies reduces their vulnerability to HIV/STIs as compared with programmes that provide only clinical and prevention services.[6 8–11 13 14] The success of the Sonagachi programme can be attributed to the active participation of sex workers in decision-making and programme implementation through the DMSC.[6 10 11] With exception to Sonagachi programme among brothel-based sex workers in Kolkata city in India, studies have identified the disperse, hidden, highly controlled and mobile nature of local sex trades as barriers to empowerment of the community.[15]

This paper focuses on the Aastha project, an up-scaled HIV prevention intervention with FSWs from varied cultures and religions, who are highly mobile, geographically dispersed and solicit clients from multiple locations including brothels, bars, streets, beaches, homes and through phone networks. The Aastha project was implemented by Family Health International (FHI) 360 in two districts of Maharashtra (Mumbai and Thane), which also have high HIV prevalence and high numbers of FSWs.[16] This paper describes the process adopted by Aastha, as part of Avahan

initiative[17] to promote FSWs' confidence in collective efficacy and build FSWs' self-esteem, self-efficacy for condom use and negotiation skills to help others in times of crisis. We hypothesise that FSWs expressing higher confidence in collective efficacy are more likely than others to demonstrate self-efficacy for condom use and confidence in handling issues that concern sex workers.

FSWs' context in Mumbai and Thane districts

Mumbai and Thane, the two most populated districts of India, located in Maharashtra state, are also known to be hubs for business, arts and the media. The 2011 Census for the Mumbai Metropolitan Region recorded a population of 12.5 million and Thane recorded 11.1 million. Being economically active, both districts provide housing and livelihoods to over 35 000 FSWs per district, which is 10 times more than any other Indian district.[18]

Of the 20 606 FSWs in the Aastha programme implementation sites, 3035 FSWs solicit clients in brothels, 7946 in bars, 5061 in streets and 4564 in homes. Many brothel-based FSWs operate out of small rooms used by 3–4 FSWs as their living and workplace. Almost all brothel keepers get a 50% share of the FSWs' earnings. Almost two-thirds of brothel-based FSWs are from less developed districts of Karnataka, Andhra Pradesh, Bengal and Nepal. Brothel keepers tend to exercise control over FSWs' lives, including condom usage and the provision of sexual services to clients. Pimps thrive where FSWs do not have direct access to clients for negotiations, such as in the bungalow system of brothels in Kamathipura, and are paid 25%–30% of FSW's fees. Street-based FSWs are mainly in the lowest socioeconomic strata and are at the mercy of pimps, local goons and the police, who are the main perpetrators of violence. FSWs working in bars present themselves as waitresses or singers and give a major percentage of their earnings to the bar manager. In contrast, home-based FSWs (who solicit clients through a phone network of pimps) are a hidden and hard-to-reach population.

As many FSWs are migrants from other states, mobility is high especially periodic visits to their native place.[19] HIV prevalence among FSWs in Mumbai and Thane exceeded 30% in 2006.[20] Although consistent condom use with occasional clients was high (Mumbai 98% and Thane 95%), it was low with regular partners (Mumbai 35% and Thane 34%).[21] These factors, combined with a high inflow of new FSWs entering these districts, necessitated a unique community mobilisation process.

Programme description: the Aastha project

Given the multicultural and large concentration of FSWs with heightened vulnerabilities, the Aastha HIV/STI prevention programme was initiated in 2004 with technical guidance from FHI 360. The objective of the Aastha project was to promote individual FSW empowerment to access and manage HIV prevention services, a strategy that went beyond the traditional approaches of community collectivisation due to the fact that the FSWs are multicultural, distributed across a wide geography and solicit clients in different types of places. Details of community mobilisation intervention strategies by each typology of sex work are presented in table 1. The Aastha project initiated the programme in select areas covering around 30 000 FSWs of a total estimated 60 000 FSWs in Mumbai and Thane districts. The remaining FSWs were covered by the government's National AIDS Control Programme under the auspices of the State AIDS Control Society.

In order to empower FSWs, the Aastha project capacitated the project team consisting of peer educators and sex workers who were given an honorarium to initiate self-help groups, also called Aastha Gats (AGs), at the local level (as shown in figure 1). About 2–3 self-help groups (AGs) of FSWs were formed within the catchment area of 50 FSWs. Each AG had non-paid (volunteer) members. The voluntary AG members and leaders of respective AGs went on to form CBOs at the subdistrict level and the Aastha Parivaar, a federation of these CBOs at the project level. AG members placed emphasis on promoting unity as needed among FSWs within defined geographical areas. The AG members formed a core group to work together on issues that concerned the community. The CBOs and the Aastha Parivaar focused on building the capacity of AG members on collectivisation for decision making, problem solving, leadership and programme and crisis management as individuals and as a group, as well as organising large-scale events in the districts.

METHODS

Study design

This paper utilises data from the Behavioural Tracking Survey, a cross-sectional behavioural survey conducted among FSWs to monitor the key components of the HIV prevention programme which included safe sex behaviour, sexually transmitted infection, treatment-seeking behaviours and community mobilisation. Survey participants were recruited from 411 sites in the two project implementation districts, Mumbai and Thane.

Survey respondents included women who were ≥18 years who had sex in exchange of cash/kind in the 1 month prior to the survey. The Aastha project actively registers each FSW in all sites and provides weekly services. FSWs migrating do not remain in the demonstration data and new FSWs are added within a week of entering any site. Thus, registration includes FSWs physically present and receiving services. FSWs for the survey were chosen from the programme registration data. Prior to sampling, the registration data were verified in the field to obtain the active status of FSWs in the registered list. The list of active members in each cluster (programme implementation area) formed the sampling frame, and FSWs were selected using a systematic sampling procedure.

A sample size of 400 FSWs was estimated allowing for the detection of an absolute difference of 15% or more from the assumed value of 50% for consistent condom use with all clients, with 95% confidence and 80% power. A design effect of 1.7 was assumed for cluster sampling, and the sample weights were calculated at the site as well as district levels. Since Mumbai and Thane districts have a large number of FSWs according to the following typologies of sex work: brothel based, street/home based and bar based, it was decided to select 400 FSWs from these three major types. From the two districts, a total of 2432 FSWs were interviewed. Of these, data were missing for 326 FSWs on the key variables considered in this paper either due to incomplete interviews or their unwillingness to share information. This resulted in an analytical sample of 2106 FSWs.

Interviews were conducted by trained researchers with verbal and written skills in Hindi, as FSWs belonging to other places and practicing sex work in the study districts understand and speak basic Hindi. In situations where FSWs spoke very little Hindi, researchers who could speak additional languages such as Telugu, Kannada and Marathi were selected to conduct the interview. All the researchers had a bachelor's degree in either sociology or statistics. The survey instrument commonly developed by Avahan for its sites in India[1 17 22 23] was modified locally to add a few questions that are relevant to the local

Table 1 FSW characteristics and community collectivisation strategy by typology of sex work under the Aastha project in Mumbai and Thane, India

Typology	Characteristics of FSWs	Community collectivisation strategy	Challenges	Activities undertaken by Aastha
Brothel-based FSWs	Total coverage =3035 FSWs; geographic coverage =7 km^2 (across 3 major and other minor sites); mainly from the states of Karnataka and West Bengal as well as Nepal and Bangladesh. Controlled by brothel managers and pimps.	Initial collectivisation focused on increasing legal literacy so as to reduce police abuse and wrongful arrest. Another key concern was reduction of violence by clients, either due to insistence on sex without condoms or free sex or money (regular partners only).	FSWs are largely controlled by brothel managers and pimps. These stakeholders also keep FSWs separated so as to have greater control over them. As a result, it is difficult to have regular access to FSWs. FSWs have a high transaction frequency and work during odd hours, leaving limited time to access and collectivise them.	Sensitisation meetings with brothel keepers and pimps are conducted on the benefits of improved health. Legal literacy sessions and exposure visits to service providers and the local police station are conducted to strengthen community-level linkages and reduce discrimination.
Bar-based FSWs	Total coverage =7946; geographic coverage of 70 km^2; majorly from the states of West Bengal and Rajasthan and Bangladesh; controlled by bar managers.	FSWs are forced by bar managers to drink alcohol with their clients in order to increase the bills. As a result, most FSWs become intoxicated regularly, increasing their vulnerability to unprotected sex. The collectivisation strategy used here was to bring the FSWs together to sensitise the bar managers to their increased risk. Different strategies were created in collaboration with the manager and waiters to reduce the alcohol intake of the FSWs, for example, drinks without alcohol or with minimal alcohol served to the FSWs.	Bar managers exercise strict control over access to the FSWs; bar girls work in shifts and rarely meet each other, therefore finding a convenient time for collectivisation is challenging.	Networking meetings are regularly conducted between self-help group leaders, Bar Association members, bar managers and bar owners to sensitise them to FSWs' issues and needs.
Home-based FSWs	Total coverage =4564 FSWs; geographic coverage =70 km^2; mainly from the states of Bihar, Uttar Pradesh and Maharashtra, controlled by pimps.	FSWs' transactions are fixed on the phone and therefore sometimes the FSWs do not know their new clients. When the FSW arrives at the designated location, multiple people are present who take advantage of her situation and on occasion do not pay. The collectivisation strategy used initially was to build support groups to prevent or resist violence of this nature.	FSWs work through the pimp network, largely through the use of mobile phones. As they are a hidden population, they try to protect their identity and so rarely are willing to identify themselves as FSWs or willing to associate with other FSWs for fear of being exposed.	The peer educator plays a crucial role as she provides project services and conducts group activities and events; thereby starting the process of unity without revealing their profession. This process takes a long time. The crisis response system and especially having a group that instantly provides support in times with violence, with regard to family members as well as clients has been the collectivisation strategy. Regular AG meetings are held re-enforcing the need to use the crisis support system.
Street-based FSWs	Total coverage =5061 FSWs; geographic coverage = 70 km^2; mainly from the state of Maharashtra, controlled by pimps and local goons.	FSWs are at the mercy of the local goons who regularly take money for protection. These are among the lowest earning FSWs and regular payments to the goons leave them with very little for themselves. Also additionally, the FSWs are dependent on local lodges and hotels to take their clients for sex. Managers change their tariff, sometimes doubling it, leading to much reduced earnings for the FSWs. The strategy used was to build support groups to regularly sensitise lodge owners to reduce exploitation and prevent violence by goons.	FSWs consider each other to be rivals; they rarely communicate, leave alone come together to support one another.	Regular monthly meetings of those in close geographical proximity are held focusing on sensitisation programmes with local goons (who take regular protection money) as well as legal literacy.

FSW, female sex worker.

context. The survey instrument was then translated from English to Hindi. The translated forms were reviewed by the study investigators who were fluent in both English and Hindi. The interview format was then pretested in selected communities.

Data management

Field staff checked each questionnaire immediately after the interview to ensure accuracy and completion. Field supervisors reviewed the completed questionnaires on the same day, and these were sent every week to the data management team for data entry. A user written computer programme in CSPro (V.4.0) was used for double data entry by trained data entry officers. Data were regularly processed to ensure consistency and accuracy.

Ethical considerations

The Behavioural Tracking Survey was reviewed and approved by FHI 360's Protection of Human Subjects Committee based in the USA. A local Community Advisory Board was constituted in Mumbai, which worked closely with the local research agency and FHI 360 to ensure that the study participants' rights were protected. A comprehensive informed consent process was followed; respondents were informed about the study, including the duration of the interview of approximately 45 min, and their queries were addressed before written consent was taken. To protect confidentiality and respect privacy, all questionnaires were entirely anonymous and names and addresses were not recorded. To maintain privacy, interviews were conducted in a private or public location, depending on the preference of the respondent. Participants were not given any monetary

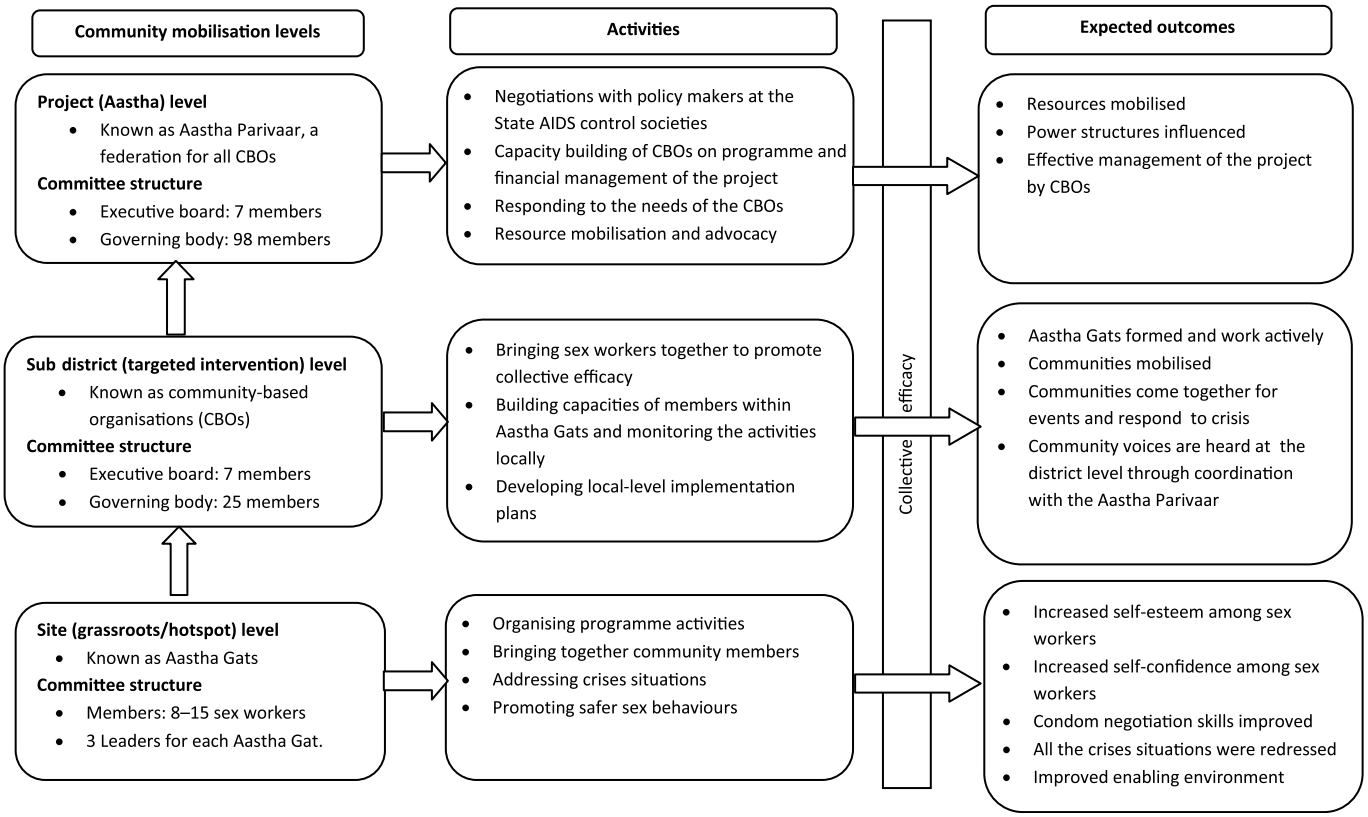

Figure 1 Structure, activities and expected outcomes in the process of community collective efficacy.

compensation for their time in the study but were provided information on HIV programmes in the area.

Measures

Socio-demographics

The variables on socio-demographic characteristics considered in this paper are obtained from single questions in the questionnaire. Responses were coded into two or three categories for analytical purposes. These responses included age (18–29 years, 30+ years), education (no formal education, formal education), marital status (never married, currently married, formerly married), duration of sex work (≤0–2 years, 3–5 years, 6 + years), typology of sex work (brothel based, street/home based, bar based) and district (Mumbai, Thane).

Community collectivisation indicators

The key independent variables considered in the paper were(1) collective efficacy for achieving certain goals and (2) collective efficacy for addressing specific problems, which are known to influence the behaviours of FSWs.

1. Collective efficacy for achieving certain goals was defined as FSWs confidence in the community to work together to achieve certain shared goals.[1 24] It was measured based on responses to the following questions: How confident are you that FSWs in your community can work together to achieve the following goals: (1) keep each other safe from harm, (2) increase condom use with clients, (3) speak up for your rights and (4) improve your lives. Responses to these questions included: not at all (code: 1), somewhat (code: 2), very (code: 3) and completely confident (code: 4). Using these four questions and corresponding responses, an index was constructed, with the scale value ranging from 1 to 4, which had a reliability (Cronbach's α) of 0.928. The index score was further divided into three equal categories of collective efficacy: low (1–1.999), medium (2–2.999) and high (3–4). The higher the score, the higher is the degree of confidence in collective efficacy (referred to as 'collective efficacy to achieve specific goals' in the paper).
2. Another measure of collective efficacy refers to the belief that FSWs can work together for change. It was measured as the willingness of mobilised community members to deal with problems that affected all or some of the FSWs' community.[1] A question was asked in the survey to measure this: if there was a problem that affected all or some of the FSW community, how many FSWs would work together to deal with the problem? Responses included: no one, some, most and all, and these responses were grouped into two categories: collective efficacy to deal with problems (yes), if the response was either 'most' or 'all'.

The above-mentioned two indicators of collective efficacy were considered separately because they were not strongly correlated to be considered as one domain, as per the results of factor and reliability analyses. For example, the Cronbach's α-value for items under both aspects of collective efficacy (all items together) was 0.712, whereas the exclusion of variable about FSWs addressing specific problems increased the α-value to 0.823 suggesting the somewhat weaker relationship of items if they were considered together.

Outcome indicators

Self-efficacy is defined as the belief that one can accomplish certain goals. The construct of self-efficacy derives from the social cognitive theory. Within this framework, a person is not passive to the environment but instead takes what is there and

manipulates it to create a self. This active role opposes theories that posit that the environment creates the individual with the individual having no say.[25] Self-efficacy measure used in this study was multidimensional, including the self-efficacy for condom use, self-efficacy to handle crises and being confident in the FSWs' ability to speak in public and access services.

Each FSW was asked a total of 12 questions to assess her ability to use condoms, negotiate condom use, handle crises, utilise resources, identify herself as a sex worker in a group and confidence in giving her opinion in front of a large group.

Self-efficacy for condom use: three questions assessed self-efficacy for consistent condom use with clients—How confident are you that you can use a condom with each client when (1) he gets angry with you, (2) he offers you more money for sex without a condom, (3) you have been using alcohol or drugs? Further, three questions assessed self-efficacy for consistent condom use with regular partners: How confident are you that you can use a condom with each regular partner when (1) he gets angry with you, (2) you think the risk of disease is low, (3) you have been using alcohol or drugs? Responses to these questions included: not at all (code: 1), somewhat (code: 2), very (code: 3) and completely confident (code: 4). Using these four questions and corresponding responses, an index was constructed, with the scale value ranging from 1 to 4, which had a reliability (Cronbach's α) of self-efficacy for condom use with occasional clients (0.692) and regular partners (0.715). The index score was further divided into two categories: low (1–2.99) and high (3–4).

Confidence in handling crises: two questions were asked reflecting FSW's confidence in handling a crisis situation to help herself or other FSWs: Whether or not the FSW was confident in (1) facing alone troublesome stakeholders such as brothel keepers, pimps, police, local goons and (2) supporting fellow sex workers in a crisis? Responses to these questions included: not at all (code: 1), somewhat (code: 2), very (code: 3) and completely confident (code: 4). Sex workers who responded either 'very' or 'completely confident' to the above two questions were considered as confident. Two questions on actual execution of behaviour by respondents were asked: Whether or not the FSW stood up to (1) the police and (2) madams/brokers to help fellow sex workers? Possible responses were no (code: 0) and yes (code: 1). Sex workers who said 'yes' to either of the two questions were considered as those who stood up to the police or madams/brokers to help fellow sex workers. A question on whether or not other sex workers helped the respondent when a partner or client was violent was also asked with possible response categories as: no (code: 1), yes (code: 2) and never had a violent partner (code: 3).

Other factors that affect FSWs' ability to access HIV prevention and care services: the community mobilisation process also included group exposure visits to police stations, meetings with local goons and other key stakeholders such as doctors in public health hospitals. The feeling of togetherness may have led to FSWs' increased confidence and their public speaking ability. These issues were measured in the study using a total of five questions: saying no to a client with whom she is unwilling to have sex, going to a service provider and disclosing her identity as an FSW, travelling alone, giving advice to other FSWs and giving her opinion in front of a large group. Responses to these questions included: not at all (code: 1), somewhat (code: 2), very (code: 3) and completely confident (code: 4). Sex workers who responded as either 'very' or 'completely' confident to the above five questions were considered as confident.

The summary measure of empowerment was constructed by averaging the responses to all the questions used for the above dimensions of self-efficacy and self-confidence. The score varied from 1 to 2, which had reliability (Cronbach's α) of 0.78. The index score was further divided into two equal categories of overall empowerment: low (1–1.4999) and high (1.50–2.0).

Data analysis

All analyses were conducted to assess the relationship between collective efficacy indicators and the selected outcome variables. Basic descriptive analyses were run on selected socio-demographic characteristics and their association with collective efficacy indicators to describe the sample. Further, both bivariate and multiple variable logistic regression models were used to examine the association between collective efficacy indicators and the outcome variables. All analyses were performed using SPSS software (V.16.0, SPSS Inc.).

RESULTS

Of the analytical sample of 2106 FSWs, 1502 (71.3%) reported medium (46%) and high (25.3%) collective efficacy for achieving goals, and 1534 (72.8%) reported collective efficacy for addressing specific problems (table 2). These dimensions were not mutually exclusive, and considerable overlap was observed. For example, 475 (22.6%) FSWs reported both a high degree of collective efficacy for achieving goals and collective efficacy for addressing specific problems, while about 2.7% reported only a high degree of collective efficacy for achieving goals and 16.8% reported only collective efficacy for addressing specific problems. FSWs who are currently married than those formerly married (34.7% vs 22.3%; $p<0.001$) and practicing sex work in streets or homes than those in bars (37.9% vs 21.2%; $p<0.001$) perceived low degree of collective efficacy for achieving certain goals. Whereas FSWs who have no formal education than those who have formal education (74.6% vs 68.7%; $p<0.05$), those formerly married than those currently married (76.8% vs 69.1%; $p<0.05$) and those practicing sex work in brothels than those in streets or homes (79.0% vs 68.0%; $p<0.001$) perceived FSWs addressing specific problems.

A greater proportion of formerly married FSWs than unmarried FSWs ($p<0.001$), brothel- and bar-based sex workers than street/home based ($p<0.001$) and FSWs from Thane than those in Mumbai ($p<0.001$) reported medium or high degree of collective efficacy for achieving goals. A higher proportion of FSWs without formal education than those with formal education ($p<0.005$), formerly married than unmarried ($p<0.001$) and brothel based than street or home based ($p<0.001$) reported high degree of collective efficacy for addressing specific problems.

Results in table 3 indicate that FSWs reporting higher collective efficacy as compared with those with lower collective efficacy for achieving goals were more likely to negotiate condom use with occasional clients (60.3% vs 19.7%; adjusted OR (AOR) =6.3, 95% CI 4.8 to 8.4) as well as regular partners (62.8% vs 20.2%; AOR =6.4, 95% CI 4.9 to 8.4). Similarly, FSWs who reported collection efficacy for addressing specific problems were more likely to negotiate condom use with occasional clients as well as regular partners. Additionally, FSWs who reported collective efficacy for addressing specific problems were more likely to report the ability to turn away clients when they were unwilling to use a condom as compared with those who did not report collective efficacy for addressing specific problems (70.8% vs 58.4%; AOR =1.8, 95% CI 1.4 to 2.2).

Table 2 Degree of collective efficacy for achieving certain goals and collective efficacy for addressing specific problems by background characteristics of female sex workers in Mumbai and Thane, India, 2010–2011

Background characteristics	Total sample	Collective efficacy for achieving certain goals				Collective efficacy for addressing specific problems		
		Low (%)	Medium (%)	High (%)	p Value*	High (%)	Low (%)	p Value*
Current age (years)					0.392			0.198
18–29	1230	27.7	46.2	26.1		73.9	26.1	
30+	876	30.1	45.8	24.1		71.3	28.7	
Education					0.265			0.005
No formal education	1487	27.8	47.0	25.2		74.6	25.4	
Formal education	619	31.0	43.6	25.4		68.7	31.3	
Marital status					<0.001			0.001
Never married	384	31.5	44.3	24.2		71.0	29.0	
Currently married	808	34.7	38.5	26.9		69.1	30.9	
Formerly married	914	22.3	53.4	24.3		76.8	23.2	
Duration of sex work (years)					0.255			0.842
≤2	406	28.6	49.9	21.5		73.8	26.2	
3–5	898	29.8	44.9	25.3		72.3	27.7	
≥6	802	27.7	45.3	27.1		72.9	27.1	
Typology†					<0.001			<0.001
Brothel based	753	27.8	51.2	21.0		79.0	21.0	
Bar based	703	21.2	50.1	28.7		70.6	29.4	
Street/home based	650	37.9	35.6	26.4		68.0	32.0	
District					<0.001			0.547
Mumbai	1064	34.1	38.3	27.7		72.2	27.8	
Thane	1042	23.3	53.9	22.8		73.4	26.6	
Collective efficacy for achieving goals								<0.001
Low	605					58.5	41.5	
Medium	969					72.7	27.3	
High	532					89.3	10.7	
Collective efficacy for addressing specific problems					<0.001			
High	1533	23.1	45.9	31.0				
Low	573	41.5	46.2	9.9				

*Differences in percentages between the categories were tested for statistical significance using the χ^2 test.
†Typology refers to the usual place of solicitation for clients.

Results in table 4 indicate that FSWs who reported high degree of collective efficacy for achieving goals were more likely to be confident in: standing up to the police, madams/brokers to help other FSWs (5.8% vs 3.3%; AOR =2.7, 95% CI 1.5 to 4.9), facing troublesome service providers (73.5% vs 38.8%; AOR =4.3, 95% CI 3.3 to 5.6), supporting fellow FSWs in a crisis (76.1% vs 49.6%; AOR =2.9, 95% CI 2.2 to 3.7) and had received help from other FSWs when a client or partner was violent (73.9% vs 46.3%; AOR =3.5, 95% CI 2.7 to 4.5).

Table 3 Self-efficacy for condom use by degree of collective efficacy for achieving certain goals and collective efficacy for addressing specific problems among female sex workers in Mumbai and Thane, India, 2010–2011

Measures	Total (N= 2106)	Collective efficacy for achieving certain goals			Collective efficacy for addressing specific problems	
		Low (N=605)	Medium (N=969)	High (N=532)	Low (N=572)	High (N=1534)
Self-efficacy in condom use with clients*						
%	45.6	19.7	53.7	60.3	38.1	48.3
AOR (95% CI)	–	Referent	4.7 (3.7 to 6.1)	6.3 (4.8 to 8.4)	Referent	1.5 (1.2 to 1.8)
Self-efficacy in condom use with regular partners†						
%	45.8	20.2	52.4	62.8	39.9	48.0
AOR (95% CI)	–	Referent	4.1 (3.2 to 5.2)	6.4 (4.9 to 8.4)	Referent	1.4 (1.1 to 1.7)
Turned away clients when they refused to use a condom						
%	67.4	85.9	50.2	78.0	58.4	70.8
AOR (95% CI)	–	Referent	0.2 (0.1 to 0.2)	0.6 (0.5 to 0.8)	Referent	1.8 (1.4 to 2.2)

Variables controlled for in the logistic regression analyses are age, education, marital status, duration into sex work, typology and study district.
*Self-efficacy for condom use with clients was calculated from the following questions: How confident are you that you can use a condom with each client when (1) he gets angry with you, (2) he offers you more money for sex without a condom, (3) you have been using alcohol or drugs.
†Self-efficacy for condom use with regular partners was calculated from the following questions: How confident are you that you can use a condom with each regular partner when (1) he gets angry with you, (2) you think the risk of disease is low, (3) you have been using alcohol or drugs.
AOR, adjusted ORs; N, total sample size in that category.

Table 4 Ability to handle crisis by degree of collective efficacy for achieving certain goals and for addressing specific problems among female sex workers in Mumbai and Thane, India, 2010–2011

		Collective efficacy for achieving certain goals			Collective efficacy for addressing specific problems	
Ability to handle crisis	**Total (N=2106)**	**Low (N=605)**	**Medium (N=969)**	**High (N=532)**	**Low (N=572)**	**High (N=1534)**
Stood up against the police and madams/ brokers to help fellow FSWs in the past 1 year*						
%	4.4	3.3	4.3	5.8	5.9	3.8
OR (95% CI)	–	Referent	1.6 (0.9 to 2.8)	2.7 (1.5 to 4.9)	Referent	0.7 (0.4 to 1.1)
Confident in facing troublesome stakeholders or service providers alone						
%	65.9	38.8	78.6	73.5	53.7	70.4
OR (95% CI)	–	Referent	6.4 (5.0 to 8.2)	4.3 (3.3 to 5.6)	Referent	2.3 (1.9 to 2.8)
Confident in supporting fellow FSWs in crisis						
%	71.6	49.6	83.0	76.1	62.8	75.0
OR (95% CI)	–	Referent	4.4 (3.4 to 5.6)	2.9 (2.2 to 3.7)	Referent	1.9 (1.6 to 2.4)
Received help from other FSWs when last time had a violent partner or client*						
%	51.1	46.3	41.4	73.9	55.0	49.8
OR (95% CI)	–	Referent	0.8 (0.6 to 1.0)	3.5 (2.7 to 4.5)	Referent	0.8 (0.6 to 1.0)

Variables controlled for in the logistic regression analyses are age, education, marital status, duration into sex work, typology and study district.
*Refers to the actual execution of behaviour.
AOR, adjusted ORs; FSW, female sex worker; N, total sample size in that category.

FSWs who reported a high degree of collective efficacy for achieving goals as compared with its counterpart were more likely to be confident in saying no to a client with whom they were unwilling to have sex (84.2% vs 65.3%; AOR =2.7, 95% CI 2.0 to 3.6), travelling alone (78.6% vs 60.2%; AOR =2.1, 95% CI 1.6 to 2.8) and voicing their opinion in front of a large group (83.6% vs 65.8%; AOR =2.4, 95% CI 1.7 to 3.2) (table 5). Similarly, FSWs who reported collective efficacy for addressing specific problems as compared with its counterpart were more likely to have confidence in: saying no to a client with whom they were unwilling to have sex (82.3% vs 70.2%; AOR =2.1, 95% CI 1.6 to 2.6), going to a service provider and disclosing their identity as a FSW (81.6% vs 65.4%; AOR =2.7, 95% CI 2.1 to 3.4), travelling alone (74.9% vs 70.3%; AOR =1.4, 95% CI 1.1 to 1.8), giving advice to others (80.0% vs 69.8%; AOR =1.9, 95% CI 1.5 to 2.4) and voicing their opinion in front of a large group (81.4% vs 72.4%; AOR =1.8, 95% CI 1.4 to 2.3).

The measure of overall individual empowerment is significantly associated with both the measures of collective efficacy. FSWs reporting high degree of collective efficacy for achieving goals were more likely to report greater empowerment (66.7% vs 29.0%; AOR =4.7, 95% CI 3.6 to 6.2) than those who reported low collective efficacy (table 6). FSWs reporting collective efficacy for addressing specific problems were more likely to report greater empowerment than those reporting no/low such collective efficacy (56.0% vs 47.0%; AOR =1.5, 95% CI 1.2 to 1.9).

Table 5 Factors affecting female sex workers' ability to negotiate for safe sex by degree of collective efficacy for achieving certain goals and for addressing specific problems) in Mumbai and Thane, India, 2010–2011

		Collective efficacy for achieving certain goals			Collective efficacy for addressing specific problems	
Self-confidence measures	**Total (N=2106)**	**Low (N=605)**	**Medium (N=969)**	**High (N=532)**	**Low (N=572)**	**High (N=1534)**
Confident in saying no to a client with whom she is unwilling to have sex						
%	79.0	65.3	82.8	84.2	70.2	82.3
OR (95% CI)		Referent	2.8 (2.2 to 3.7)	2.7 (2.0 to 3.6)	Referent	2.1 (1.6 to 2.6)
Confident in going to a service provider and disclosing her identity as an FSW						
%	77.2	70.4	80.8	78.6	65.4	81.6
OR (95% CI)		Referent	1.6 (1.3 to 2.1)	1.3 (0.9 to 1.7)	Referent	2.7 (2.1 to 3.4)
Confident in travelling alone						
%	73.6	60.2	79.4	78.6	70.3	74.9
OR (95% CI)		Referent	2.3 (1.8 to 3.1)	2.1 (1.6 to 2.8)	Referent	1.4 (1.1 to 1.8)
Confident in giving advice to neighbours and other FSWs						
%	77.2	64.5	82.8	81.8	69.8	80.0
OR (95% CI)		Referent	2.4 (1.8 to 3.0)	2.2 (1.7 to 2.9)	Referent	1.9 (1.5 to 2.4)
Confident in voicing an opinion in front of a large group						
%	78.9	65.8	84.5	83.6	72.4	81.4
OR (95% CI)		Referent	2.5 (1.9 to 3.3)	2.4 (1.7 to 3.2)	Referent	1.8 (1.4 to 2.3)

Variables controlled for in the logistic regression analyses are: age, education, marital status, duration into sex work, typology and study district.
AOR, adjusted ORs; FSW, female sex worker; N, total sample size in that category.

Table 6 Overall empowerment by degree of collective efficacy for achieving certain goals and for addressing specific problems among female sex workers in Mumbai and Thane, India, 2010—11

		Collective efficacy for achieving certain goals			Collective efficacy for addressing specific problems	
	Total (N=2106)	Low (N=605)	Medium (N=969)	High (N=532)	Low (N=572)	High (N=1534)
Overall empowerment						
%	53.6	29.0	61.7	66.7	47.0	56.0
OR (95% CI)		Referent	3.8 (3.0 to 4.8)	4.7 (3.6 to 6.2)	Referent	1.5 (1.2 to 1.9)

Variables controlled for in the logistic regression analyses are age, education, marital status, duration into sex work, typology and study district. The summary measure of empowerment was constructed by averaging the responses to the 12 questions used for the dimensions of self- efficacy and self-confidence: her ability to use condoms, negotiate condom use, handle crises, utilise resources, identify herself as a sex worker in a group, and confidence in giving her opinion in front of a large group. The score varied from 1 to 2, which had reliability (Cronbach's alpha) of 0.78. The index score was further divided into two equal categories of overall empowerment: low (1-1.4999) and high (1.50-2.0).
AOR, adjusted ORs; N, total sample size in that category.

DISCUSSION

This cross-sectional investigation of association between collectivisation and empowerment-related indicators for FSWs indicates that those reporting higher collective efficacy are also more likely to report higher self-efficacy in condom use with clients and regular partners and their ability to turn away clients when they refuse to use condoms. This demonstrated relationship between collectivisation, collective efficacy and the indicators of self-efficacy, and confidence gains importance given that FSWs are highly mobile and face multiple vulnerabilities associated with duration of sex work and educational background in cities like Mumbai and Thane.[19] Importantly, findings from the current study underline the importance of collective efficacy as strategy to promote HIV prevention interventions, especially in challenging settings as evidenced in the Aastha project and elsewhere.[22 23] These results parallel the previous research findings in Karnataka where it was shown that a higher degree of collectivisation was associated with increased knowledge and condom use by FSWs,[5] and in Andhra Pradesh, where it was evident that higher degree of community mobilisation increased condom use and reduce violence.[1 22]

Findings of this study also provide empirical evidence of the relationship between FSWs collectivisation and their confidence in standing up to the police and troublesome stakeholders if there were any issues that affected the FSW community. These results indicate much more benefits in an HIV prevention initiative than mere promotion of safe sex behaviours. Two-thirds of FSWs reported medium or high collective efficacy for achieving goals, which can be attributed to the support systems developed across different levels of the Aastha Parivaar and the continuous support provided by Aastha CBOs to AGs at the local level. The systems developed in the project also included building FSWs' knowledge and capacity to provide support promptly to each other. FSW collectivisation, as envisaged under the Aastha community mobilisation strategy, resulted in their enhanced ability to manage crisis situations independently and stand up to power structures, including brothel keepers, the police and brokers.[17] These findings support previous research results which report that interventions using peer education for FSWs could improve their daily lives.[26 27] The findings that FSWs are willing to speak in public, are not afraid of travelling alone and are able to give advice to fellow FSWs show the correlation between collectivisation and higher confidence levels.

The study results on the association between collective efficacy for addressing specific problems and FSWs increased self-confidence in facing troublesome stakeholders or service providers independently and also helping fellow sex workers in crises situations reinforce the need for building relationship bonds between FSWs and that they should be initiated in the early stages of the programme. While it is difficult to determine whether collective efficacy per se actually helped in building FSWs' self-confidence on many issues; however, the data show that FSWs' confidence in expression of thoughts and feelings/speaking publicly is perhaps a consequence of collectivisation. Programme experience suggests that in the early stages of the intervention, FSWs rarely communicated with each other, let alone coming together for any purpose or event. Most FSWs considered each other as rivals, which is believed to have compounded their sense of isolation created by being from different cultural backgrounds. During this period, the project emphasised the need to collectivise FSWs into AGs, which would provide a forum to discuss and solve individual as well as group issues. Following these efforts, FSWs realised they had common issues and began to experience group bonding. The knowledge of having a support system which they could access in case of a crisis situation greatly contributed to building their self-confidence and self-efficacy, and individual FSWs began to insist on condom use with clients or resist violence with the belief that the larger group would intervene if needed. These descriptions from the programme and our study results reinforce the need for developing collective groups and communicating on the benefits of such collectivisation.

Although the empirical evidence on the linkages between collectivisation and self-efficacy and confidence has several important programmatic implications, the results of this study must be interpreted cautiously in light of several limitations. First, responses to reported collective efficacy and self-confidence outcomes are based on self-reports and may therefore be vulnerable to significant social desirability and reporting biases. The use of experienced research staff linked with training and local support was designed to increase respondents' comfort and reduce social desirability; moreover, the use of short time-frames for questions was used to indicate their current status on all the indicators used. Second, the analyses are cross-sectional; thus, causality cannot be assumed in linkages between degree of reported collective efficacy and empowerment of FSWs. While this provides useful information in terms of the association between the indicators of self-efficacy and self-confidence with collective efficacy, further longitudinal research is needed to understand the causality between the two sets of measures used in the study. Due to this limitation, the findings of this study refer to the association between the degree of perceived collectivisation and empowerment of FSWs and not to how collectivisation per se led to increased empowerment of FSWs. Third, this study was conducted in Mumbai and Thane districts of Maharashtra, which are both highly industrial, economic hubs of commerce as well as migration destinations that have also seen a significant churn rate of FSWs. The sex work setting in these two industrial districts is highly heterogeneous and may be different from sex work settings in other cities, states or

What is already known on this subject

- Community collectives can empower vulnerable populations to negotiate safe sex practices.
- Empowerment strategies have been successful with homogenous groups of sex workers.

What this study adds

- Community collective efficacy is strongly associated with FSWs' increased confidence in times of crisis and increased self-efficacy for condom use.
- Collective efficacy for achieving goals, addressing specific problems and the associated self-efficacy within HIV prevention intervention is a possibility even in diverse settings through a context-specific grass-root-level programme planning and implementation.
- Community collectivisation through smaller groups (two to three self-help groups for every 50 FSWs), expanding to become community-based organisations and then a federation is a bottom-to-top approach in the scaling-up of HIV prevention interventions.

provinces and countries; hence, the results may not be generalisable and solely refers to the study districts. Finally, the independent associations measured between degree of collectivisation and the empowerment of FSWs could also question the adequacy of the items included in each of the measures. While future studies could address some of the issues related to measurement of collectivisation, this large-scale study highlights the relationship between collective efficacy and self-efficacy and self-confidence among FSWs who belong to different states of the country.

In summary, the results of this study suggest that FSWs who perceived high degree of collectivisation were more likely to also report self-efficacy for condom use and self-confidence in handling crisis situations. The Aastha intervention conducted with a heterogeneous group of FSWs belonging to different regions, religions and social sectors adapted the strategy of creating smaller groups at the local level that helped mobilise the community and formation of community-based organisation at the macro level. The model may be relevant in other national settings but focused research with a longitudinal study design is needed to document the pathways or mechanisms for the effect of collectivisation on individuals' empowerment.

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Community advocacy groups as a means to address the social environment of female sex workers: a case study in Andhra Pradesh, India

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ABSTRACT

Background To examine the association between the presence of community advocacy groups (CAGs) and female sex workers' (FSWs) access to social entitlements and outcomes of police advocacy.

Methods Data were used from a cross-sectional survey conducted in 2010–2011 among 1986 FSWs and 104 NGO outreach workers from five districts of Andhra Pradesh. FSWs were recruited using a probability-based sampling from 104 primary sampling units (PSUs). A PSU is a geographical area covered by one outreach worker and is expected to have an active CAG as per community mobilisation efforts. The presence of active CAGs was defined as the presence of an active committee or advocacy group in the area (PSU). Outcome indicators included acquisition of different social entitlements and measures of police response as reported by FSWs. Multivariate linear and logistic regression analyses were used to examine the associations.

Results Areas with active CAGs compared with their counterparts had a significantly higher mean number of FSWs linked to ration cards (12.8 vs 6.8; $p<0.01$), bank accounts (9.3 vs 5.9; $p=0.05$) and health insurance (13.1 vs 7.0; $p=0.02$). A significantly higher percentage of FSWs from areas with active CAGs as compared with others reported that the police treat them more fairly now than a year before (79.7% vs 70.3%; $p<0.05$) and the police explained the reasons for arrest when arrested the last time (95.7% vs 87%; $p<0.05$).

Conclusion FSWs from areas with active CAGs were more likely to access certain social entitlements and to receive a fair response from the police, highlighting the contributions of CAGs in community mobilisation.

INTRODUCTION

In India currently about 2.3 million people are infected with HIV.[1] The epidemic in the country is predominantly heterosexual and is assumed to be driven through unprotected sex with female sex workers (FSWs).[2] HIV prevalence among Indian FSWs is about 15 times higher than the general populations.[3 4] Studies indicate that FSWs are at high risk for HIV and are highly vulnerable to various forms of violence, abuse and stigma.[5] They are often deprived of social benefits and entitlements that are otherwise accessed by women in the general population.[6–10] Violence experienced by FSWs and their limited access to social entitlements may contribute to HIV risk-taking behaviours in various ways.[7–12] For example, forced sex is usually unprotected and can result in injuries that increase the transmission of HIV.[13] Similarly, barriers to accessing services such as bank accounts increase FSWs' vulnerability to theft as well as debt from informal sources such as money lenders, madams and pimps that reduce their negotiation ability in sexual exchange.[11]

The role of violence and lack of access to social entitlements in increasing the vulnerability of FSWs have been documented in the state of Andhra Pradesh, which is one of the six HIV high-prevalence states in India.[1] A recent community-based survey in eight districts of Andhra Pradesh found HIV prevalence among FSWs ranging from 6.5% to 23.3%.[14] FSWs from the state experience substantially high rates of physical and sexual violence, which is positively correlated with economic insecurity.[10] Another study has concluded that unstable housing among FSWs is linked to experience of sexual and physical violence and their risky sexual behaviours.[12]

Recognising the importance of such structural barriers, researchers have argued that HIV prevention programmes must go beyond the peer-led intervention approach to address the complex social, cultural, political and economic vulnerabilities faced by marginalised population groups most at risk of acquiring HIV infection.[9 15–18] One of the strategies to address these structural barriers is through the development of community-based organisations (CBOs), in which vulnerable populations, especially FSWs and men who have sex with men/transgenders, participate in group formation and work towards reducing the vulnerability of marginalised communities [6 9 19–21] An essential component of these structural interventions is to reduce the stigma, abuse and violence directed at sex workers, particularly incidents perpetrated by the police, *goondas* (abusive men) and sexual partners/clients.[6 19] Another important component is to provide organised support to FSWs to obtain their social and economic entitlements, such as ration cards, bank accounts and plots of land for housing (L Ramachandar, unpublished, 2011).[9] A specific advocacy structure within CBOs has also been recommended to address the social vulnerabilities faced by FSWs and to create an enabling environment.[22–24] An example of such structural intervention is the setting up of an active advocacy group which works at different levels to influence

policy makers and state administrative agencies to benefit marginalised communities.[23] However, less is known about the scale-up strategy in development and implementation of an active advocacy group and their relative benefits. This paper describes the development of a scaled-up community advocacy group (CAG) system and its effect on related programme outcomes: increasing FSWs' access to social entitlements and fair response from the police (less police arrests, police informing FSWs of the reasons for arrest and perceived fair treatment by the police in general). These outcomes were examined by comparing the FSWs from areas where CAGs were active (functional) and areas where there were no active CAGs.

Description of the programme: the CAG

The HIV prevention programme considered in this paper covered a total of 14 districts in Andhra Pradesh. CAGs were initiated in 2006 as part of the development of CBOs and other components of the programme. The development of CBOs in Andhra Pradesh, as in many other states of India, has drawn lessons from community mobilisation in the Sonagachi project in Kolkata, which has reported the increased empowerment of FSWs.[9 21]

During the early phases of the structural intervention programme, it was observed on many occasions that FSWs could not use condoms or access clinical services due to factors such as threats from the police and local *goondas* and fear of identification as a sex worker. The experience of violence and abuse also contributed to low self-esteem, thus undermining the possibility of effective HIV prevention.[25] Surveys carried out among FSWs in the early phases of the programme showed that most sex workers had low expectations concerning the usefulness of group action. *'Overall only one in four FSWs strongly believed that participating in a peer group could empower them …. Similarly, perceptions of social support among the entire sample were low…'.*[26]

This evidence led the programme to develop an organised system of advocacy, which involved the participation of FSWs. Training of FSWs in communication and advocacy skills and building their knowledge of legal rights and related information began on a pilot basis in four districts in November 2006. Initially, CAGs focused on sensitising the police, local *goondas*, auto rickshaw/taxi drivers and others to reduce violence among FSWs. After six months of intervention, interaction with FSWs revealed that the advocacy activities were leading to a significant reduction in the abuse of FSWs and increase in their access to social entitlements. The types of social entitlements accessed in the programme and the key stakeholders approached for these are detailed in table 1.

Structure and functioning of the CAG system

At places where FSWs solicit clients (referred to as hotspots), small groups of FSWs, locally known as community action teams, were formed to address FSWs' problems, including abuse, violence and lack of access to social entitlements. These groups of FSWs were assisted to form CAGs at the mandal (subdistrict) and the NGO (multiple mandal) levels. Community action teams from different hotspots coordinated advocacy needs with CAGs at the mandal and NGO levels. Meetings of NGO-level CAGs were held once a month to address difficult cases and review the progress of advocacy activities at the mandal and local levels. Every NGO-level team was provided a crisis telephone number, which a sex worker could call in the event of violence. The functioning of the community action team was similar to the crisis response system established within community mobilisation programmes in other settings.[24] The structure and functioning of CAGs are detailed in figure 1.

METHODS

The functioning of the CAG system was regularly monitored using two data streams: (1) the monitoring and information system (MIS) and (2) the Behavioural Tracking Survey. The MIS captured the number of violence cases documented, the number of FSWs who applied for social entitlements and the number of police personnel who attended advocacy meetings. The Behavioural Tracking Survey is a cross-sectional survey conducted among FSWs and outreach workers who work with the NGOs to provide programme services to FSWs.

This paper utilises data primarily from the Behavioural Tracking Survey conducted in 2010–2011 in five districts of Andhra Pradesh, namely Khammam, Warangal, Kurnool, Medak and Ananthapur. The objectives of the survey were to monitor the key components of the HIV prevention programme such as community mobilisation, access to social entitlements, violence and abuse, treatment seeking for sexually transmitted infection and the formation and functioning of advocacy groups. The study districts were purposively selected to include areas where the HIV prevention programme is being implemented, and behavioural and biological surveys have not been conducted prior to the Behavioural Tracking Survey. A sample size of 400 FSWs was calculated for each district based on the prevalence of consistent condom use and expected level of change with each unit change in the degree of community mobilisation.

In order to prepare the sampling frame for the selection of FSWs from each hotspot, a rapid mapping exercise was conducted by the data collection agency using key informant

Table 1 Type of social entitlements accessed in the programme and key stakeholders approached

Type of social entitlement	Definition	Key stakeholders involved
Ration card	► Allows an individual or a family living below the poverty line to access certain essential commodities like rice, sugar and kerosene at subsidised prices ► Used as a proof of identity ► In some cases makes the card holder eligible to obtain other benefits such as membership in a state-sponsored health insurance scheme and cooking gas at a reduced price	District/local-level government officials
Voter identity card	► Provides evidence of an individual's civic identity ► Gives a person the right to vote in elections ► Essential for accessing many benefits from government programmes	District/local-level government officials
Bank account	Allows independent savings and independent access to savings	Bank managers, guarantors
Free education for children	Allows children of school-going age to access free education services	District/local-level government officials, staff of local schools
Health insurance	► A state-sponsored community health insurance scheme for BLP families (*Rajiv Aarogyasri*) ► Entitles card holders to access medical services from corporate hospitals	District/local-level government officials
House site *pattas* (*certificates*)	Poor houseless persons are given government wasteland for housing	District/local-level government officials

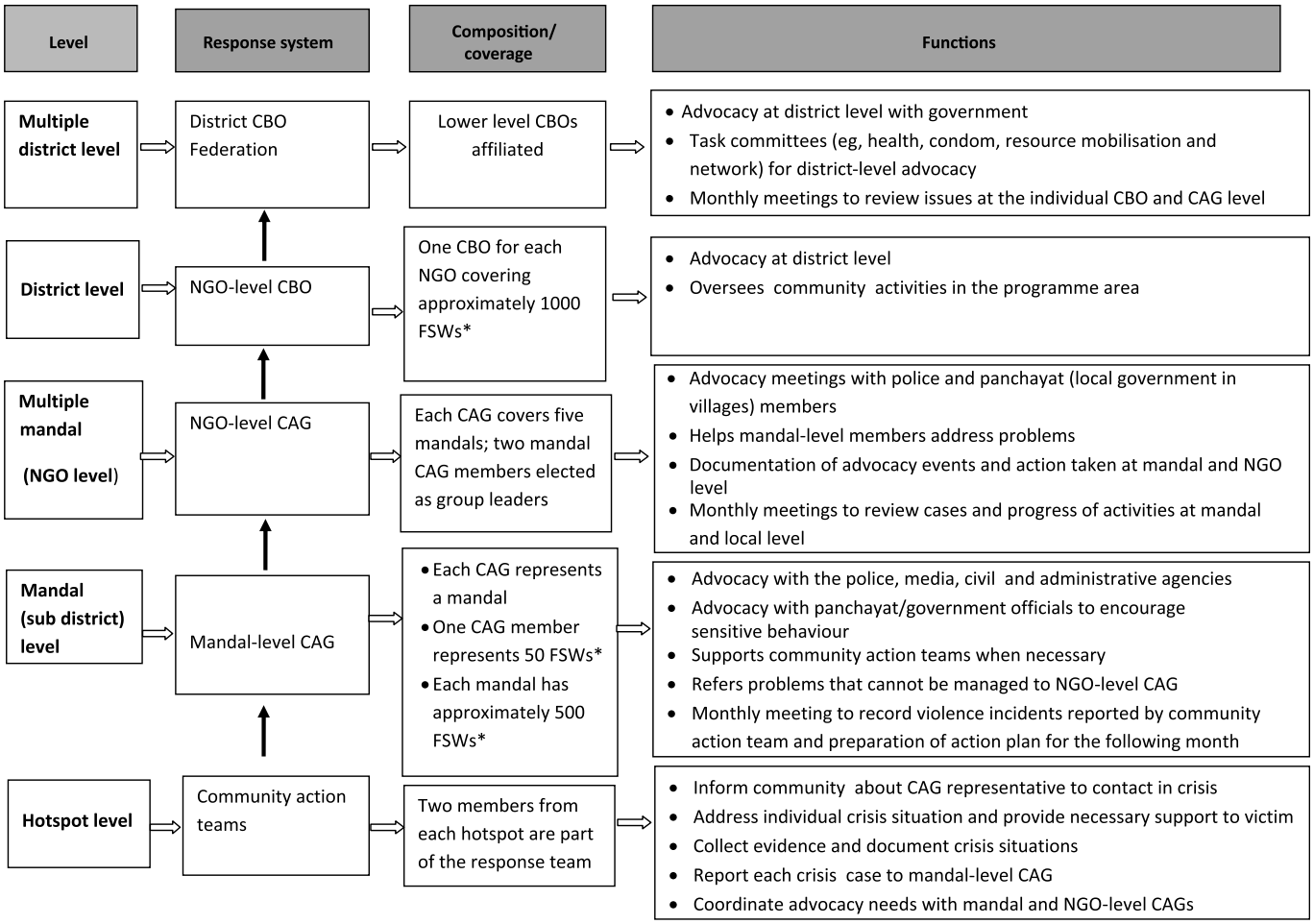

Figure 1 Structure of the community advocacy system. *Approximate values are presented which may vary depending upon the size of female sex workers' population in the area.

interviews with community members, police staff and social workers in the area to validate the existing list of hotspots that were originally developed by the programme-implementing agency. The hotspots were grouped into two categories: (1) non-public place hotspots (brothels, hotels, lodges, roadside eating establishments and homes) and (2) public place hotspots (streets, market areas, highways and cinema halls). For each non-public place hotspot, data were gathered on the number of FSWs available at the hotspot. For each public place hotspot, data were gathered on the number of FSWs at the hotspot, segregated by the time slots when they gathered for sex work (eg, 9:00—13:00; 15:00—19:00, etc). Primary sampling units (PSUs) were defined as the geographical area covered by an NGO outreach worker for programme implementation, which usually consists of approximately 250 FSWs. Thus, each PSU consisted of several public place and non-public place hotspots.

FSWs in each PSU were recruited through a two-stage sampling procedure. In the first stage, a fixed number of hotspots within each PSU were selected using the proportion to population size procedure. The number of interviews to be conducted in each PSU was proportionally allocated in accordance with its share in the total population of FSWs in the district. The number of interviews to be conducted from each PSU was further proportionately disaggregated between public place and non-public place hotspots. A conventional cluster sampling approach was used to select non-public place hotspots, whereas time-location cluster sampling was used to select public place hotspots. In time-location cluster sampling, a hotspot was replicated multiple times to form a time-location cluster for each time slot when FSWs congregate at the hotspot. Details of the time-location cluster sampling approach are available elsewhere.[27] In the second stage, FSWs were randomly selected within each selected hotspot. Data on socio-demographics, incidents of violence, behaviour of the police and access to different social entitlements were collected through face-to-face interviews using a structured questionnaire.

Of the total 2389 FSWs approached, 403 either refused to participate in the study or withdrew during the course of the interview. This resulted in a total analytical sample of 1986 FSWs from 104 PSUs. The response rate was 83.1%. The main reasons for non-participation were phone calls or interruption from clients, heavy rain and objections from pimps/brokers or madams.

In addition to interviews with FSWs from the 104 PSUs, all the 104 outreach workers from these PSUs were interviewed face-to-face using a semistructured questionnaire to assess: whether FSWs in their area perceived the need for a particular social entitlement such as ration cards, voter identity cards, bank accounts, free education for children, health insurance and other (eg, housing *pattas* (certificates) and cooking gas connections); whether a cell group/individual had been assigned to facilitate access to the particular entitlement and the number of FSWs who had been linked to a particular entitlement in the past 1 year. Of the 104 outreach workers interviewed, 98 were FSWs.

All interviews were conducted by trained researchers with verbal and written skills in Telugu, the local language of Andhra Pradesh. All the researchers had a Bachelor's degree in sociology or statistics. The survey instrument was developed in English and translated into Telugu. The translated forms were reviewed by study investigators who were fluent in both English and Telugu. The interview schedule was then pretested in communities that were similar to the survey sites. Field staff checked the data immediately after the interviews to ensure accuracy and completion of questionnaires. Field supervisors reviewed the data on the same day and survey forms were sent every week to the data management team for data entry. A user written computer programme in CSPro (V.4.0) was used for double data entry by trained data entry officers.

Ethical considerations

The overall study design and questionnaires were reviewed and approved by the institutional review boards of Family Health International and the Karnataka Health Promotion Trust. A comprehensive informed consent process was followed; respondents were informed about the study, including the duration of the interview (approximately 30 min), and their queries addressed before verbal consent was taken. For ethical reasons, only those FSWs who were at least 18 years of age were interviewed. To protect confidentiality and respect privacy, all questionnaires were anonymous and interviews were conducted in a private or public location depending on the FSW's preference. A small room was hired in each PSU where interviews were conducted in privacy. In areas where it was not possible to hire a room, public locations were identified such as parks or isolated corner roads where others would not be able to listen to the interview. Participants were not given any monetary compensation for their time in the study but were provided information on HIV services available in the area.

Key measures

Socio-demographic characteristics of FSWs

The socio-demographic characteristics of FSWs considered in this paper were current age, any formal schooling (no, yes), marital status (currently married, not currently married), typology of sex work (brothel-based, home-based, public place-based) and duration of sex work. Any formal schooling was defined as the ability to both read and write. Typology of sex work was derived on the basis of primary place of solicitation.

CAG status

The key independent variable in the present study was the status of the CAG (non-active, active) in each PSU. For each social entitlement considered in the paper, PSUs were defined to have an active CAG if at least one individual or a group was assigned to facilitate access to that particular social entitlement. Any active CAG was defined as the presence of any type of advocacy group in the PSU (no, yes).

Acquisition of social entitlements

FSWs were asked whether or not they have the following social entitlements: ration card, voter identity card, bank account and free education for children. Those who reported having a social entitlement were further asked when they had acquired the particular entitlement. Based on responses to these questions, a variable measuring duration of acquisition of the social entitlement with the following three categories was computed: not acquired, acquired for more than 36 months and acquired within the last 36 months. The cut-off point of 36 months was chosen because CAGs were formed approximately 36 months prior to the survey.

Behaviour of the police with FSWs

The behaviour of the police with FSWs was measured by the following indicators collected by interviewing FSWs: ever arrested by the police (no, yes), whether the police explained reasons when arrested last time (no, yes), whether the police had informed at least one friend or relative about the arrest when arrested last time (no, yes), whether ever interacted with the police (no, yes) and whether FSWs perceive that the police treat them more fairly now than they did a year before (no, yes).

Statistical analyses

The association between CAG status and acquisition of social entitlements (as per the programme-monitoring data) in the past 1 year was examined by using multivariate linear regression models with the number of FSWs linked to different social entitlements in the PSUs as the continuous outcome measure. Separate linear regression models were used to estimate the regression coefficient (β) and corresponding SEs for CAG status for different social entitlements. The number of FSWs registered in the HIV prevention programme in PSUs was considered as a covariate in each regression model. To supplement the observed association between CAG status and number of FSWs linked to different social entitlements in each PSU, data sets collected from FSWs and outreach workers were merged. The percentage of FSWs in categories of duration of acquisition (not acquired, acquired for more than 36 months, acquired within last 36 months) for different social entitlements was compared for PSUs with and without active CAGs. Significance of the differences in the percentages was tested using the Z test statistic. The merged data were also used to examine the association between CAG status and police behaviour with FSWs.

Table 2 FSWs' interaction with the police and reported experiences of abuse in five district of Andhra Pradesh, Behavioural Tracking Survey, 2010–2011

Interaction with the police and experience of abuse	Ananthapur (N=400)	Medak (N=400)	Khammam (N=396)	Warangal (N=390)	Kurnool (N=400)	Total (N=1986)
Ever arrested by the police (%)***	19.8	2.9	5.7	7.6	20.3	14.9
Police explained reasons for arrest† (%)***	97.2	75.1	73.0	89.9	91.3	93.8
Police informed at least one friend or relative about the arrest† (%)**	49.2	30.2	49.5	23.1	32.1	44.6
Ever interacted with the police (%)***	80.5	39.2	39.5	66.4	63.2	66.2
Feels that the police treat FSWs more fairly now than they did 1 year before‡ (%)***	83.3	59.5	59.0	76.6	74.9	77.9

**p<0.01; ***p<0.001. Significance of the differences in the percentages across districts was tested using χ^2 test.
†Among FSWs who had ever been arrested refers to FSWs' experience when they were arrested last time.
‡Among FSWs who had ever interacted with the police.
FSW, female sex worker; N, number of cases.

Multiple multivariate logistic regression models were used to estimate adjusted ORs and the corresponding 95% CIs for different indicators of police behaviour with FSWs. The socio-demographic characteristics of FSWs were used as covariates in the logistic regression models. Data were analysed using the statistical software STATA (V.11).

RESULTS

In the CAG programme, over 500 FSWs were trained in the basic components of legal literacy and communication skills to conduct advocacy sessions with the police and other stake-holders such as the media. They also received training on meeting government officials to negotiate on acquisition of social entitlements. The MIS records show that during January to December 2010, CAG members met with over 500 police personnel to sensitise them and presented information on 175 crisis cases in various print and electronic media.

Overall, about two-thirds (66.2%) of FSWs interacted with the police and 14.9% reported police arrest (table 2). About three-fourths (77.9%) of FSWs who had ever interacted with the police perceived that the behaviour of the police was better than the previous year. All the indicators shown in table 2 varied significantly across the districts. For example, while about 59.0% of FSWs in Medak and Khammam reported better treatment by the police, this percentage was as high as 76.6% in Warangal and 83.3% in Ananthapur ($p<0.001$).

Results in table 3 indicate that the presence of active CAGs had a significant effect in increasing the number of FSWs who have been linked to ration cards, bank accounts and health insurance in the year preceding the survey. For example, the mean number of FSWs who received ration cards in PSUs with active CAGs was 12.8 as compared with 6.8 in PSUs with non-active CAGs ($\beta=6.2$; SE=1.7; $p<0.001$). Similarly, PSUs with active CAGs, compared with those with non-active CAGs, had a significantly higher mean number of FSWs who were linked to bank accounts (5.9 vs 9.3; $\beta=3.4$; SE=1.6; $p=0.05$) and health insurance (13.1 vs 7.0; $\beta=6.3$; SE=2.4; $p=0.02$).

Table 4 presents the association between CAG status and duration of acquisition of different social entitlements. A smaller proportion of FSWs belonging to PSUs with active CAGs as compared with those from other PSUs reported acquisition for more than 36 months of a ration card (80.1% vs 89.6%, $p<0.01$), bank account (12.8% vs 19.5%, $p=0.06$) and enrolment of children in the free educational system (51.5% vs 61.2%, $p=0.04$). A little more than one-tenth (10.8%) of FSWs from PSUs with active CAGs had received a ration card within the past 36 months, whereas this percentage was 2.7% for FSWs belonging to PSUs without active CAGs ($p<0.01$).

Table 5 shows the association between the presence of active CAGs and police behaviour with FSWs. In PSUs with active CAGs compared with their counterparts, the police were significantly more likely to explain the reasons for arrest (95.7% vs 87%; adjusted OR: 2.9, 95% CI 1.2 to 6.9). FSWs belonging to PSUs with active CAGs were significantly more likely to interact with the police than others (68.0% vs 59.6%; adjusted OR: 1.5, 95% CI 1.2 to 1.9). A higher proportion of FSWs from PSUs with active CAGs than their counterparts perceived that the police treated them more fairly now than a year before (79.7% vs 70.3%; adjusted OR: 1.7, 95% CI 1.2 to 2.3).

DISCUSSION

The present study highlights the lessons learnt from the setting up of a CAG system, which is part of a scaled-up community

Table 3 Association between CAG status and FSWs' acquisition of social entitlements in the year preceding the survey in five districts of Andhra Pradesh, Behavioural Tracking Survey, 2010–2011

Type of social entitlement	Number of PSUs with an identified need for the social entitlement	Number of CAGs		Number of FSWs registered in the HIV prevention programme by CAG status		Number of FSWs linked to social entitlements in the last 1 year by CAG status		Mean number of FSWs per PSU who received social entitlements in the last year		Results from the multiple linear regression analyses		
		Non-active CAGs	Active CAGs	Non-active CAGs	Active CAGs	Non-active CAGs	Active CAGs	Non-active CAGs	Active CAGs	Constant term	Adjusted* regression coefficient (β) for CAG status (SE)	p Values
Ration card	80	17	63	4543	15 436	117	812	6.8	12.8	4.5	6.2 (1.7)	<0.01
Voter identity card	59	12	47	2912	12 200	126	558	10.5	11.9	1.6	0.7 (2.4)	0.76
Bank account	40	11	29	2550	6187	65	269	5.9	9.3	4.7	3.4 (1.6)	0.05
Admission of children into free educational system	34	6	28	1243	6142	55	292	9.1	10.4	9.6	1.3 (2.7)	0.65
Health insurance	30	6	24	1529	5585	42	316	7.0	13.1	8.1	6.3 (2.4)	0.02
Other	29	10	19	2273	4292	110	176	11.0	9.3	−0.40	−3.2 (3.1)	0.31

Other refers to housing *pattas* (certificates) and cooking gas connections. Active CAG: at least one individual or cell/group or committee assigned to work for the particular social entitlement; non-active CAG: no individual or cell/group or committee assigned to work for the particular social entitlement.
*Adjusted for the registered number of FSWs in the PSU using linear multivariate regression. Separate linear regression models were estimated for each of the social entitlements.
CAG, community action group; FSW, female sex worker; PSU, primary sampling unit.

Table 4 Association between CAG status and duration of acquisition of social entitlements among FSWs in five districts of Andhra Pradesh, Behavioural Tracking Survey, 2010–2011

Duration of acquisition of social entitlement	Ration card (%)			Voter identity card (%)			Bank account (%)			Admission of children in the free educational system (%)*		
	Non-active CAG (N=222)	Active CAG (N=1403)	p Value	Non-active CAG (N=153)	Active CAG (N=1161)	p Value	Non-active CAG (N=113)	Active CAG (N=533)	p Value	Non-active CAG (N=121)	Active CAG (N=611)	p Value
Not acquired	7.8	9.2	0.49	12.4	12.3	0.97	35.9	37.9	0.69	32.4	37.1	0.33
Acquired for more than 36 months	89.6	80.1	<0.01	71.3	68.7	0.38	19.5	12.8	0.06	61.2	51.5	0.04
Acquired within last 36 months	2.7	10.8	<0.01	16.3	19.0	0.42	44.5	49.2	0.36	6.4	11.1	0.12

Active CAG: at least one individual or cell/group or committee assigned to work for the particular social entitlement; non-active CAG: no individual or cell/group or committee assigned to work for the particular social entitlement. Differences in the percentages across categories were tested using the Z test statistic.
*Among those who have children of school-going age.
CAG, community action group.

mobilisation strategy where individual FSWs in the intervention districts were facilitated to acquire social entitlements and the efforts were done to sensitise police behaviour. Although the system was established uniformly across the intervention districts around the same time, there were some sites where the CAG system was active and others where the CAG was not active at the time of the survey. The results of the survey suggest that a larger number of FSWs belonging to areas where CAGs were active received ration cards, bank accounts and health insurance as compared with FSWs in areas where CAGs were not active. Similarly, a larger percentage of FSWs from areas where CAGs were active perceived fair treatment by the police and perceived that the police explains the reasons for arrest (if they were arrested) as compared with FSWs in areas where CAGs were not active. The findings of this paper are similar to reports from other programmes in Andhra Pradesh as well as the qualitative materials of programmes in Karnataka, which show the positive effects of advocacy, one of the components of the community mobilisation programme (L Ramachandar, unpublished, 2011).[6 19]

The communities identified ration cards as the most needed social benefit, whereas lower priority was given to entitlements that have long-term benefits such as enrolment of children in the free education system and health insurance. This preference can perhaps be attributed to poverty and the community's immediate need for essential commodities. The CAGs facilitated several interactions between marginalised groups such as FSWs and those who wield power, such as the police. Facilitating such interactions and establishing communications between these two groups was an essential step to make the police understand the problems that FSWs face in a particular social, cultural, political and legal milieu. The survey data support this hypothesis and more positive response from the police in areas with active CAGs as compared with others. These findings highlight the need to initiate special advocacy measures within HIV prevention programmes, which include strategies to work with administrative agencies like the police and municipal corporations and agencies like banks and educational institutions to create an enabling environment for the sex worker community.

In addition to the quantitative data presented in this paper, several 'success stories' based on the activities of the CAG system have been presented in the news media.[28] These narratives show that ongoing advocacy efforts and the principle of 'strength in numbers,' coupled with FSWs' sound knowledge of legal matters, are often key factors in advocacy encounters. For instance, in Khammam district of Andhra Pradesh, CAG leaders took a batch of FSWs' applications for ration cards and voter identity cards to the appropriate government offices and made a number of follow-up visits to these officials. Following ongoing pressure, after two months, the ration cards and voter identity cards were issued to all the members who had applied.

Although CAG members made persistent efforts to sensitise the police during the initial intervention period, the frequent transfers of sensitised police staff within and outside the implementation districts was a challenge as CAG members would have to restart the process of sensitising new incumbents each time new staff were posted. To address this issue, CAG members began organising 'thanksgiving parties' for sensitised staff, where community members as well as new incumbents were invited. These parties provided a platform for new incumbents to be sensitised by their own colleagues.

While this paper provides evidence of the effect of the CAG system on the community mobilisation programme, the results

Table 5 Association between the presence of any active CAG and behaviour of the police with FSWs in five districts of Andhra Pradesh, Behavioural Tracking Survey, 2010–2011

	Any active CAG		
Police behaviour	**No (N=781)**	**Yes (N=1205)**	**Adjusted OR (95% CI)**
Ever arrested by the police (%)	14.4	15.0	1.1 (0.8 to 1.4)
Police explained reasons for arrest* (%)	87.0	95.7	3.2 (1.1 to 8.9)
Police informed at least one friend or relative about the arrest* (%)	31.4	48.1	1.8 (0.9 to 3.7)
Ever interacted with the police (%)	59.6	68.0	1.5 (1.2 to 1.9)
Feel that the police treat FSWs more fairly now than they did a year before † (%)	70.3	79.7	1.7 (1.2 to 2.3)

Any active CAG: at least one individual or cell/group or committee assigned to work for any of the following social entitlements: ration card, voter card, bank account, free education for children and health insurance. PSU without any active CAG were considered as reference group.
ORs were adjusted for the following socio-demographic characteristics of FSWs: current age (entered as continuous variable), any formal schooling (no, yes), marital status (currently married, not currently married), typology of sex work (home based, street based, brothel based) and duration of sex work (entered as continuous variable) using logistic regression.
*Among FSWs who had ever been arrested. It refers to FSWs' experience when they were arrested last time.
†Among FSWs who had ever interacted with police.
CAG, community action group; FSW, female sex worker; PSU, primary sampling unit.

of this study must be interpreted cautiously due to several limitations. This study does not present a full-scale evaluation of the CAG system, rather it aimed to provide a description of the CAG system and demonstrate its benefits for FSWs. Moreover, the areas without an active CAG did not represent a 'true control area' due to several reasons. First, both areas with active CAGs and those without active CAGs had identical community mobilisation programmes. Second, advocacy with powerful state actors at the district level may have benefited even those areas within the district that do not have an active CAG. Third, FSWs are often mobile, and some of those who were interviewed might have moved from areas with active CAGs to areas without active CAGs or vice versa; such unrecorded intra- and inter-district mobility is likely to have confounded the comparison. Finally, although this study establishes the significant positive benefit of the presence of active CAGs for marginalised communities in terms of increasing FSWs' access to social entitlements, little has been achieved by CAGs in the programme. Some of the social entitlements (eg, free education for FSWs' children, bank accounts, health insurance) still appear to be out of reach for a substantial proportion of sex workers even in the presence of active CAGs. These results highlight the need for further research on the reasons for the inability of CAGs to advocate access to certain social entitlements for FSWs and the underlying response mechanisms from civil society and government organisations to the efforts of CAGs.

In conclusion, our study findings suggest that community mobilisation programmes to influence structural-level issues may require a specialised and dedicated advocacy group to improve community well-being and reduce the potential vulnerability of marginalised groups to abuse by several stakeholders including state administrative agencies. Given that the active CAG system had increased FSWs' acquisition of social benefits, programmes that include CAG systems need to ensure their active engagement in the programme and continuous dialogue between the community and stakeholders. Since HIV prevention interventions need to go beyond the promotion of safe sex behaviour, further attention is needed to develop community advocacy systems and strengthen existing CAGs to prevent abuse and protect the rights of marginalised communities.

What is already known on this subject

- HIV prevention interventions with FSWs highlight the need for a structural system to address violence and crisis situations in sex work settings.
- A few published programmatic research studies, which have mainly been conducted in brothel-based settings, show that incidents of violence reduce with the collectivisation of FSWs.

What this study adds

- Describes the process of developing CAGs in a setting where the majority of FSWs solicit clients from the non-brothel areas.
- Describes differences in sex workers' access to social benefits and enabling environment in the presence and absence of active CAGs.

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Mobilising community collectivisation among female sex workers to promote STI service utilisation from the government healthcare system in Andhra Pradesh, India

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ABSTRACT

Background To assess the association between female sex workers' (FSWs) degree of community collectivisation and self-efficacy, utilisation of sexually transmitted infection (STI) services from government-run health centres in Andhra Pradesh, India.

Methods Cross-sectional analyses of 1986 FSWs recruited using a probability-based sampling from five districts of Andhra Pradesh during 2010—2011. Multiple logistic regression models were constructed to assess associations. The independent variables included—collective efficacy, collective agency and collective action—measured using a series of items that assessed the grouping of the community on issues that concern most sex workers. An additional independent variable included FSWs belonging to an area where there was a project partnership with government health centres to provide STI treatment services to FSWs. The outcome indicators included self-efficacy for service utilisation from government health facilities and the treatment for STIs from government health facilities at least once in the past year experience of STI symptoms.

Results Of the 1986 FSWs, nearly two-fifths (39.5%) reported a high level of overall collectivisation (collective efficacy: 89%, collective agency: 50.7%; collective action: 12.7%). Sex workers with a high degree compared with low degree of overall collectivisation were significantly more likely to report high self-efficacy to use government health facilities (75.0% vs 57.3%, adjusted OR 2.5, 95% CI 2.0 to 3.1) and to use government health centres for STI treatment in past 1 year (78.1% vs 63.2%, adjusted OR 2.1, 95% CI 1.6 to 2.8), irrespective of project partnership with government centres.

Conclusion The current research findings reinforce the need for stronger community mobilisation for better utilisation of government health facilities for STI and HIV prevention interventions.

INTRODUCTION

There is increasing evidence that the treatment of sexually transmitted infection (STI) among dispersed female sex workers (FSWs) and other marginalised populations, particularly those in rural areas, is more cost-effective and viable if these services are provided by a primary care physician.[1–3] Such provider-based interventions call for project partnerships with government and/or private healthcare practitioners located in areas with high-risk population groups.[4–6] With the evolution of National Rural Health Mission in India,[7] there has been renewed interest in using the services of government and private healthcare facilities and providers, through sustainable partnerships, to reach at-risk populations within targeted HIV and other interventions in India.[4 8 9] Although there have been significant efforts to promote the utilisation of services of primary care physicians in interventions targeted to FSWs in India, this has often been a challenge.

This paper focuses on a community mobilisation strategy adopted among FSWs to create a demand for the utilisation of STI services at government health facilities in five districts of Andhra Pradesh, India. Across the world, community mobilisation initiatives suggest several advantages associated with this strategy, including the empowerment of sex workers, reduced vulnerability to HIV and STI, increased condom use and reduced violence perpetrated by district or state administrative personnel.[10–20] Although some studies highlight the difficulties in bringing sex workers together in some settings, given the high turnover due to their mobility,[10 16] most studies suggest that the collectivisation of FSWs is an effective method for increased community participation and achieving HIV/STI risk reduction outcomes.[12 21–25] In a study of 'community-led' health promotion in Sonagachi in Kolkata, India, the authors suggest that 'community mobilisation' refers to wider principles of involvement in or influence on the project and not merely a local grouping of marginalised sex workers.[22 26] These studies have indicated the need to measure community mobilisation as collectivisation in response to the needs of sex workers within the community. To implement community mobilisation interventions for STI service utilisation in India, a number of issues need to be addressed, including strengthening government health facilities to provide STI treatment, reducing stigma and creating a demand for the use of government health services.

In this paper, we briefly describe the methods adopted to implement a community mobilisation intervention among FSWs and to build partnerships with government health facilities to deliver STI services in Andhra Pradesh. We then assess the effect of the degree of community collectivisation on FSWs' self-efficacy and their utilisation of STI care services from government health facilities by comparing FSWs from areas where the project partnered with government health facilities for STI

treatment and FSWs from areas where STI services were provided by other methods. The intervention and evaluation data were collected as part of an ongoing 10-year (2004–2013) HIV prevention project among FSWs in Andhra Pradesh, which is being implemented by India AIDS Alliance (hereafter referred to as Alliance), a not-for-profit organisation working to prevent HIV and build healthy communities. Project activities included supporting community collectivisation among FSWs as part of an overall community mobilisation intervention across all intervention sites and building partnerships with government healthcare facilities in certain selected intervention sites.

METHODS

Study setting

The Alliance intervention covers a total of 14 districts with an estimated 36 905 FSWs spread across both urban and rural areas of Andhra Pradesh. The intervention was initiated in 2004 and was scaled up across 68 sites by 2006; it was further extended to 139 sites, including 72 rural sites in 2007. The estimated number of FSWs in the rural sites was 14 180, with the majority dispersed across wide geographies.

Healthcare facilities available in the rural areas of Andhra Pradesh where FSWs reside and practice sex work include a primary health centre (PHC) and a community health centre (CHC), presenting a typical scenario of primary healthcare settings across India. Each of these health centres includes a qualified doctor recruited by the government.

As FSWs in rural areas are scattered across wide geographies, providing STI service delivery through a static NGO clinic was not seen as a viable intervention. Rather, the project used the services of government-run PHCs, CHCs and Urban Health Center (UHCs) by establishing partnerships with these centres to provide cost-effective STI treatment to FSWs. To select intervention sites and to build such partnerships, the project mapped the fully functioning government and other health facilities located within a distance of 5 km from the target community areas. A total of 72 government health facilities were identified, which were fully functional in terms of infrastructure and where the doctor was willing to provide STI treatment services to the sex worker population.

Healthcare providers in these government facilities were trained on the syndromic management of STIs and provided an uninterrupted supply of colour-coded STI treatment kits and condoms. A project-supported auxiliary nurse-midwife was placed at each facility to conduct rapid syphilis screening and to oversee and support adherence to infection control practices and data recording.

The project promoted the utilisation of government-run facilities for STI services through its community collectivisation programme. The project team initiated sensitisation meetings with outreach staff and community members on the benefits of accessing STI treatment from government health facilities. Supervising NGOs supported community-based groups, formed as a result of community collectivisation efforts at the site level, to engage and mobilise FSWs to come together and to explain to the community the long-term benefits of accessing government facilities for STI treatment. It was emphasised that these centres would be a one-stop shop to meet FSWs' comprehensive health requirements, including their sexual and reproductive health needs. To create a demand for STI services at the hot spot level, awareness camps using games, street plays, puppet shows and magnet theatre shows were organised with a focus on building FSWs' risk perception. Overall, community collectivisation was conceived as a process to promote STI treatment service utilisation from government-run health centres.

Data

This paper uses data from the Behavioural Tracking Survey, a cross-sectional behavioural survey conducted among FSWs in five districts (Khammam, Warangal, Kurnool, Medak and Ananthapur) of Andhra Pradesh during 2010–2011 to monitor the key components of the HIV prevention programme: community mobilisation, safe sex behaviour and STI treatment-seeking behaviour. The districts were purposively selected for the survey to include areas where the HIV prevention programme was being implemented by Alliance, and no surveys specifically measuring community mobilisation had previously been conducted. A sample size of 400 FSWs was calculated for each district based on prevalence of consistent condom use and expected level of change with each unit change in the degree of community mobilisation. A total of 1986 FSWs from various sites were recruited through a two-stage sampling procedure. For FSWs based on non-public places (brothels, lodges similar to hotels for accommodation, roadside eating establishments and homes), the conventional cluster sampling approach was used by selecting hot spots. For FSWs based on public places (streets, market areas, highways and cinema halls), time–location cluster sampling was used where a hot spot was replicated multiple times to form a cluster for each time slot when FSWs congregate at the hot spot.[27 28] In the second stage, within each selected hot spot, respondents were randomly selected. Details of sampling and the study design are discussed in another paper of this supplement.[29]

Ethical considerations

The overall study design and questionnaires were reviewed and approved by the institutional review boards of Family Health International and the Karnataka Health Promotion Trust. Oral consent was obtained from all respondents prior to participation in the interview, and steps were taken to ensure their confidentiality. For ethical reasons, only those FSWs who were at least 18 years of age were interviewed. No names and addresses were recorded on the questionnaires. Participants were not provided any compensation for their time in the study but were referred to local project services run by Alliance in the study districts.

Measures

Socio-demographic characteristics

The socio-demographic characteristics considered in the paper were obtained from single-item questions in the questionnaire. Responses were coded into two or three categories for analytical purposes. The variables and their coding included: age, education (any formal schooling=1, no formal schooling=0), marital status (currently married=1, not currently married=0), typology of sex work (brothel-based=1, home-based=2, public place-based=3) and duration of sex work. Any formal schooling was defined as the ability to both read and write.

Community collectivisation indicators

We sought to measure three distinct dimensions of collectivisation: collective efficacy, collective agency and collective action. These indicators were measured using a series of questions in the questionnaire that assessed the grouping of the community on issues that concern most or all sex workers.

Collective efficacy refers to FSWs' confidence in the power of the community to work together for positive change in the

interest of the community. We measured collective efficacy based on responses to the following four questions: How confident are you that FSWs in your community can work together to achieve the following goals: (1) keep each other safe from harm; (2) increase condom use with clients; (3) speak up for your rights and (4) improve your lives? Responses to these questions included: not at all (coded as 1), somewhat (coded as 2), very (coded as 3) and completely confident (coded as 4). Using these four questions and corresponding responses, an index was constructed, with the scale values ranging from 1 to 4, which had a reliability (Cronbach's α) of 0.796. The index score was divided into two equal categories of collective efficacy: low (1–2.4999) and high (2.5–4).

Collective agency refers to FSWs' ability to claim their rights and make others accountable for their rights. This was measured based on responses to the question: In the past 6 months, have you negotiated with or stood up to the following stakeholders (police, madam/broker, local goon (gang member) and clients or any other sexual partner) in order to help a fellow sex worker? A separate question for each of the above stakeholders was asked, with the possible binary response categories 'Yes' (coded as 1) and 'No' (coded as 0). Using these questions and corresponding responses, an index was constructed, with the scale values ranging from 0 to 1, which had a reliability (Cronbach's α) of 0.756. The index score was further divided into two equal categories of collective agency: low (0–0.4999) and high (0.5–1).

Collective action refers to the pursuit of a goal or set of goals by two or more individuals who work together. This was measured based on responses to the following six questions: Whether the sex workers group comes together to demand/help for the following: (1) voters' card, (2) bank account, (3) free education for children, (4) health insurance, (5) representation in government forums and (6) better government health services. Responses to these questions included 'Yes' (coded as 1) and 'No' (coded as 0). Using these six questions and corresponding responses, an index was constructed, with the scale values ranging from 0 to 1, which had a reliability (Cronbach's α) of 0.760. The index score was further divided into two equal categories of collective action: low (0–0.4999) and high (0.5–1).

The summary measure of collectivisation was based on responses to all the questions used for the above three dimensions of collectivisation. For questions with two possible answers (viz., yes, no), the responses 'No' were re-coded as '1' and the responses 'Yes' were re-coded as '2'. Questions with four possible answers were taken as they were (as described above). The scores varied from 1 to 2.533, which had a reliability (Cronbach's α) of 0.741. The index score was further divided into two equal categories of the summary measure of collectivisation: low (1–1.7599) and high (1.7600–2.533).

STI service delivery model

Based on areas where the survey was conducted, the survey questionnaires recorded the kind of STI service delivery model implemented by the programme. Areas where project has made partnership with government health facilities (PHCs and CHCs) for STI treatment were referred as government partnership (coded as 1), and rest were considered to have other models of STI service delivery (coded as 0). The other type of STI service delivery models used in the programme was the project-run STI clinic, managed either by the programme implementing agencies or in partnership with private healthcare practitioners.

Outcome indicators

We considered two binary outcome indicators: (1) self-efficacy for service utilisation from government health facilities and (2) STI treatment-seeking from government referral health facilities. Self-efficacy for service utilisation from government health facilities was measured based on responses to the following two questions: (1) How confident are you that you can go to the government health clinic to get the reproductive health services you need if the health workers there treat you badly and (2) How confident are you that you can go to the government health clinic to get reproductive health services even if the health worker knows that you are a sex worker? Responses to these questions included: not at all (coded as 1), somewhat (coded as 2), very (coded as 3) and completely confident (coded as 4). Using responses to the two questions, an index was constructed with the scale values ranging from 1 to 4, which had a reliability (Cronbach's α) of 0.834. The index score was further divided into two equal categories of self-efficacy for service utilisation from government health facilities: low (1–2.4999) and high (2.5–4).

For the outcome measure of STI treatment-seeking behaviour, two questions were asked. The first question assessed participants' experience of any of the following three STI symptoms at least once in the past 1 year: (1) genital sores/ulcers, (2) yellowish/greenish discharge from the vagina and (3) lower abdominal pain. All those who experienced STI symptoms were asked a question about the places they had visited for STI treatment. The multiple responses for this question included: government health facilities, STI clinic administered by the NGO, private clinics or hospitals, private pharmacies, self-medication and no treatment. A dummy variable measuring whether or not the respondent had sought STI treatment from government health facilities was derived. As respondents selected more than one answer for this question, those who reported seeking STI treatment from a government health facility at least once in the past year's experience of STI (irrespective of their visits to other places) were coded as 1, and the remaining were coded as 0.

Statistical analyses

Basic descriptive statistics (ie, proportions, means and SD) were presented to describe participants' socio-demographic characteristics, the strength of community collectivisation and the outcome indicators. Differences in proportions were tested using Z-test statistics, and differences in mean values were tested using t test statistics. The analyses first examined the independent association of community collectivisation indicators and partnership with government health facilities with outcome indicators by estimating adjusted ORs and their 95% CIs using multiple logistic regression models. Furthermore, to examine whether the effects of community collectivisation vary depending on the areas where the project had a partnership with government health facilities, data were grouped into four categories: (1) FSWs reporting a low level of collectivisation from areas with other STI service delivery models; (2) FSWs reporting a low level of collectivisation from areas with government partnerships; (3) FSWs with a high level of collectivisation from areas with other STI service delivery models and (4) FSWs with a high level of collectivisation from areas with government partnerships. In all multivariate analyses, we controlled for the socio-demographic characteristics considered in this paper. All analyses were conducted using STATA software (V.11.0).

RESULTS

FSWs' socio-demographic characteristics, community collectivisation, self-efficacy and treatment-seeking behaviour for STI

Of the 1986 FSWs interviewed, 1116 (56.2%) belonged to areas where STI services were delivered in partnership with government health facilities; the remaining 870 FSWs (43.8%) were from areas where STI services were provided by other STI service delivery models (table 1). The mean age of the participants was 29 years, nearly half (46.2%) had any formal schooling and close to three-fifths (57.1%) were currently married. About two-thirds (63.8%) solicited clients from public places such as streets, highways, parks and near cinema halls; the average duration of sex work was 4.4 years. About 90% reported a high degree of collective efficacy, and half (50.7%) reported a high degree of collective agency. Only 13% of FSWs reported participation in collective action. The proportion of FSWs reporting high community collectivisation was found to be greater in areas where the project was a partnership with a government health facility for STI treatment than those without such a partnership (collective efficacy: 92.0% vs 85.1%, $p<0.001$; collective agency: 56.5% vs 43.2%, $p<0.001$ and overall collectivisation 41.5% vs 37.5%, $p=0.042$).

Association between collectivisation, partnership with government health facilities and self-efficacy for service utilisation and STI treatment-seeking from government health facilities among FSWs

Multiple logistic regression results presented in table 2 suggest that the odds of self-efficacy for service utilisation were significantly higher for the group with a high degree compared with those with a low degree of collective efficacy (67.9% vs 35.2%, adjusted OR 3.8, 95% CI 2.8 to 5.1), those with a high degree compared with a low degree of collective agency (75.2% vs 53.0%, adjusted OR 2.8, 95% CI 2.3 to 3.4) and those with a high degree compared with a low degree of collective action (78.5% vs 62.2%, adjusted OR 2.5, 95% CI 1.8 to 3.5). Similarly, the odds of seeking STI treatment from government health facilities was higher for the group with a high degree of overall collectivisation (78.1% vs 63.2%, adjusted OR 2.1, 95% CI 1.6 to 2.8) compared with the group with a low degree of overall collectivisation. The self-efficacy for STI service utilisation from government health facilities was higher for those FSWs belonging to the areas where there was a project partnership with government health facilities than those belonging to areas without partnership (67.5% vs 60.1%, adjusted OR 1.4, 95% CI 1.2 to 1.7).

Combined association of collectivisation and partnership with government health facilities with self-efficacy for service utilisation and STI treatment-seeking from government health facilities among FSWs

The proportion of FSW with high self-efficacy for service utilisation varied significantly across the combinations of levels of collectivisation and service delivery models (table 3). Results suggest that the proportion of FSWs with high self-efficacy for service utilisation was low (54.0%) among those who reported a low level of overall collectivisation from areas where STI services were not delivered through government health facilities. Compared with this group, the percentage of FSWs with high self-efficacy for service utilisation was higher among those who reported low levels of overall collectivisation from areas with government partnership (59.9%, adjusted OR 1.3, 95% CI 1.0 to 1.6), who reported a high level of overall collectivisation from areas with other models of STI service delivery (70.3%, adjusted OR 2.1, 95% CI 1.6 to 2.9) and who reported a high level of overall collectivisation from areas with government partnerships (78.2%, adjusted OR 3.4, 95% CI 2.6 to 4.6). Similar results are noted for STI treatment at government health facilities, according to degree and type of collectivisation and project partnership with government health facilities.

Table 1 Socio-demographic characteristics, indicators of community collectivisation, experience of STIs and STI treatment-seeking behaviour by the project partnership with government health system among female sex workers in five districts of Andhra Pradesh, India

Socio-demographic characteristics	Total sample (N=1986) n (%)	Project partnership with government health facilities		
		Yes (n=1116) n (%)	No (n=870) n (%)	p Value*
Demographic characteristics				
Age (years), mean (SD)	29.2 (5.3)	29.1 (5.1)	29.3 (5.5)	0.533
Any formal schooling	917 (46.2)	512 (45.9)	405 (46.6)	0.765
Currently married	1134 (57.1)	665 (59.6)	469 (53.9)	0.011
Typology of sex work				
Homes	566 (28.5)	358 (32.1)	208 (23.9)	<0.001
Public places (streets, highways, parks)	1267 (63.8)	711 (63.7)	556 (63.9)	0.927
Brothels or lodges	153 (7.7)	47 (4.2)	106 (12.2)	<0.001
Mean duration of sex work (SD)	4.4 (2.4)	4.3 (2.4)	4.5 (2.5)	0.086
Indicators of community collectivisation				
Collective efficacy: high	1768 (89.0)	1027 (92.0)	741 (85.1)	<0.001
Collective agency: high	1006 (50.7)	630 (56.5)	376 (43.2)	<0.001
Collective action: high	253 (12.7)	156 (14.0)	97 (11.1)	0.054
Overall: high†	785 (39.5)	463 (41.5)	322 (37.0)	0.042
Self-efficacy for service utilisation	1276 (64.3)	753 (67.5)	523 (60.1)	0.001
Any STI symptoms, past 1 year	1014 (51.1)	544 (48.4)	470 (54.0)	0.021
Taken treatment from government health facilities‡	708 (69.8)	389 (71.5)	319 (67.8)	0.199

*p Values are obtained by testing the significance of differences in percentages (Z-test) and mean values (t test) between the groups.
†Refers to the summary measure of collectivisation.
‡Among those who reported at least one of the following STI symptoms in the past 1 year: (1) genital sores/ulcers, (2) yellowish/greenish discharge from the vagina and (3) lower abdominal pain.
STI, sexually transmitted infections; SD, Standard deviation

Table 2 Multiple logistic regression analyses assessing the associations between indicators of collectivisation, partnership with government health facilities and self-efficacy for service utilisation and STI treatment from government health facilities among female sex workers in Andhra Pradesh, India

Collectivisation and service delivery model	Self-efficacy for service utilisation from government health facilities			STI treatment from government health facilities		
	N	n (%)	Adjusted OR* (95% CI)	N	n (%)	Adjusted OR* (95% CI)
Collective efficacy						
Low	218	77 (35.2)	Referent	61	25 (41.4)	Referent
High	1768	1201 (67.9)	3.8 (2.8 to 5.1)	953	682 (71.6)	4.0 (2.3 to 6.7)
Collective agency						
Low	980	519 (53.0)	Referent	457	295 (64.5)	Referent
High	1006	757 (75.2)	2.8 (2.3 to 3.4)	557	413 (74.1)	1.7 (1.3 to 2.3)
Collective action						
Low	1733	1078 (62.2)	Referent	857	582 (67.9)	Referent
High	253	199 (78.5)	2.5 (1.8 to 3.5)	157	126 (80.2)	2.0 (1.3 to 3.0)
Summary measure of collectivisation						
Low	1201	688 (57.3)	Referent	569	360 (63.2)	Referent
High	785	589 (75.0)	2.5 (2.0 to 3.1)	445	348 (78.1)	2.1 (1.6 to 2.8)
Project partnership with government health facilities for STI treatment						
No	870	523 (60.1)	Referent	470	319 (67.8)	Referent
Yes	1116	753 (67.5)	1.4 (1.2 to 1.7)	544	389 (71.5)	1.2 (0.9 to 1.6)

*ORs were adjusted for following background characteristics: current age (entered as continuous variable), any formal schooling (no, yes) marital status (currently married, not currently married), typology of sex work (home-based, street-based, brothel-based) and duration of sex work (entered as continuous variable) using logistic regression.
STI, sexually transmitted infections.

DISCUSSION

Our findings show that FSWs who reported high collectivisation are significantly more likely than those who reported low levels of collectivisation to access STI treatment from government health facilities. These associations are not just a consequence of the presence of partnerships with government facilities for STI treatment, or of socio-demographic vulnerabilities, as the data suggest that FSWs from areas without partnerships with government health facilities also reported high attendance in government centres for STI treatment. Research is needed to explore why STI service utilisation from government health facilities is higher among FSWs who report or perceive higher levels of collectivisation than others. Previous evidence that a high degree of collectivisation and collective identity among FSWs lead to increased condom use and HIV risk reduction[12 13 15 22–24 26] may be interpreted to suggest that

Table 3 Multiple logistic regression analyses to assess the combined association of collectivisation indicators and partnership with government health facilities on self-efficacy for service utilisation and STI treatment from government health facilities among FSWs in Andhra Pradesh, India

Levels of collectivisation by partnership with government health facilities for STI treatment	Self-efficacy for service utilisation from government health facilities			STI treatment from government health facilities		
	N	n (%)	Adjusted OR* (95% CI)	N	n (%)	Adjusted OR* (95% CI)
Collective efficacy×Project partnership with government health facilities for STI treatment						
Low×No	130	39 (29.8)	Referent	38	14 (36.2)	Referent
Low×Yes	89	39 (43.3)	1.9 (1.1 to 3.3)	24	12 (49.7)	2.1 (0.7 to 6.2)
High×No	741	485 (65.4)	4.4 (2.9 to 6.6)	432	305 (70.5)	5.1 (2.5 to 10.6)
High×Yes	1027	715 (69.6)	5.5 (3.7 to 8.4)	521	378 (72.5)	5.8 (2.8 to 11.9)
Collective agency×Project partnership with government health facilities for STI treatment						
Low×No	494	252 (51.1)	Referent	238	142 (59.8)	Referent
Low×Yes	486	267 (55.0)	1.1 (0.9 to 1.5)	219	154 (70.3)	1.6 (1.1 to 2.4)
High×No	376	270 (71.9)	2.5 (1.8 to 3.3)	232	178 (76.6)	2.3 (1.5 to 3.5)
High×Yes	630	486 (77.2)	3.3 (2.6 to 4.4)	326	236 (72.3)	1.8 (1.3 to 2.6)
Collective action×Project partnership with government health facilities for STI treatment						
Low×No	773	450 (58.2)	Referent	399	264 (66.2)	Referent
Low×Yes	960	628 (65.4)	1.4 (1.1 to 1.7)	458	317 (69.3)	1.2 (0.9 to 1.6)
High×No	97	73 (75.2)	2.5 (1.5 to 4.1)	71	55 (76.8)	1.8 (1.0 to 3.2)
High×Yes	156	126 (80.5)	3.5 (2.3 to 5.4)	87	72 (83.1)	2.5 (1.4 to 4.7)
Overall collectivisation×Project partnership with government health facilities for STI treatment						
Low×No	548	296 (54.0)	Referent	265	155 (58.5)	Referent
Low×Yes	653	391 (59.9)	1.3 (1.0 to 1.6)	303	204 (67.4)	1.5 (1.1 to 2.1)
High×No	322	226 (70.3)	2.1 (1.6 to 2.9)	204	163 (79.9)	2.9 (1.9 to 4.4)
High×Yes	463	362 (78.2)	3.4 (2.6 to 4.6)	241	185 (76.6)	2.3 (1.6 to 3.4)

'Low' and 'High' refer to the levels of corresponding index for collectivisation. The combination of dummy for STI service partnership with government primary healthcare system and levels of collectivisation represent FSWs with a low (or high) level of collectivisation from areas where intervention collaborated (or did not collaborated) with government primary healthcare facilities to deliver STI services.
*ORs were adjusted for following background characteristics: current age (entered as continuous variable), any formal schooling (no, yes) marital status (currently married, not currently married), typology of sex work (home-based, street-based, brothel-based) and duration of sex work (entered as continuous variable) using logistic regression.
FSWs, female sex workers; STI, sexually transmitted infections.

Research report

FSWs have the ability and confidence to exercise their rights as citizens within the public health system, irrespective of health workers knowing their status. The current findings suggest that collectivisation in the presence of partnerships with government health facilities increases the rate of STI service utilisation from government centres more than if interventions focus only on collectivisation or only on improving the provision of STI services.

Notably, current findings are consistent with previous research documenting significant associations between collectivisation or indicators of community mobilisation and reduced sexual risk behaviours and HIV.[13 15 22–26] Thus, the current research findings and previous evidence indicate that community collectivisation is a good strategy for changing health and treatment-seeking behaviour among FSWs populations in HIV prevention interventions. Such interventions could include strategies for creating an enabling environment that is safe for sex workers,[17 18 30 31] ensuring consistent condom use with all types of partners[22–24 32] and promoting STI treatment-seeking behaviour from government-supported STI treatment centres.[4 25 31] Hence, efforts to mobilise and build the capacity of sex workers and their communities are likely to improve their health and could be mainstreamed within targeted interventions supported by the National AIDS Control Programme.[4]

We found that although large proportions of FSWs reported high collective efficacy and collective agency, relatively few reported high collective action. However, the post hoc analyses suggest that about 38% of FSWs reported that the sex workers group had come together to demand or help FSWs to access at least one of the six entitlements. This result suggests that a greater proportion of sex workers reported group coming together for one or the other type of entitlements; however, higher degree at which they participate in such activities seems to be lower in this study population.

Although our findings offer important insights into the relationship between community collectivisation, the provision of STI services in government facilities and their effect on the self-efficacy of FSWs to use STI services from government health facilities in India, they must be interpreted in the light of certain study limitations. Most of the input indicators and outcomes were based on self- reports, which are vulnerable to social desirability and recall biases. Analyses are cross-sectional, and causality cannot be assumed; however, community collectivisation is an event that occurred over a period of time and much likely before the assessed outcomes; therefore, ordering of this exposure relative to self-efficacy for service utilisation can be assumed. Biases were also introduced into the study due to the nature of the sample. The samples drawn for the current study were from areas where the community mobilisation intervention was implemented. Although there are areas that were clearly identified by sites where the project has partnered with government health facilities, the mobile nature of sex workers may have disturbed the clear control subjects from that perspective. More importantly, government health facilities in the districts where the survey was undertaken also provide treatment for STI, irrespective of project partnership; however, the quality of services and the availability of skilled doctors and colour-coded kits for STI treatment are concerns in these facilities.

An additional issue concerns the measurement of community collectivisation. Researchers both in India and in abroad have measured community mobilisation in multiple ways, such as collective identity,[33–35] structural intervention[36] or social policy and community participation.[37 38] In view of this, the measures used in the current paper may have some validation issues in settings other than sex work that measure community mobilisation. However, the results of our study are similar to many studies that focus on community mobilisation, whether within the HIV setting or the development sector, which points to the advantages associated with such efforts. Lessons learnt from our research and previous evidence suggest that community collectivisation works as a mechanism to popularise and build a demand for quality services at the ground level.

In conclusion, the current study documents that, irrespective of project partnerships with government health facilities for STI treatment, the degree of community collectivisation is predictive of self-efficacy and STI service utilisation from government health facilities. The results presented in this paper offer some support to the growing evidence of the effects of community collectivisation on HIV/STI risk reduction and highlight the need for programmes to provide ongoing support to communities to sustain the efforts that are built by programmes. Findings also reveal the need for targeted HIV interventions to focus on areas/sites where sex workers' perceive less collectivisation in order to increase their ability to access treatment from government health facilities. This work will be particularly important in rural areas, where FSWs are dispersed across a wide geography and where limited service delivery mechanisms exist.

What is already known on this subject

- Community mobilisation has an important influence on the lives of FSWs populations.
- Studies indicate that community mobilisation has an impact on HIV-related outcomes.
- Promotion of STI treatment from government-run health centres is a challenge.
- Health services, including STI treatment for FSW from government-run health centres, have several advantages as a long-term goal to achieve universal coverage in the control and management of STIs.

What this study adds

- Self-efficacy for health service utilisation from government health centres (irrespective of special efforts to enhance the services within government centres) was strongly linked with the degree of community collectivisation.
- STI treatment from government health centres (irrespective of project partnership with government services) was strongly linked with the degree of community collectivisation.
- In the presence of both project partnerships with government health centres with enhanced provision of services and a high degree of collectivisation, service utilisation outcome indicators improve, even after controlling for socio-demographic characteristics.

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design of the study and assisted with interpretation of study findings. NS provided overall guidance with analytical approach, manuscript writing and interpretation of study findings. All authors read and approved the final manuscript.

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Other program interventions

Other program interventions

- Intervention programs to improve truckers' safe sex behaviors should be continued with the same intensity; however, efforts are needed to increase program coverage in this high-risk group. An evaluation study indicates that once exposed to an intensive program, truckers are likely to adopt safe sex behaviors (Pandey et al., 2011).

Structural interventions continue to be an important focus in India's HIV prevention program. Efforts to reach long-distance truckers and other vulnerable groups need a structural focus.

- Programs for truckers need to incorporate mid-media activities to increase awareness of HIV, and set up accessible clinics for counseling and treatment. As the evidence shows, a combination of mid-media events and provision of treatment services has resulted in increased condom use among long-distance truckers (Juneja et al., 2013).
- To increase coverage and promote the optimum utilization of services, HIV prevention programs for mobile populations, such as truckers and migrants, need to be implemented in limited high-impact locations, supported by branded and standardized services. An evaluation of an intervention for truckers indicates that providing conveniently located, uniformly branded and standardized services, with a mix of communication activities, results in effective program coverage and service utilization (Rao et al., 2013).
- Efforts are required to sustain/increase opportunities for injecting drug users to access program services; particular focus is needed to promote HIV testing and to target the risk of sexual transmission of HIV and sexually transmitted infections among high-risk drug users, and increase awareness of the risk of hepatitis C transmission associated with unsafe injection practices. A recent evaluation indicates that drug users who have been using HIV prevention services are more likely than others to engage in safe injecting and sexual practices (Armstrong et al., 2011).

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REVIEW Open Access

Heading towards the Safer Highways: an assessment of the Avahan prevention programme among long distance truck drivers in India

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Abstract

Background: Using data from two rounds of a cross-sectional, national-level survey of long-distance truck drivers, this paper examines the extent and trend of sexual risk behavior, prevalence of STI/HIV, and the linkage between exposure to HIV prevention programs and safe sex behavior.

Methods: Following the time location cluster sampling approach, major transshipment locations covering the bulk of India's transport volume along four routes, North-East (NE), North-South (NS), North-West (NW) and South-East (SE) were surveyed. First round of the survey was conducted in 2007 (sample size 2066) whereas the second round was undertaken in 2009-2010 (sample size 2085). Long distance truck drivers were interviewed about their sexual behaviors, condom use practices, exposure to different HIV prevention interventions, and tested for HIV, reactive syphilis serology, *Neiserria gonorrhoeae* and *Chlamydia trachomatis*. The key variable of this evaluation study - exposure to HIV prevention interventions was divided into three categories - no exposure, less intensive exposure and intensive exposure. Data were analyzed using multiple logistic regression methods to understand the relationship between risk behavior and exposure to intervention and between program exposure and condom use.

Results: The proportion of truckers exposed to HIV prevention interventions has increased over time with much significant increase in the intensive exposure across all the four routes (NE: from 14.9% to 28%, $P < 0.01$; NS: from 20.9% to 38.1%; NW: 11.5% to 39.5%, $P < 0.01$; SE: 4.7% to 9.7%, $P < 0.05$). Overall, the consistent condom use in sex with non-regular female partners too has increased over the time (paid female partners: from 67.1% to 73.2%, $P < 0.05$; non-paid female partners: from 17.9% to 37.1%, $P < 0.05$). At the aggregate level, the proportion tested HIV positive has declined from 3.2% to 2.5% in ($p<0.10$) and proportion tested positive for Syphilis too has reduced from 3.2% to 1.7% ($p<0.05$). Truckers who had sex with paid female partners (men at risk) were significantly more likely to get exposed to intensive program (aOR: 2.6, 95%CI 1.9-3.4) as compared to those who did not have sex with paid partners. Truckers who had sex with paid partners and exposed to intervention program were more likely to use condoms consistently (aOR: 2.1, 95% CI 1.2-3.7). The consistent condom use among respondents who travel through states with targeted interventions towards female sex workers was higher than those who travel through states with less intensive program among FSWs.

Conclusions: These evaluation study results highlight the ability of intensive program to reach truckers who have sex outside marriage with HIV prevention interventions and promote safe sex behaviors among them. Truckers who practice safe sex behaviors with an exposure to intensive program are less likely to suffer from STIs and HIV, which has implications for HIV prevention program with truckers' population in India and elsewhere. The

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simultaneous targeted interventions among female sex workers appeared to have contributed to safe sexual practices among truckers.

Introduction

India trucking population is estimated at five to six million truck drivers and helpers, with about two to two and half million being long-distance truckers [1]. The Indian long-distance trucking industry consists of three different segments: free agents, port operators, and express cargo operators. Truckers tend to specialize in any one of these segments, primarily because it is difficult to build business networks in more than one segment. The free agent segment which accounts for approximately 70 percent of the long-distance truckers, is fragmented with a vast majority working for small transport operators [2]. In the late 1990s, almost 77% of India's truck fleet was owned by operators with no more than five trucks, while only about 6% of trucks were owned by operators with more than 20 trucks [3]. This ownership profile created middlemen (transporters and brokers) on whom small trucking operators depend to generate business. This structure of the Indian trucking industry has diluted the visibility of the industry to transport planners and policy-makers [4,5].

Truck drivers and their helpers, particularly those who travel on highways for longer distances, have been associated with the spread of sexually transmitted infections including HIV in many parts of the world including India [6-18]. Long distance truckers are considered to be particularly vulnerable to STIs and HIV infection because they spend many days away from their families in contrast to short-distance, state-level truckers [7,18]. Earlier reports demonstrated that in spite of high rates of STI prevalence of HIV remained lower in long distance truck drivers [19,20]. However, because of high-risk behavior coupled with their mobility these long distance truckers are said to have potential of spreading HIV to different geographical areas [1,7,9]. For these reasons, truckers have been key target populations in the Indian national response since 1996 under National AIDS Control Program II and III. The three major components of the target interventions among truckers are- (1) Behavioral Change Communication (2) Condom promotion activity through social marketing and free distribution of condoms, and (3) Treatment of sexually transmitted infections (STIs) [21,22]. Given that HIV programs in India are implemented at the state level through State AIDS Control Societies, state-level truckers were routinely covered under Targeted Interventions funded by the National AIDS Control Organization. However, long distance truckers who worked on the national highways were not targeted specifically in these interventions [23,24].

In 2003, Avahan, the India AIDS Initiative was started in India with the aim to slow down the HIV epidemic through focused, integrated, large-scale prevention programs providing saturated coverage to high risk populations including female sex workers (FSW), men who have sex with men, transgenders, injecting drug users in the six high prevalence states in India. Potential clients of FSWs were also targeted through interventions at sex worker solicitation areas ("hot-spots") along with long distance truck drivers (LDTD) [24,25]. The Avahan intervention with LDTD began in 2004. To enhance accessibility of clinical services to truckers *Khushi* (meaning 'happiness' in Hindi/Urdu) clinics were established at 36 truck halt points. This intervention was redesigned in 2006 by halving the numbers of implementation sites from 36 to 17 focusing on the major truck halt points in nine Indian States. It was revamped to take advantage of the structure of the Indian trucking industry with middlemen where truckers spend time between shipments. It recruited peer educators, increased the emphasis on professional media expertise in mid-media and mass media events, improved signage and satellite clinical services at the halt points. More details about the interventions can be found elsewhere [2,25].

A component of the evaluation design of the Avahan intervention includes two rounds of large scale cross-sectional surveys of long distance truck drivers with both a behavioral and biological component [26]. The two rounds of the surveys are known as Integrated Behavioral and Biological Assessment (IBBA) on national highways. This paper presents an analysis of both rounds of IBBA on national highways to assess whether highways have become 'safer' in terms of risk of HIV transmission among truckers. By safer highways we mean increase in exposure to HIV prevention interventions and consistent condom use with non regular female sexual partners along with reduction in sexually transmitted infections (STI) including HIV among truckers. As the IBBA on national highways was conducted only among long distance truck drivers, the term trucker in this paper stands for long distance truck drivers (and not the helpers).

Data and methods

The first round of IBBA on national highways was conducted in 2007 at seven transshipment locations (TSL) covering the bulk of India's transport volume along four routes, North-East (NE), North-South (NS), North-West

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(NW) and South-East (SE). TSL were the places where the transporters and brokers operate by linking truckers with individuals wanting their goods to be transported and the route categories were the road corridors traveled by LDTD. Following TSL were considered as survey sites- Sanjay Gandhi Transport Nagar, New Delhi; Ghaziabad Transport Nagar, Ghaziabad; Kalamboli, Mumbai; Narol Chowkdi, Ahmedabad; Gandhidham, Kandla; Neelamangala, Bangalore and Territy bazar, Kolkata. The first survey round covered a total of 2,066 long distance truck drivers (NE- 498; NS- 540; NW- 515; SE- 513) with an overall participation rate of 97% (NE- 97%; NS- 96%; NW- 98% and SE- 98%). Results from the first round of survey are available [17].

The second round of the survey was conducted in 2009-10 at same TSL except for that in Kandla along the four aforesaid routes. The main reason behind excluding TSL at Kandla was less availability of long distance truck drivers. The TSL and route categories covered in both rounds are shown in Figure 1. Identical survey design and methodology as described below were adopted in both survey rounds.

Methods

A sample size of 500 long-distance truck drivers was used for each route. A two-stage time-location cluster sampling approach was used to select the respondents. Behavioral data were collected by face to face interview using a pre-tested, pre-coded questionnaire translated into local languages by native speakers. It collected information on demographics, work, mobility, sexual behavior, history and symptoms of STI, knowledge of HIV and its prevention and exposure to HIV prevention interventions supported by Avahan and other agencies.

Blood and urine samples were collected from all participating truckers. Anticubital venipunctured blood sample (5ml) collected in a vacutainer was allowed to clot for separation of serum and was stored at 2° to 8°C. From each participant 30 ml urine sample was collected and from this 2 ml quantity only was stored in a urine specimen transport tube as per the protocol of M/s Gen –Probe Aptima Combo 2 Assay (Gen-Probe Incorporated, USA). Sera were tested for both HIV-1 and HIV-2 by Microlisa HIV kit (J. Mitra & Co. Pvt Ltd, India and GENEDIA HIV ½ ELISA 3.0 Kit, Gencross Life Science Corporation, Korea). Syphilis reactive serology was performed by Rapid Plasma Reagin Test Kit (Span Diagnostics Ltd, India) and was confirmed by *Teponema pallidum* hemagglutination assay (TPHA) using Syphagen TPHA Kit). All cases with RPR reactive serology of any titer with TPHA positivity were considered positive. For the diagnosis of *Neisseria gonorrhoeae* and *Chlamydia trachomatis*, urine samples were tested using Transcription- Mediated Amplification Assay and Dual Kinetic Assay (Gen-Probe Incorporated, USA). About 10 percent of serum samples were screened for herpes

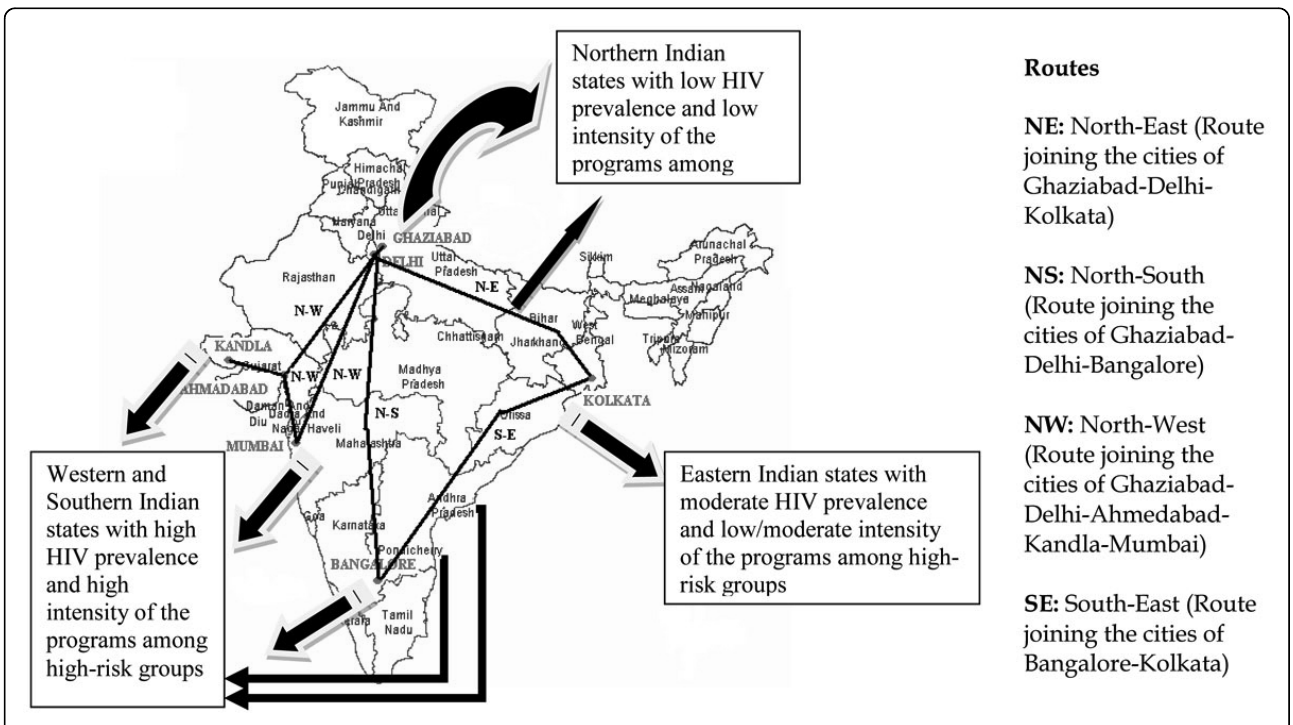

Figure 1 Route Corridors Covered by Avahan Intervention Sampled in IBBA on National Highways

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simplex virus type 2 using HerpeSelect 2 ELISA IgG Kit (FOCUS Technologies, USA).

The study was approved by all relevant institutional review boards (Health Ministry Screening Committee, Government of India, Scientific Advisory Committee of National AIDS Research Institute, Protection of Human Subjects Committee of Family Health International and Scientific Advisory Committee and Ethical Committee of National Institute of Medical Statistics). Participation followed written informed consent and all data were recorded in a linked anonymous manner using numerically coded cards. Clinics run by the Transport Corporation of India Foundation at highway locations were used to enable participants to obtain syphilis test results and treatment upon presentation of the numerically coded cards. More information about the survey methodology can be found elsewhere [17,26,27].

Measures

Programme exposure

Based on information from truckers on their awareness of HIV prevention interventions and utilization of services from Avahan or non-Avahan interventions three categories of program exposure were created: no program exposure if they never heard of any HIV prevention intervention along their route; less intensive exposure if they heard of HIV prevention intervention but either did not utilize its services in past 12 months, or received services only from non-Avahan interventions; intensive exposure if they received any of the following services either from Avahan or from both Avahan and non-Avahan at least once in past 12 months- contacts by peer educators/ out-reach workers, receipt of condoms from peer educator or outreach worker, visit to Khushi clinics, counseling services on HIV/AIDS, , participation in any community meeting or events (such as street plays, health games, truckers' festival) organized by Khushi clinic. By non-Avahan interventions we mean all interventions which are being implemented by agencies other than Avahan. Our definition of classifying interventions under Avahan as being more intensive than interventions under other program is consistent with that provided elsewhere [25,28].

Sexual behaviors

Two types of non-regular female sexual partners were defined- paid female partners (PFP) and non-paid female partners (NPFP). The paid female partner was defined as women whom the respondent had paid cash in exchange for having sex in past 12 months. A non-paid female partner was defined as women with whom the responded had sex but was not marred to and did not pay cash in exchange for sex in past 12 months. These variables were derived based on the single questions asked in the questionnaire. Age at first paid sex was defined as age of the respondent at first paid sex and was also derived based on a single question asked in the questionnaire.

Consistent condom use

Consistent condom use with both paid and non-paid female sex partners was the primary outcome variable measuring HIV-related risk behaviour. The consistent condom use with a given sexual partner was defined as use of condom in every sexual encounter with that particular partner in past 12 months.

Socio-demographic and work related characteristics

The socio-demographic characteristics include their age (in completed years), literacy (the ability to both read and write) and marital status (currently married verses not). The work related characteristics are route category on which the respondent usually travels, years of working as a driver, number of round trips between main cities of operation in past six months and ownership of trucks by respondent (yes verses no). These variables were derived based on single questions asked in the questionnaire.

These abovementioned socio-demographic and work related characteristics along with variable measuring age at first paid sex were controlled in all multivariate analyses done in the paper.

Prevalence of STI/HIV

Prevalence of following four STIs is given- Syphilis, *N. gonorrhoeae* and *C. trachomatis* and HIV. By Syphilis, we mean active Syphilis infection. Any STI was defined as presence of at least one of the four above said STIs. As HSV-2 was tested only among 10% of the subsample, it has not been considered for the analysis. A respondent was termed as HIV positive if he was found positive either for HIV-1 or HIV-2 or both.

Statistical techniques

For both rounds of the survey two sets of sampling weights were computed; one route specific for getting route-wise estimates and the other was overall weights for combined dataset. By combined dataset we mean data obtained by combining route-specific data. Statistical software Stata (version 11) was used for statistical analysis.

We have done route-wise analysis using data from both rounds of the survey to provide estimates related to socio-demographic and work related characteristics, program exposure, sexual behavior and prevalence of STI/HIV at two points of time. Differences in the mean values between the survey rounds were tested using the

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t-test while differences in the percentages were tested using z-test statistic. To examine the association of program exposure with risk behavior we have used data from second round only. It has been done because the first round was considered as proxy for the baseline [17]. Moreover, the interventions (particularly those belonging to Avahan) were in place for substantial duration in 2009-10 when second round of the survey was undertaken.

Cross-tabulations were made to examine the association between having sex with non-regular female partners and program exposure. Differences between the categories were tested using Chi-square test. A multivariate multinomial logistic regression analysis with program exposure as dependent variable was done to examine this association after adjusting for the control variables. Similarly, to examine the associations between program exposure and consistent condom use with non-regular partners, cross-tabulations were made followed by two multivariate logistic regressions with following two outcome variables- (1) consistent condom use with paid female partners in past 12 months (ii) consistent condom use with non-paid female partners in past 12 months. While the bi-variate analyses were carried out separately for each route the multivariate analysis were restricted to combined data only.

Results

In second round of the IBBA on national highways, a total of 2085 truckers for whom both behavioral and biological data were available were used for analysis (NE- 524; NS- 538; NW- 526; SE- 497). The overall participation rate in second round of the survey was 77% (NE- 76%; NS- 74%; NW- 85% and SE- 71%).

Background characteristics

Table 1 depicts the background characteristics and reported program exposure at two points of time among long distance truck drivers who travel on the four routes. The mean ages of respondents at the aggregate level as well as in NE and NW route were significantly increased between the two survey rounds. Literacy was increased across all the four routes and the differences were significant in NE, NS and SE route. Percentage of drivers who own the truck was significantly reduced on NE (from 8.9% to 4.8%, P <0.05) and NS (from 17.1% to 2.4%, P <0.05) routes between the two rounds. No significant differences were observed in the marital status of the respondents and average number of years of working as drivers. The average number of round trips between main cities of operation in past six months remained almost constant over time except for NW route where it declined significantly from 13.4 to 11.2 (P<0.05).

Trends in exposure to intensive HIV prevention program

Overall, the percentage of respondents with no program exposure declined between two survey rounds. This percentage remained almost same for NE and NS route whereas it decreased significantly on NW route (from

Table 1 Background Characteristics and Reported Exposure to Interventions among Long Distance Truck Drivers Round-1 and Round-2 of the IBBA on National Highways

Background characteristics	All Routes		North-East (NE)		North-South (NS)		North-West (NW)		South-East (SE)	
	Round-1 (N= 2066)	Round-2 (N= 2085)	Round-1 (N= 498)	Round-2 (N= 524)	Round-1 (N= 540)	Round-2 (N= 538)	Round-1 (N= 515)	Round-2 (N= 526)	Round-1 (N= 513)	Round-2 (N= 497)
Average Age	31.1	33.5***	31.8	33.4*	31.4	31.8	30.1	32.4**	33.9	35.0
Percent literates	87.6	94.1**	83.3	89.7*	90.8	97.5**	88.5	89.6	87.3	94.6**
Percent Currently married	73.5	74.3	75.2	74.2	74.9	71.2	72.0	73.6	82.3	84.0
Average number of years of working as a driver	8.9	9.4	9.7	9.7	9.3	9.9	8.0	8.5	10.7	11.1
Average number of round trips in past six months[a]	11.9	11.2	11.4	11.1	10.1	10.1	13.4	11.2**	12.4	12.7
Percent who own truck	14.2	9.0***	8.9	4.8**	13.9	13.5	17.1	2.4**	13.1	11.2
Exposure to interventions (%)										
No	49.8	45.0**	44.4	48.9	36.7	42.8	61.0	36.4***	34.7	62.7***
Less intensive	36.1	25.4***	40.7	23.1***	42.4	19.2	27.5	24.1	60.2	27.6***
Intensive	14.1	29.6***	14.9	28.0***	20.9	38.1**	11.5	39.5***	4.7	9.7**

* P< 0.10; ** P< 0.05; *** P <0.01

Differences between the mean values were tested using t-test whereas the differences between percentages were tested using Z-test statistic.

Averages refer to the mean values.

Literacy refers to the ability of both read and write.

[a] Between main cities of operation.

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61.0% to 36.4%; P < 0.01) and increased significantly on SE route (from 34.7% to 62.7%; P<0.01). The intensive program coverage was significantly increased across all the four routes between the two rounds of survey (NE: from 14.9% to 28.0%, P<0.01; NS: from 20.9% to 38.1%, P<0.05; NW: from 11.5% to 39.5%, P<0.01; SE: from 4.7% to 9.7%, P<0.05). On the other hand, less intensive exposure was declined significantly on NE and SE routes and remained at constant level in the remaining two routes.

Trend in risk behavior and STI/HIV prevalence

Table 2 provides the trend in risk behavior and STI/HIV prevalence among respondents. In both survey rounds about one-quarter to one-third of the long distance truck drivers on the NE, NS and NW routes reported having had sex with a paid female partner. In contrast, the percentage of reported sex with paid female partners dropped significantly on SE route, from 44% to 14% (P <0.05). Overall, there was a significant increase in the mean age at first paid sex between two rounds. These were significantly increased over time on NW and NS routes respectively. A significant increase in reported consistent condom use with paid female partners was noticed in NW (from 60.5 to 75.8%; P <0.05) and SE route (from 63.8 to 87.5%; P <0.05). The proportion of long distance truck drivers who reported visiting non-paid female partners in the past one year was significantly increased in NE and NW routes whereas it remained at almost same level in other routes. A significantly higher consistent condom use with non-paid female partners was reported in three out of four routes- NS (from 20.4% to 49.1%, P<0.05), NW (from 15.3% to 32.6%, P <0.10) and SE (from 14.0% to 31.6%, P <0.10).

Overall, the Syphilis prevalence was declined among long distance truck drivers from 3.2% to 1.7% (P<0.05). This decline was visible in three out of four routes- NS (from 3.2 to 1.3%; P <0.10), NW (from 3.0 to 1.3%; P <0.10) and SE (from 1.2 to 0.2%; P <0.05). *N. gonorrhoeae* and *C. trachomatis* remained at low constant level over time. At the aggregate level, a decline in the HIV prevalence from 3.5 to 2.5% (P< 0.10) was noticed among long distance truck drivers between two survey rounds. The same was true for NW (from 3.8 to 1.9%; P <0.10) and SE (from 6.8 to 3.3%; P <0.10) route where HIV decline was noticeable. A significant decline in the prevalence of any STI (from 6.9 to 4.7%; P < 0.05) was observed at aggregate level. The same trend was observed in three of the four routes- NS (from 6.1 to 3.7%; P <0.10); NW (from 6.5 to 3.8%; P <0.10) and SE (from 8.2 to 4.3%, P <0.05).

Table 2 Trend in Sexual Behavior and STI/ HIV Prevalence among Long Distance Truck Drivers between Round-1 and Round-2 of the IBBA on National Highways

	All Routes		North-East (NE)		North-South (NS)		North-West (NW)		South-East (SE)	
Sexual Behavior	**Round-1**	**Round-2**	**Round-1**	**Round-2**	**Round-1**	**Round-2**	**Round-1**	**Round-2**	**Round-1**	**Round-2**
Had sex with PFP in past one year	31.0	24.3**	24.8	25.6	30.3	28.9	29.1	28.6	43.7	13.9***
(N)	(2066)	(2085)	(498)	(524)	(540)	(538)	(515)	(526)	(513)	(497)
Mean age at first paid sex	21.0	22.3**	21.4	22.4	20.6	22.1***	21.5	22.9*	20.9	21.7
(N)	(640)	(507)	(124)	(134)	(164)	(155)	(150)	(149)	(224)	(69)
Consistent condom use with PFP in past one year	67.1	74.6**	68.5	64.5	71.4	75.6	60.5	75.8**	63.8	87.5**
(N)	(640)	(507)	(124)	(134)	(164)	(155)	(150)	(149)	(224)	(69)
Had sex with NPFP in past one year	20.4	19.6	17.8	23.2*	21.6	17.1	21.7	34.1**	20.9	15.3
(N)	(2066)	(2085)	(498)	(524)	(540)	(538)	(515)	(526)	(513)	(497)
Consistent condom use with NPFP in past one year	17.9	37.1**	18.9	33.7	20.4	49.1**	15.3	32.6*	14.0	31.6*
(N)	(421)	(423)	(89)	(122)	(117)	(92)	(112)	(179)	(107)	(76)
STI/HIV										
(N)										
Syphilis	3.2	1.7**	3.7	3.7	3.2	1.3*	3.0	1.3*	1.2	0.2*
N. Gonorrhoeae^	0.3	0.1	0.3	0.3	0.7	0.0	0.0	0.0	0.0	0.0
C. Trachomatis^	0.3	0.7	0.9	0.7	0.0	0.6	0.0	0.7	0.6	0.9
HIV	3.5	2.5*	3.1	2.5	2.4	2.2	3.8	1.9*	6.8	3.3*
Any STI	6.9	4.7**	7.6	6.9	6.1	3.7*	6.5	3.8*	8.2	4.3**

* P< 0.10; ** P< 0.05; *** P <0.01

Differences between the mean values were tested using t-test whereas the differences between percentages were tested using Z-test statistic.

PFP: Paid female partner; NPFP: Non-paid female partner

^Statistical tests were not applied for because of low prevalence.

Any STI refers to presence of at least one of the four STIs- Syphilis, N. Gonorrhoeae, C. Trachomatis and HIV.

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Association between sex with non-regular female partners and program exposure

Table 3 describes the bi-variate association between having sex with paid and non-paid female partners and program exposure. The program exposure was positively associated with having sex with paid female partners in past 12 months across all the four routes. These associations were statistically significant in NE and NW routes as well as at aggregate level. Similarly, program exposure was positively linked with having sex with non-paid female partners in past 12 months. However, the association could reach at statistical significance only in NW route.

Results from multinomial logistic regression confirmed these bi-variate associations of having sex with paid female partners (Table 4) and non-paid female partners (Table 5). Table 4 depicts that those who had sex with paid female partners in past 12 months were significantly more likely to have either less intensive (aRRR = 2.5, 95%CI 1.9 – 3.5) or intensive program exposure (aRRR = 3.8, 95%CI 2.8– 4.9) as compared to those who did not have paid sex in same duration. Similarly Table 5 shows that those who had sex with non-paid female partners in past 12 months were significantly more likely to have less intensive program (aRRR = 1.6, 95% CI 1.2-2.5) than their counterparts. However, in this

Table 3 Associations between sex with paid and non-paid female partner and exposure to the program, IBBA Round-2 on National Highways

	Exposure to HIV prevention program		
	% not exposed	% exposed to less intensive program	% exposed to intensive program
All Routes			
Had sex with PFP in last 12 months* **			
No (N= 1578)	**50.6**	**24.2**	**25.2**
Yes (N = 507)	**26.5**	**29.5**	**44.0**
Had sex with NPFP in last 12 months			
No (N= 1618)	**44.7**	**24.7**	**30.6**
Yes (N = 467)	**46.0**	**28.5**	**25.5**
North-East			
Had sex with PFP in last 12 months * **			
No (N= 387)	**56.1**	**22.1**	**21.8**
Yes (N = 137)	**28.2**	**26.0**	**45.8**
Had sex with NPFP in last 12 months			
No (N= 387)	**50.0**	**22.6**	**27.4**
Yes (N = 137)	**45.4**	**24.7**	**29.9**
North-South			
Had sex with PFP in last 12 months			
No (N= 390)	**43.5**	**18.7**	**37.8**
Yes (N = 148)	**41.0**	**20.3**	**38.7**
Had sex with NPFP in last 12 months			
No (N= 443)	**42.1**	**17.6**	**40.2**
Yes (N = 95)	**45.7**	**26.7**	**27.3**
North-West			
Had sex with PFP in last 12 months **			
No (N= 369)	**39.8**	**26.7**	**33.2**
Yes (N = 157)	**27.9**	**16.9**	**55.2**
Had sex with NPFP in last 12 months **			
No (N= 356)	**42.7**	**17.9**	**39.4**
Yes (N = 170)	**24.2**	**36.1**	**39.7**
South-East			
Had sex with PFP in last 12 months			
No (N= 432)	**63.9**	**27.8**	**8.4**
Yes (N = 65)	**55.6**	**26.9**	**17.5**
Had sex with NPFP in last 12 months			
No (N= 432)	**67.7**	**30.0**	**2.2**
Yes (N = 65)	**61.8**	**27.2**	**10.9**

** P< 0.05; *** P <0.01

Differences between the categories were tested by using Chi-square test.

PFP: Paid female partner; NPFP: Non-paid female partner

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Table 4 Multivariate Analysis: Exposure to intervention and sex with paid female partners, IBBA Round-2 on National Highways

Sex with paid female partners	Exposure to HIV prevention program	
	Less intensive exposure vs. No exposure	Intensive exposure vs. No exposure
	Adjusted RRR [95% CI]	Adjusted RRR [95% CI]
Had sex with PFP in last 12 months		
No (Reference category)	**1.0**	**1.0**
Yes	**2.5 [1.9 – 3.5]**	**3.8 [2.8 – 4.9]**
Route Categories		
North-East (Reference category)	**1.00**	**1.00**
North-South	**1.2 [0.9 – 1.6]**	**2.1 [1.6 – 2.7]**
North-West	**1.2 [0.8 – 1.8]**	**1.9 [1.3 – 2.7]**
South-East	**0.9 [0.6 – 1.1]**	**0.2 [0.2 – 0.5]**
Current age (years) [a]	1.0 [0.9 – 1.1]	0.9 [0.9 – 1.0]
Literacy		
Illiterate (Reference category)	1.0	1.0
Literate	1.4 [0.9 -2.1]	2.6 [1.5 - 4.6]
Marital status		
Not currently married (Reference category)	1.0	1.0
Currently married	1.5 [1.1 -1.9]	2.5 [1.6 -2.9]
Duration of working as truck driver (years) [a]	1.0 [0.9 – 1.1]	1.1 [0.9 – 1.2]
Number of round trips [a, b]	0.9 [0.8 – 1.2]	1.0 [0.9 – 1.1]
Ownership of truck		
Respondent (Reference category)	1.0	1.0
Other	0.8 [0.6 -1.3]	0.5 [0.3 -1.0]

RRR: Relative Risk Ratio; PFP: Paid female partner; NPFP: Non-paid female partner; 95% CI: 95% Confidence Interval

The analysis was done using combined data from all four routes. Adjusted RRR were estimated using multivariate multinomial logistic regression models.

[a] Entered as continuous variable in the multivariate multinomial logistic regression models.

[b] Between main cities of operation in past six months

Table 5 Multivariate Analysis: Exposure to intervention and sex with non-paid female partners, IBBA Round-2 on National Highways

Sex with non-regular female partners	Exposure to HIV prevention program	
	Less intensive exposure vs. No exposure	Intensive exposure vs. No exposure
	Adjusted RRR [95% CI]	Adjusted RRR [95% CI]
Had sex with NPFP in last 12 months		
No (Reference category)	**1.00**	
Yes	**1.6 [1.2 – 2.5]**	**1.00**
		1.1 [0.8 – 1.4]
Route Categories		
North-East (Reference category)	**1.00**	**1.00**
North-South	**1.2 [0.9 – 1.6]**	**1.9 [1.5 – 2.5]**
North-West	**1.1 [0.8 – 1.7]**	**1.8 [1.3 – 2.8]**
South-East	**0.8 [0.6 – 1.0]**	**0.2 [0.1 – 0.4]**
Current age (years) [a]	1.0 [0.9 – 1.1]	0.9 [0.9 – 1.1]
Literacy		
Illiterate (Reference category)	1.0	1.0
Literate	1.3 [0.9 -2.1]	2.6 [1.5 - 4.6]
Marital status		
Not currently married (Reference category)	1.0	1.0
Currently married	1.2 [0.9 -1.8]	1.7 [1.2 -2.4]
Duration of working as truck driver (years) [a]	0.9 [0.8 – 1.0]	1.0 [0.9 – 1.0]
Number of round trips [a, b]	1.0 [0.9 – 1.2]	1.1 [0.8 – 1.2]
Ownership of truck		
Respondent (Reference category)	1.0	1.0
Other	0.8 [0.6 -1.3]	0.7 [0.4 -1.1]

RRR: Relative Risk Ratio; PFP: Paid female partner; NPFP: Non-paid female partner; 95% CI: 95% Confidence Interval

The analysis was done using combined data from all four routes. Adjusted RRR were estimated using multivariate multinomial logistic regression models.

[a] Entered as continuous variable in the multivariate multinomial logistic regression models.

[b] Between main cities of operation in past six months

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case exposure to intensive program was not found to have any significant association.

Association between program exposure and safe sex behavior

Table 6 shows the associations between program exposure and consistent condom use with paid and non-paid female partners. Overall, those exposed to intensive program were more likely to use condom consistently with paid female partners than those who were not exposed to any of the HIV prevention program (83.0% versus 63.9%; OR = 2.7, 95%CI 1.7 – 4.6). The same relationship was found in three out of four routes- NE, NS and SE. At the same time, intensive program exposure did not have any association with the consistent condom use with non-paid female partners. On contrary, those exposed to less intensive program were more likely to use condom consistently use with non-paid female partners than those who were not exposed to any of the HIV prevention program (52.6% versus 33.9%; OR= 2.2, 95%CI 1.3 – 3.4). The same relationship was found in three out of four routes- NE, NW and SE. However, exposure to less intensive exposure could not establish any significant association with consistent condom use with paid female partners.

Table 6 also indicates that even among those who had no exposure to any HIV prevention program consistent condom use with paid female partners was relatively higher on NS, NW and SE routes than on NE route (NS: 71.8%; NW: 79.8%; SE: 77.1%, NE: 59.8%). The same was true in the case of condom use with non-paid female partners.

Results from multivariate logistic regression analysis confirmed the bi-variate relations between exposure to interventions and consistent condom use after adjusting for the control variables (Table 7). It can be seen that those who were exposed to the intensive program were two times more likely to use condom every time with paid female partners (aOR= 2.4, 95%CI 1.4-4.1). Exposure to less intensive program continued to have positive association with consistent condom use with non-paid female partners but it lost its statistical significance after adjusting for the control variables (aOR = 2.3, 95% CI 0.9 - 3.8).

Discussion

This is the first report of two national level cross-sectional surveys of long-distance truck drivers being used to assess the impact of an HIV prevention intervention in this larger, mobile population. The data shows that

Table 6 Association between exposure to intervention and consistent condom use with paid and non-paid female partners, IBBA Round-2 on National Highways

Exposure to HIV prevention program	Consistent condom use with PFP			Consistent condom use with NPFP		
	N	%	Crude OR [95% CI]	N	%	Crude OR [95% CI]
All Routes						
No	174	63.9	1.0	217	33.9	1.0
Less intensive	107	71.6	1.4 [0.8 – 2.3]	104	52.6	2.2 [1.3 – 3.5]
Intensive	226	83.0	2.7 [1.7 – 4.6]	147	25.5	0.7 [0.4 – 1.2]
North-East						
No	33	59.8	1.0	59	24.2	1.0
Less intensive	32	54.8	0.8 [0.3 – 2.1]	26	58.8	4.5 [1.9 – 10.8]
Intensive	72	73.1	1.8 [1.1 – 4.3]	52	27.4	1.1 [0.5 – 2.9]
North-South						
No	55	71.8	1.0	42	58.7	1.0
Less intensive	26	56.4	0.6 [0.2 – 1.4]	25	48.4	0.7 [0.3 – 1.8]
Intensive	67	89.9	3.5 [1.3 – 9.5]	29	37.2	0.5 [0.2 – 1.1]
North West						
No	51	79.8	1.0	69	41.6	1.0
Less intensive	29	83.6	1.3 [0.4 – 4.7]	38	51.7	1.5 [0.5 – 4.7]
Intensive	77	71.4	0.7 [0.3 – 1.5]	63	29.7	0.4 [0.1 – 1.6]
South-East						
No	35	77.1	1.0	47	22.4	1.0
Less intensive	20	85.0	1.2 [0.3 – 7.1]	15	50.1	3.4 [1.1 – 9.2]
Intensive	10	90.1	2.7 [0.3 – 24.3]	3	63.3	NA

PFP: Paid female partners; NPFP: Non-paid female partner

OR: Odds Ratios; 95% CI: 95% Confidence Interval.

NA: Odds Ratio has not been computed because of small cell frequency

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Table 7 Multivariate Analysis: Exposure to interventions and consistent condom use with paid and non-paid female partners, IBBA Round-2 on National Highways

Exposure to intervention and background characteristics	Consistent condom use with PFP	Consistent condom use with NPFP
	Adjusted OR [95% CI]	Adjusted OR [95% CI]
Exposure to HIV prevention program		
No (Reference category)	1.0	1.0
Less intensive	1.4 [0.8 – 2.5]	2.3 [0.9 – 3.8]
Intensive	2.4 [1.4 – 4.1]	0.6 [0.4 – 1.9]
Route Categories		
North-East (Reference category)	1.0	1.0
North- South	1.7 [1.1 – 2.8]	1.7 [0.9 – 3.0]
North-West	1.5 [0.8 – 2.9]	0.9 [0.5 – 1.7]
South-East	1.8 [0.9 – 3.4]	1.0 [0.6 – 1.9]
Current age (years) [a]	1.0 [0.9 – 1.2]	0.9 [0.8 – 1.1]
Literacy		
Illiterate (Reference category)	1.0	1.0
Literate	1.4 [0.7 – 2.2]	1.1 [0.4 – 2.9]
Marital status		
Not currently married (Reference category)	1.0	1.0
Currently married	1.2 [0.8 – 1.9]	1.1 [0.6 – 1.7]
Duration of working as truck driver (years) [a]	0.9 [0.9 – 1.0]	1.0 [0.8 – 1.2]
Number of round trips [a, b]	0.8 [0.8 – 1.1]	0.9 [0.8 – 1.1]
Ownership of truck		
Respondent (Reference category)	1.0	1.0
Other	0.7 [0.3 – 1.5]	0.6 [0.3 – 1.7]

PFP: Paid female partners; NPFP: Non-paid female partner

OR: Odds Ratios; 95% CI: 95% Confidence Interval

The analysis was done using combined data from all four routes. Adjusted OR were estimated using multivariate logistic regression models.

[a] Entered as continuous variable in the multivariate logistic regression models.

[b] Between main cities of operation in past six months

overall program has reached about 50% of the long distance truck drivers with considerable variations across the routes. The reported program exposure was found highest north-west route whereas it was found lowest on south-east route. A recent study in India has also concluded low exposure to public funded HIV prevention program among long distance truckers in Andhra Pradesh that falls on the south-east route [29]. Though the proportion of truckers visiting paid female partners remained almost unchanged over time across most of the routes, significant improvements in consistent condom use with paid as well as non-paid female partners were observed. A welcome reduction in the prevalence of Syphilis and HIV was observed at the aggregate level as well as across the routes. These improvements in safer sexual practices and reductions in the STIs were statistically significant in totality as well as in some of the routes.

The data also showed that truck drivers who had sex with paid female partners were significantly more likely to have program exposure, particularly the intensive exposure. On the other hand, those who had sexual contacts with non-paid female partners were more likely to have less intensive exposure. These findings suggests that the program has not just increased its coverage in the targeted population; it has been able to reach those who have sexual contacts outside marriage and hence at more risk of acquiring STI/HIV. This could be due to the two reasons. First, the program purposively targets those who take higher risk. Second, those who have riskier behavior may approach the program to avail information and services [30].

The paper also points out that consistent condom use with paid female partners was higher even among unexposed truckers in NS, NW and SE routes as compared to that in NE route. These points could be explained, at least partly, by attributing this as confounding effect of other parallel interventions among FSWs in several Indian states which are connected through the four route corridors. The NS and NW route corridors connect low HIV prevalence northern Indian states to high HIV prevalence southern and western states whereas the SE route connects the high HIV prevalence southern states to the low/ moderate HIV prevalence eastern

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states. On the other hand, majority of the NE corridor falls within the low HIV prevalence northern states and partially into the low/ moderate HIV prevalence eastern states [2,31]. Due to higher prevalence of STI/HIV, the western and southern states have been receiving intensive intervention programs (including condom social marketing at 'hot-spots' where the commercial sex takes place) among all the high-risk groups, especially FSWs whereas the northern states are known to have low intensive intervention programs among high-risk groups [22,23,3]. The decision on using condom use in a commercial sex is not just a trucker's own behavior rather it represents behavior of two individuals - trucker and FSW. Thus, besides the effect of truckers' intervention, higher consistent condom use among respondents traveling on NS, NW and SE routes reflects the effect of interventions targeted towards FSWs. On the other hand, truckers plying on the NE route usually interact with FSWs who do not receive any program of high intensity; hence the consistent condom among unexposed truckers remained at lower level. The possibility that the simultaneous implementation of interventions targeted towards both FSWs and their clients may increase the condom use rates in commercial sex encounters has also been discussed elsewhere [33]. Studies in other settings have shown declines in client STI prevalence as a result of interventions directed towards FSWs [34,35]. Though it is not possible to separate out the effect of several simultaneous interventions, the large difference between the consistent condom uses among unexposed and those having intensive exposure in NE route may be largely attributed to the intervention programs among truckers. However even on this route, we do not deny the possible effects of other programs.

In summary, truckers who had intensive coverage were more likely to use condom consistently with paid female partners. This association was significant even after adjusting the possible confounding effects from socio economic and work related characteristics. This means, once exposed to the intensive program truckers were more likely to adopt safe sexual practices irrespective of important characteristics such as age, literacy, marital status, duration of working as truck drivers, ownership of truck, the routes on which they usually travel and number of round trips. This establishes strong positive effect of intensive exposure with safe sexual practices. It indicates that an integrated intensive large scale intervention can change beliefs and behavior towards safe sexual practices among long distance truckers whereas interventions among truckers that focused on five repeated in-depth interactions with programme staff has been reported to have limited effectiveness [36]. At the same time, the lack of equal success among those who have sex with non-paid female partners is certainly a challenge for the intensive program. Moreover, still about half or less of the targeted population had no exposure of any kind across the four routes. This demands continuing efforts with same intensity to increase the coverage in overall population as well as to achieve universal coverage among those who take greater risk.

Conclusions

The paper concludes that there is an overall improvement in the safe sexual practices along with the increasing program exposure among long distance truck drivers in the country. The study summarizes that the program has been able to reach at those truckers who took higher risks and once exposed to intensive program these high-risk truckers were more likely to follow safe sexual practices by using condom every time in all commercial sex acts.. The paper also indicates towards the possible contribution of interventions targeted towards FSWs in bringing safe sexual practices among truckers. Realizing that almost half of the truckers have no exposure to any program, we recommend that the intervention programs must be continued with same intensity.

List of abbreviations used

AIDS: Acquired immune deficiency syndrome; aOR: Adjusted Odds Ratio; aRRR: Adjusted Relative Risk Ratio; CI: Confidence Interval; FSW: Female Sex Workers; HIV: Human Immunodeficiency Virus; IBBA: Integrated Behavioral and Biological Assessment; LDTD: Long Distance Truck Drivers; NE: North-East; NPFP: Non-paid Female Partners; NS: North-South; NW: North-West; OR: Odds Ratios; PFP: Paid Female Partners; RPR: Rapid Plasma Regain; RRR: Relative Risk Ratio; SE: South- East; STI: Sexually Transmitted Infections; TPHA: Treponema Pallidum Hemagglutination Assay; TSL: Transshipment Location.

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ORIGINAL PAPER

Impact of an HIV Prevention Intervention on Condom Use among Long Distance Truckers in India

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Abstract This paper examines the impact of three components of an HIV prevention program (mid-media, interpersonal communication, and project-run clinics) on consistent condom use by long distance truckers with paid and non-paid female partners in India. Data from 2,723 long distance truckers were analyzed using the propensity score matching approach. Based on utilization of services, the following categories of intervention exposure were derived: no exposure, exposure only to mid-media, exposure only to mid-media and interpersonal communication, exposure only to mid-media and project-run clinics, and exposure to all three intervention components. Compared to those who were not exposed to any intervention, exposure to mid-media alone increased consistent condom use with paid female partners by about ten percent. Exposure to mid-media and visits to project-run clinics increased consistent condom use with non-paid female partners by 26 %. These findings suggest that mid-media events and clinics were the most effective package of services to increase consistent condom use among the long distance truckers.

Keywords Truckers · Intervention · Propensity scores · HIV

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Introduction

Long distance truck drivers and their helpers (hereafter referred to as truckers) are considered to be at high risk for sexually transmitted infections (STI) and HIV in many parts of the world, including Asia [1–4], Africa [5–8], South America [9, 10] and the United States [11, 12]. Truckers' increased HIV risk is largely attributed to long periods of absence from the family [11, 13, 14].

In India, recent evidence shows that around one-fourth of truckers have sex with female sex workers (FSWs) [15] and less than three-fourth use condoms consistently in sex with these partners [14–16]. Substantial proportions of truckers also have sexual relations with non-paid female partners [14–16] and only about one-third use condoms consistently in such sexual encounters [15, 16]. Studies in the country have found high HIV prevalence (2–16 %) [14, 15, 17, 18] and high STI prevalence (3–13 %) among truckers [15, 17, 18].

Due to high risk behaviours, high STI and HIV prevalence, and ability to transmit infections to new geographic areas, HIV prevention interventions among truckers started in early 1990s with aim to raise the awareness through group discussion on matters related to HIV, using posters and pamphlets with positive AIDS messages, street theatres and puppetry, and distribution of condoms [19–21]. Some interventions also used one-to-one and one-to-group education sessions through peers, and provided treatment for STI at truckers' halt points [22, 23]. The HIV prevention efforts among truckers were strengthened towards the end of 1990s when a large-scale HIV prevention program among truckers, named as 'Healthy Highway' was initiated. The project offered services including treatment and counseling for STIs, condom promotion, dissemination of educational materials, and face-to-face behavioural change communication to truckers at major halt points where at

least 50 trucks were parked at any time of the day or night [24]. In 1998, the second phase of the National AIDS Control Program initiated specific interventions among truckers that were largely based on the strategies of the Healthy Highway program [25]. The Healthy Highway program was handed over to the government in 2000 which replaced the central management team of the Healthy Highway program by independent State AIDS Control Societies [26].However, despite several individual HIV prevention programs for truckers being implemented through State AIDS Control Societies, the need for a large-scale intensive program was recognized due to lack of coordination among interventions within or across states, language barriers, and the absence of a standard network of services to address the needs of truckers [26]. In this context, a large-scale intervention, called Kavach (meaning 'shield' in Hindi/Sanskrit) for truckers in India was started as part of Avahan, the India AIDS initiative [27]. In addition to working with truckers, Avahan supported interventions among other high risk groups such as FSWs and their clients, men who have sex with men/transgenders and injecting drug users in several high HIV prevalence states of India [27, 28]. This paper describes the Kavach intervention and examines the impact of its components on condom use behavior by truckers with non-regular female sexual partners.

Kavach Intervention

The Kavach intervention was initiated in 2004 in 36 transshipment locations across India covering the major national highways along six routes, namely, North–East, North–West, North–South, West–South, South–East and West–East. Transshipment locations are places where transporters and brokers operate to link truckers with clients who need to transport goods, and routes are road corridors on which truckers travel.

The Kavach intervention was redesigned in 2006 by halving the number of implementation sites from 36 to 17 to focus on the major truck halt points in nine Indian states. Unlike the other HIV prevention programs to cover large number of intervention sites for truckers coverage, the redesigned program aimed to provide maximum coverage to truckers by working with high intensity program (i.e., ensuring more contacts by peer educators, greater program visibility and increased number of project-run clinics) at major transshipment locations in the country where large number of truckers halt and wait for their consignments.

The Kavach intervention had three main components: mid-media events; peer-led dialogue based interpersonal communication (IPC) and project-run clinics. Mid-media events included street plays, health games, film shows, truckers' festivals and the distribution of audio cassettes/compact discs. Mid-media events aimed to communicate messages on safe sex practices to truckers and motivate them to visit project-run clinics. Trained professionals conducted about ten street plays every month at each intervention site. Health games were conducted twice a day and film shows were organized once a week at each intervention site. Truckers' festivals were large-scale events conducted annually to create an interest among brokers, transporters and truckers in the program. Audio cassettes/compact discs with catchy local songs interspersed with spoofs on popular film actors delivering HIV prevention messages and endorsing services at project-run clinics were distributed to truckers so as to reinforce positive messages on HIV when they travel on the highway. The project monitoring data indicate that nationally around 150,000 audio cassettes/compact discs were distributed every year.

In the Kavach intervention, IPC included one-to-group discussions by trained peer educators who were either active truckers or ex-truckers. About 10–12 IPC sessions were conducted every day at each intervention site. In order to reinforce messages already received in the mid-media events, those messages were repeated during the IPC sessions.

One static clinic and two mobile clinics were established at each intervention site to provide services at the door-step of truckers' halting points. To avoid becoming stigmatized as STI clinics, the project clinics treated a range of general health ailments in addition to providing counseling services by a qualified counselor on safe sex practices, correct and consistent condom use, and diagnosis and treatment of STI so that truckers would not hesitate to visit these clinics. Following the McDonald's business franchisee model, where the look and service of outlets do not differ across any location [29], project-run clinics were branded with uniform appearance and services across all intervention sites to facilitate greater acceptance and easy recognition by truckers. Social marketing of condoms was promoted in partnership with condom marketing organizations by opening non-traditional outlets such as at tea stalls, and installing condom vending machines at strategically chosen places in the implementation sites. Details of the Kavach intervention are available elsewhere [26].

Methods

Study Setting and Sampling

Of the 17 intervention sites, six were purposively chosen as survey sites for data collection. The selected sites were

located at Ghaziabad and Delhi in northern India, Indore in central India, Mumbai and Pune in western India, and Bengaluru in southern India. These sites were chosen because truckers from different parts of the country wait at these places for a considerable length of time for new consignments. Data were collected during February–August 2009 in two phases at each selected site in order to cover wider group of truckers' population. A total sample size of 2,800 truckers was estimated for the survey.

The total sample size was distributed across the six transshipment locations chosen for the survey in proportion to the number of truckers available at those transshipment locations. Parking areas for trucks were considered as clusters in each transshipment location for the multistage cluster sampling and all clusters were selected for the survey. The registration number of the trucks parked in each cluster on the day of the survey was listed and a systematic random sampling approach was used to select the trucks. The main driver or helper of the selected trucks was approached to participate in the survey.

Respondents were selected only if they met the following three criteria: (i) aged 18 years or more; (2) had worked as a trucker for the past 2 years or more; and (3) were working in a truck with a national permit (i.e., permission from the government to carry goods to and from any part of the country). Truckers who had already participated in the survey (either in an earlier phase of the survey or in the same phase) were not interviewed again.

A pre-coded questionnaire translated into the local language was used to collect data by trained native speakers. A total of 2,810 truckers were interviewed in the survey. Of these, cases who were traveling on the South–East route [30]; cases exposed only to IPC [20] and exposed only to project-run clinics [31]; and cases where there was incomplete information on exposure to intervention [2] were excluded from the analyses due to the small number of observations. This resulted in a total analytical sample of 2,723 cases.

Ethical Considerations

A comprehensive informed consent process was followed. Respondents were informed about the study including the duration of the interview (approx. 30 min), and their queries addressed before written consent was taken. To protect confidentiality all questionnaires were entirely anonymous and the names and addresses of respondents were not recorded. To maintain privacy, interviews were either conducted inside the truck or in a secluded public area such a corner road where others would not be able to listen to the interview. Participants were not given any monetary compensation for their time in the study.

Measures

Socio-Demographic Characteristics

The socio-demographic characteristics considered in this paper were age (completed years), formal schooling (no, yes), marital status (not currently married, currently married), usual place of residence (native place, others), route generally travelled (North–East, North–South, North–West, West–South and West–East), duration of work as a trucker (completed years), occupation (driver, helper) and availability of music player in the truck (no, yes). Formal schooling was defined as the ability to both read and write.

Exposure to the Intervention

Exposure to mid-media was defined as exposure to at least one mid-media events (watched street plays, participated in health games, watched film shows, participated in truckers' festivals, received audio cassettes/compact discs) in the past 12 months (no, yes). Exposure to IPC was defined as participation in at least one IPC session in the past 12 months (no, yes). Exposure to project-run clinics was defined as at least one visit to a project clinic (either static or mobile) in the past 12 months (no, yes). Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in past 12 months.

To measure exposure to different intervention components in the past 12 months, a variable with the following five mutually exclusive categories were derived: no exposure, exposure only to mid-media, exposure only to mid-media and IPC, exposure only to mid-media and project-run clinics, and exposure to all three intervention components.

Consistent Condom Use

Consistent condom use with paid female partners and non-paid female partners was the primary outcome variable measuring HIV-related risk behaviour. A paid female partner was defined as a woman to whom the respondent had paid cash in exchange for sex. A non-paid female partner was defined as a woman to whom the respondent was not married and did not pay cash in exchange for sex. Consistent condom use with a sexual partner was defined as condom use in every sexual encounter with that particular partner (no, yes).

Statistical Analyses

Basic descriptive statistics (i.e., proportions, means and standard deviations) were presented to describe participants' socio-demographic characteristics, exposure to the

intervention, and outcome indicators. The bivariate association between the categories of intervention exposure and outcome indicators was examined using χ^2 test.

The propensity score matching (PSM) approach was adopted to examine the impact of truckers' exposure to any intervention as well as exposure to different categories of intervention on consistent condom use by them with paid and non-paid female partners. Studies indicate that when only observational data are available without a valid control group, the PSM approach can be adopted to evaluate the impact of intervention exposure on an outcome [30–34]. The PSM approach to examine the impact of intervention exposure on consistent condom use included two steps. First, for each respondent a propensity score was calculated using multivariate logistic regression, with variable measuring exposure to intervention as the binary dependent measure and observed socio-demographic characteristics as covariates. The next step consisted of matching exposed and unexposed truckers with similar propensity scores.

The observed socio-demographic characteristics including age, literacy, marital status, occupation, duration of work as trucker, time away from family, and route category were considered as the covariates because these characteristics have been found to correlate with truckers' sexual risk behaviors in India [11, 14, 17, 35, 36]. We added presence of music player in the truck as one of the covariates as it was likely to affect truckers' exposure to mid-media intervention components (distribution of audio-cassettes/compact discs).

Matching was carried out using the radius method in which each exposed trucker was matched only with the unexposed truckers whose propensity score fell into a predefined neighborhood of the estimated propensity score of the exposed trucker [37]. The predefined neighborhood was determined by estimating the radius as one-fourth of the standard deviation of the corresponding propensity scores [37–39]. The common support restriction (to exclude data from exposed truckers with a propensity score higher than that of any unexposed trucker) was imposed to improve the quality of the matches [30]. Among unexposed truckers, those who had propensity scores similar to exposed truckers were termed as matched unexposed and they served as controls for the exposed group. Matching was done with replacement so that one matched unexposed (or exposed) trucker could potentially serve as match for several exposed (or unexposed) truckers [37].

The key assumption in the PSM approach is that conditional on the propensity score, assignments to exposed and unexposed groups can be considered as random [32]. One test of this assumption is to examine the balancing property which states that, conditional on the propensity scores, the distribution of confounding factors are similar among exposed and matched unexposed groups [38]. To examine whether the balancing property was satisfied, differences in the socio-demographic characteristics of exposed truckers with all unexposed truckers (to assess the differences before matching) and matched unexposed truckers (to assess the differences after matching) were tested for significance using the χ^2 test (for percentages) and unpaired t test (for mean values). The overall covariate imbalance of the model was examined by testing the joint significance of all the regressors (ability of covariates to predict exposure to any intervention) using the likelihood ratio test before and after matching.

The PSM approach enabled us to estimate the average effect of intervention exposure among exposed truckers (difference in condom use among exposed truckers and matched unexposed truckers) and the average effect of intervention exposure among unexposed truckers (difference in condom use of unexposed truckers and matched exposed truckers). The average effect of intervention exposure among exposed truckers measured the impact of intervention on exposed truckers whereas the average effect of intervention exposure among unexposed truckers measured the impact that the interventions would have had on unexposed truckers if they were exposed. These two effects were weighted by the proportion of truckers exposed and unexposed respectively to arrive at the impact of intervention exposure on consistent condom use which measured the increase in consistent condom use due to intervention exposure [30, 32]. As a final diagnostic check, sensitivity analyses were conducted to assess the potential effect of unmeasured confounders on the results. The Rosenbaum bounds approach was adopted, which is described elsewhere [32].

Following these steps, we first examined the impact of exposure to any intervention on condom use by comparing the consistent condom use among truckers exposed to any intervention with that among matched unexposed truckers. Since exposure to mid-media was common among all the exposed truckers, categories with significant impact on outcomes were examined against exposure only to mid-media for assessing the additional impact different components. Analyses were conducted using the statistical software STATA (version 11).

Results

Socio-Demographic Characteristics, Exposure to Intervention, and Sexual Behavior

Mean age of the respondents was about 30 years. Of the 2,723 respondents, more than three-fourth (83.4 %) had formal schooling, nearly two-third (66.6 %) were currently married, and about one-fifth (22.1 %) were working as helpers. A total of 991 (36.4 %) truckers were not exposed to

the intervention in the past 12 months, 651 (23.9 %) were exposed only to mid-media, 188 (6.9 %) were exposed only to mid-media and IPC, 449 (16.5 %) were exposed only to mid-media and clinics, and 444 (16.3 %) were exposed to all three intervention components. About 45 % of respondents reported sex with paid female partners in the past 12 months and almost three-fourths (74.1 %) reported using condoms consistently in such sexual encounters. About 22 % of reported having sex with non-paid female partners and less than half (41.8 %) had used condom consistently in such sexual acts (Table 1).

Intervention Exposure and Consistent Condom Use

Consistent condom use with both paid and non-paid female partners was significantly higher among truckers exposed to any intervention than those with no intervention exposure (paid female partners: 76.5 % vs 65.8 %, χ^2 statistic = 12.85, $p < 0.001$; non-paid female partners: 45.3 % vs 32.5 %, χ^2 statistic = 7.82, $p = 0.005$) (Table 2). Consistent condom use with paid female partners varied significantly from about two-thirds (63.3 %) among truckers exposed only to mid-media to more than three-fourth (80.7 %) among those exposed only to mid-media and project-run clinics (χ^2 statistic = 23.56, $p < 0.001$). Consistent condom use with non-paid female partners also varied from about one-third (31.8 %) among truckers exposed only to mid-media and IPC, to almost half among those exposed to mid-media and project-run clinics (54.9 %) and those exposed to all three intervention components (50.9 %) (χ^2 statistic = 24.67, $p < 0.001$).

Matching of Exposed and Unexposed Truckers

Among truckers who had sex with paid female partners, those exposed to any intervention differed significantly from all unexposed truckers in terms of almost all the socio-demographic characteristics (Table 3). However, no significant differences in socio-demographic characteristics were found when truckers exposed to any intervention were compared with matched unexposed truckers. Similar results were observed for truckers who reported sex with non-paid female partners. The likelihood ratio Chi-square statistic computed to test the joint insignificance of covariates reduced significantly after matching among truckers reporting sex with paid female partners (before matching: χ^2 statistic = 99.6, $p < 0.001$; after matching: χ^2 statistic = 4.6, $p = 0.948$) as well as among those reporting sex with non-paid female partners (before matching: χ^2 statistic = 74.4, $p < 0.001$; after matching: χ^2 statistic = 11.3, $p = 0.418$). Similar results were obtained while comparing socio-demographic characteristics of all unexposed and matched unexposed truckers with the socio-demographic characteristics of truckers exposed to different categories of intervention exposure (results not shown in tabular form but available upon request).

Table 1 Socio-demographic characteristics, intervention exposure, and sexual behavior among truckers, India, 2009 ($N = 2,723$)

Socio-demographic characteristics, intervention exposure, and sexual behavior	Percentage and mean
Socio-demographic characteristics	
Mean age in years (SD)	30.2 (8.0)
Formal schooling[a]	83.4
Marital status	
Currently married	66.7
Not currently married[b]	33.3
Occupation	
Driver	77.9
Helper	22.1
Mean duration of working as trucker in years (SD)	8.4 (6.5)
Route categories	
North–East	20.1
North–South	20.6
North–West	31.2
West–South	11.8
West–East	16.2
Living at native place	56.6
Intervention Exposure	
No exposure	36.4
Exposed only to mid-media	23.9
Exposed only to mid-media and IPC	6.9
Exposed only to mid-media and clinics	16.5
Exposed to all three intervention components	16.3
Exposed to any intervention[c]	63.6
Sexual behavior	
Sex with paid female partners in the past 12 months	44.6
Consistent condom use with paid female partners[d]	74.1
Sex with non-paid female partners in the past 12 months	21.8
Consistent condom use with non-paid female partners[e]	41.8

SD standard deviation, *IPC* interpersonal communication

[a] Formal schooling refers to the ability to both read and write

[b] Not currently married includes truckers who were never married, divorced or widower

[c] Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in the past 12 months

[d] Among those who reported sex with paid female partners in the past 12 months

[e] Among those who reported sex with non-paid female partners in the past 12 months

Table 2 Truckers' sexual behavior by exposure to intervention components, India, 2009 ($N = 2,723$)

Sexual behavior in past 12 months	Exposure to any intervention[a]			Categories of intervention exposure				
	No ($N = 991$)	Yes ($N = 1,732$)	p value[b] (test Statistic)	Only mid-media (N = 651)	Only mid-media and IPC (N = 188)	Only mid-media and project-run clinic (N = 449)	All three intervention components (N = 444)	p value[c] (test Statistic)
Sex with paid female partners (%)	28.3	53.3	<0.001 (166.92)	43.3	47.6	61.4	64.5	<0.001 (229.91)
Sex with non-paid female partners (%)	16.1	25.0	<0.001 (29.23)	16.4	27.5	24.9	36.6	<0.001 (93.29)
Consistent condom use with paid female partners[d] (%)	65.8	76.5	<0.001 (12.85)	77.3	63.3	80.7	76.0	<0.001 (23.56)
Consistent condom use with non-paid female partners[e] (%)	32.5	45.3	0.005 (7.82)	31.8	34.6	54.9	50.9	<0.001 (24.67)

IPC interpersonal communication

[a] Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in the past 12 months

[b] p values are obtained by comparing percentages for those who were exposed to any intervention and those who were not exposed to any intervention using Person's χ^2 test statistic. Estimated values of the χ^2 statistic are given in brackets below the corresponding p-values

[c] p values are obtained by comparing percentages across categories of intervention exposure using χ^2 statistic. Estimated values of the χ^2 statistic are given in brackets below the corresponding p values

[d] Among those who reported having sex with paid female partners in the past 12 months

[e] Among those who reported having sex with non-paid female partners in the past 12 months

Impact of Intervention Exposure on Consistent Condom Use

Table 4 shows the impact of truckers' exposure to different intervention components on consistent condom use with paid and non-paid female partners. When compared with no exposure, the exposure to any intervention increased consistent condom use with paid female partners by 7.2 % (95 % confidence interval (CI): 4.5–16.9, $p = 0.001$) and consistent condom use with non-paid female partners by 12.4 % (95 % CI: 4.3–21.2, $p = 0.003$). Exposure to mid-media alone increased consistent condom use with paid female partners by 9.9 % (95 % CI; 4.0–18.9, $p = 0.003$) as compared with no exposure; however, this was not found to have an impact on consistent condom use with non-paid female partners. Similarly, exposure to only mid-media and project-run clinics increased consistent condom use with paid female partners by 11.4 % (95 % CI: 8.2–21.5, $p < 0.001$) and consistent condom use with non-paid female partners by 26.0 % (95 % CI: 11.6–33.3, $p < 0.001$) when compared with no exposure.

The additional impact of project-run clinics on consistent condom use with paid female partners was not evident when compared with exposure to only mid-media. However, visits to project-run clinics increased consistent condom use with non-paid female partners by about 20 % (95 % CI: 11.1–35.2, $p < 0.001$) as compared to exposure to mid-media alone. Similar results about the additional combined impact of IPC and project-run clinics were found while comparing exposure to all three components with exposure to mid-media alone.

Sensitivity Analyses

The estimated impact of truckers' exposure to any intervention on consistent condom use with paid female partners was insensitive to a bias introduced by unobserved confounders that increase the odds of exposure to any intervention up to 30 % (Mantel–Haenszel statistic = 1.85, $p = 0.030$) (Table 5). Similarly, its impact on consistent condom use with non-paid female partners remained insensitive to the presence of an unobserved confounder that increased the odds of exposure up to 20 % (Mantel–Haenszel

Table 3 Matching socio-demographic characteristics of truckers who had sex with paid and non-paid female partners in the past 12 months, India, 2009

Socio-demographic Characteristics	Had sex with paid female partners					Had sex with non-paid female partners				
	Exposed to any intervention[a]	All unexposed	p value[b] (test statistic)	Matched unexposed	p value[c] (test statistic)	Exposed to any intervention[a]	All unexposed	p value[b] (test statistic)	Matched unexposed	p value[c] (test statistic)
Average age (years)	30.7	29.0	0.001 (3.26)	30.5	0.900 (0.13)	29.0	26.2	<0.001 (4.13)	29.1	0.605 (0.52)
Formal schooling[d] (%)	84.7	78.3	0.012 (2.51)	87.6	0.066 (1.84)	87.5	78.8	0.008 (2.68)	89.1	0.447 (0.76)
Currently married (%)	68.4	57.3	0.001 (3.48)	68.2	0.987 (0.02)	59.4	38.8	<0.001 (4.54)	58.8	0.976 (0.03)
Working as driver (%)	85.4	68.3	<0.001 (6.57)	85.9	0.717 (0.36)	82.9	58.1	<0.001 (6.50)	83.9	0.641 (0.47)
Average duration of work as a trucker (years)	8.5	7.4	0.008 (2.65)	8.3	0.923 (0.10)	7.9	5.8	<0.001 (4.00)	7.6	0.836 (0.21)
Have music player in truck (%)	83.3	73.3	<0.001 (3.75)	82.7	0.802 (0.25)	79.9	67.5	0.002 (3.19)	77.1	0.379 (0.88)
Traveling on North–East route (%)	15.8	21.0	0.040 (2.05)	16.9	0.560 (0.58)	10.2	17.5	0.015 (2.44)	6.9	0.076 (1.78)
Traveling on North–South route (%)	23.8	16.7	0.012 (2.51)	21.9	0.401 (0.84)	19.9	16.3	0.319 (1.03)	23.7	0.128 (1.52)
Traveling on North–West route (%)	33.5	35.2	0.602 (0.52)	34.2	0.969 (0.04)	34.4	31.3	0.470 (0.72)	37.0	0.452 (0.75)
Traveling on West–South route (%)	15.4	9.6	0.014 (2.47)	14.6	0.856 (0.18)	18.9	10.6	0.016 (2.42)	15.1	0.136 (1.49)
Traveling on West–East route (%)	11.5	17.4	0.009 (2.63)	12.4	0.575 (0.56)	16.6	24.4	0.032 (2.15)	17.3	0.852 (0.19)
Living at native place (%)	62.9	45.9	<0.001 (5.13)	60.9	0.481 (0.70)	64.9	51.9	0.004 (2.91)	61.2	0.315 (1.01)
N[e]	933	281		277		433	160		157	
Likelihood ratio χ^2 test statistic (p value)[f]										
Before matching	99.6 (<0.001)					74.4 (<0.001)				
After matching	4.6 (0.948)					11.3 (0.418)				

[a] Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in the past 12 months

[b] p values were obtained by comparing percentages for those who were exposed to any intervention and all unexposed truckers. All unexposed refer to truckers who were not exposed to any intervention. Differences in percentages were tested using χ^2 test statistic and differences in average values were tested using unpaired t test statistic. Estimated values of the test statistic are given in brackets below the corresponding p values

[c] p values were obtained by comparing percentages for those who were exposed to any intervention and matched unexposed truckers. Matched unexposed refers to truckers who were unexposed and had propensity scores similar to that for those exposed group. Differences in percentages were tested using χ^2 test statistic and differences in average values were tested using unpaired t test statistic. Estimated values of the test statistic are given in brackets below the corresponding p values

[d] Formal schooling refers to the ability to both read and write

[e] Differences in N values for matched unexposed and all unexposed indicate number of unexposed cases dropped from the analysis as no match could be found for them

[f] The Likelihood Ratio χ^2 test statistic was used to test the joint significance of all the regressors (that is, the ability of covariates to predict exposure to any intervention) before and after matching. The estimated value of the χ^2 test statistic and corresponding p values (in brackets) are shown

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Table 4 Percent increase in condom use among truckers with paid and non-paid female partners in the past 12 months by exposure to intervention components, India, 2009

Exposure to intervention components	Consistent condom use with paid female partners				Consistent condom use with non- paid female partners			
	Average effect of exposure among exposed[a] (%)	Average effect of exposure among unexposed[b] (%)	Expected increase in consistent condom use[c] (%)	95 % CI for expected increase in consistent condom use	Average effect of exposure among exposed[a] (%)	Average effect of exposure among unexposed[b] (%)	Expected increase in consistent condom use[c] (%)	95 % CI for expected increase in consistent condom use
Any intervention[d] versus no intervention	6.1	10.7	7.2	(4.5–16.9)**	12.4	10.8	12.4	(4.3–21.2)**
Only mid-media versus no intervention	9.6	10.2	9.9	(4.0–18.9)**	1.5	−3.7	−1.5	(-7.1–5.2)
Only mid-media and IPC versus no intervention	−0.2	−4.7	−3.5	(−6.1–8.3)	−0.1	−0.8	−0.7	(-6.9–9.1)
Only mid-media and clinic versus no intervention	10.5	12.3	11.4	(8.2–21.5)***	28.5	24.1	26.0	(11.6–33.3)***
All three intervention components versus no intervention	4.1	9.4	6.6	(4.7–18.2)*	19.7	7.8	11.6	(6.1–30.8)**
Only mid-media and clinic versus only mid-media	5.2	-0.9	2.1	(−3.9–10.7)	17.4	21.8	19.6	(11.1–35.2)***
All three intervention components versus only mid-media	−1.4	−4.9	−3.1	(−8.4–5.7)	7.6	10.6	8.8	(7.7–30.6)**

CI confidence intervals, *IPC* interpersonal communication

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

[a] Average effect of exposure among exposed truckers measured the impact of intervention on exposed truckers

[b] Average effect of exposure among unexposed truckers measured the impact that the interventions would have had on unexposed truckers if they were exposed

[c] It represents the impact of the program obtained by averaging the impact across all the individuals (exposed and unexposed)

[d] Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in past 12 months

Table 5 Sensitivity analysis: Rosenbaum bounds for the estimated impact of exposure to intervention on consistent condom use with paid and non-paid female partners, India, 2009

Exposure to intervention components	Consistent condom use with paid female partners		Consistent condom use with non-paid female partners	
	Permissible odds of differential exposure to intervention due to unobserved factors	p value[a] (test statistic)	Permissible odds of differential exposure to intervention due to unobserved factors	p value[a] (test statistic)
Any intervention[b] versus no intervention	30 %	0.032 (1.85)	20 %	0.044 (1.71)
Only mid-media versus no intervention	30 %	0.048 (1.66)	NA	NA
Only mid-media and project-run clinic versus no intervention	50 %	0.029 (1.89)	60 %	0.038 (1.77)
All three intervention components versus no intervention	20 %	0.034 (1.82)	30 %	0.041 (1.74)
Only mid-media and clinic versus only mid-media	NA	NA	50 %	0.033 (1.82)
All three intervention components versus only mid-media	NA	NA	30 %	0.044 (1.73)

NA: The sensitivity analyses were not done as exposure to the corresponding components of intervention did not result in a significant difference in condom use with paid female partners and non-paid female partners

[a] p values were estimated using Mantel–Haenszel statistic under the assumption of overestimation of the impact of exposure to corresponding component of intervention. Estimated values of Mantel–Haenszel test statistic are given in brackets below the corresponding p values

[b] Exposure to any intervention was defined as exposure to at least one of the three intervention components, namely, mid-media, IPC and project-run clinics in the past 12 months

statistic = 1.71, $p = 0.044$). Similar results were obtained for estimated impact of exposure to different categories of intervention exposure on consistent condom use with paid and non-paid female partners.

Discussion

The study findings showed differential effects of exposure to components of the Kavach intervention on consistent condom use with paid and non-paid female partners. For instance, trucker's exposure to mid-media alone as compared to those who were not exposed to any intervention reported significantly higher consistent condom use with paid female partners. Whereas, truckers who visited project-run clinics as compared to those with exposure to mid-media alone have reported higher consistent condom use with non-paid female partners. Exposure only to mid-media and IPC, without being supplemented by visits to project-run clinics, did not have a significant impact on condom use behavior.

The finding that truckers' exposure to mid-media alone has increased consistent condom use with paid female partners can be explained, to some extent, by the possible confounding effect of parallel intensive interventions among FSWs in several states of India [15]. The national AIDS control program as well as the Avahan supported initiatives for the social marketing of condoms at 'hotspots' in high HIV prevalence states in India have increased the availability of condoms in high risk settings where commercial sex takes place [28, 40]. In the context of several intervention programs to promote condom use in commercial sex, information on the availability and importance of condom use imparted through the mid-media could lead to high rates of consistent condom use with paid female partners. However, as the study findings indicate, exposure to mid-media alone did not increase consistent condom use with non-paid female partners, which may perhaps be explained by two factors. First, the degree of intimacy and trust is higher with non-paid female partners than paid partners, and hence condom use with such partners is low [14–16]. Second, non-commercial sex takes place in settings (e.g., homes) where the reach and effectiveness of HIV prevention programs may be limited.

Information on safe sexual practices provided by mid-media events coupled with counseling by a qualified counselor on safe sexual practices, correct and consistent condom use and treatment of STI by a qualified doctor in project-run clinics appear to be the most effective package of services to increase condom use with both paid and non-paid female partners. Findings suggest that visits to project-run clinics did not have an additional impact as compared to exposure to mid-media alone in terms of consistent

condom use with paid female partners. However, visits to project-run clinics had an additional impact on consistent condom use with non-paid female partners compared to exposure to mid-media alone. One possible reason behind success of project-run clinics in increasing consistent condom use with non-paid female partners could be the in-depth one-to-one discussions with qualified counselors and qualified doctors. Research from developing countries indicate that HIV counseling recipients are more likely to use condom than those who do not receive it [41]. A recent study among cross-border truck drivers in Hong Kong also found voluntary HIV counseling and testing plus the information dissemination approach to be more effective in promoting safe sex behaviors than the information dissemination approach alone [42]. Although further studies are needed to understand the processes that motivate truckers to use condoms with non-paid female partners, this paper suggests that the provision of clinics with integrated one-to-one counseling by trained professionals promotes consistent condom use, particularly with non-paid female partners.

Findings also indicate that as compared to no exposure, exposure to only mid-media and IPC did not improve condom use behavior. This could be due to the small sample size of truckers exposed to these two intervention components, as well as the fact that truckers who were exposed to only mid-media and IPC constitute a subgroup who did not visit the project-run clinics even after being exposed to two intervention components that were aimed to motivate them to visit these clinics. As this group of truckers could not be convinced to visit clinics even after repeated efforts, it may be argued that these truckers did not give much importance to the messages on condom use provided during mid-media events and IPC sessions. Hence, though covered by the program, these truckers' condom use behavior was similar to those who were not exposed to any intervention component. These findings suggest the need to change the IPC approach (e.g., using photographs to illustrate the consequences of STI) to motivate truckers to use condoms with non-regular female sexual partners.

The percentage of truckers exposed to the intervention as observed in this study was found to be higher than that found in a large-scale survey among long distance truck drivers conducted during 2009–10 in India [15]. This may be because our study was limited to transshipment locations where the Kavach intervention program was being implemented whereas the above-mentioned study included transshipment locations where this program did not operate.

On the other hand, the levels of consistent condom use with paid female partners (74.1 %) and non-paid female partners (41.8 %) as found in this study are consistent with other large-scale study among long distance truckers in India which found that about 74 % of the truck drivers used condoms consistently with paid female partners whereas about 37 % of them used condom consistently with non-paid female partners [15]. In recent past, small-scale studies in different parts of the country have found a wide range (57 %–84 %) of estimates for consistent condom use by truckers with paid female partners. This wide variation in estimates across the small-scale studies are often due to small sample size, and variation in geographic region. Differentials in sexual behaviors of truckers from different parts of the country have been documented elsewhere [15, 35].

This study has some limitations, which should be considered when interpreting the results. First, findings are based on self- reports, which are vulnerable to social desirability and recall biases. The survey measured a limited number of socio-demographic characteristics and did not include some of the important variables such as income and alcohol consumption, which may confound the results. Finally, although the PSM approach was used to establish a causal relationship between exposure to intervention and consistent condom use, this should not be considered an alternative approach to randomized trials with valid case and control groups.

In conclusion, the study documents that the Kavach intervention resulted in a significant increase in consistent condom use with both paid and non-paid female partners. Exposure to mid-media alone substantially increased consistent condom use by truckers with paid female partners whereas exposure to project-run clinics had a significant impact on increasing condom use with non-paid female partners. These findings suggest the need for intensive mid-media events to increase awareness of HIV and easily accessible clinics that provide counseling on safe sex practices and STI treatment services to truckers to increase the adoption of consistent condom use with non-regular female partners. It also highlights the need to understand truckers' risk perceptions, needs and the barriers to the uptake of project-run clinic services even after repeated attempts to promote behavior change.

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ORIGINAL RESEARCH

Evaluating the McDonald's business model for HIV prevention among truckers to improve program coverage and service utilization in India, 2004–2010

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Background: This study describes the experiences and results of a large-scale human immunodeficiency virus (HIV) prevention intervention for long-distance truck drivers operating on the national highways of India.

Methods: The intervention for long-distance truckers started in 2004 across 34 trans-shipment locations. However, due to poor coverage and utilization of services by truckers in the initial 18-month period, the intervention was redesigned to focus on only 17 trans-shipment locations. The redesigned intervention model was based on the McDonald's business franchise model where the focus is on optimal placement of services, supported with branding and standardization of services offered, and a surround sound communication approach. Program output indicators were assessed using program monitoring data over 7 years (2004–2010) and two rounds of cross-sectional behavioral surveys conducted in January 2008 (n = 1402) and July 2009 (n = 1407).

Results: The number of truckers contacted per month per site increased from 374 in 2004 to 4327 in 2010. Analysis of survey data showed a seven-fold increase in clinic visits in the past 12 months from 2008 to 2009 (21% versus 63%, $P < 0.001$). A significant increase was also observed in the percentage of truckers who watched street plays (10% to 56%, $P < 0.001$), and participated in health exhibitions (6% to 35%, $P < 0.001$). Furthermore, an increase from round 1 to round 2 was observed in the percentage who received condoms (13% to 22%, $P < 0.001$), and attended one-one counseling (15% to 21%, $P < 0.01$). Treatment-seeking from program clinics for symptoms related to sexually transmitted infections increased six-fold during this period (16% versus 50%, $P < 0.001$).

Conclusion: Adoption of a business model for HIV prevention helped to increase program coverage and service utilization among long-distance truckers. Implementing HIV prevention programs in a highly mobile population such as truckers, in a limited number of high-impact locations, supported by branding of services, could help in saturating coverage and optimum utilization of available resources.

Keywords: truckers, human immunodeficiency virus, HIV prevention, program redesign, coverage, sexually transmitted infection

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Introduction

The role of truckers, particularly long-distance truckers, as an effective bridge in spreading human immunodeficiency virus (HIV) infection from high-risk groups, such as female sex workers, to low-risk women in the general population has been highlighted.[1,2] Truckers spend much of their time on the road, where they are likely

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to engage in risky sexual activities. Their likelihood of exposure to HIV prevention programs is also restricted due to their constant mobility. The situation of truckers in India is no different from that in other countries. There are about 5 million truckers including helpers in India, of whom about 40% operate on long-distance routes covering more than 800 km one way.[3] Previous research in India among truckers has revealed a high rate of unprotected sex with female sex workers and sexually transmitted infection (STI).[4–7] A large biobehavioral survey indicates that one-fifth of long-distance truckers were using condoms inconsistently with paid female partners and one in five truckers were diagnosed with an STI, including HIV and syphilis.[7]

HIV prevention interventions targeted at truckers started in India in 1993, when truckers were provided clinical services at major highway stopping points.[8] Thereafter, an upscaled intervention, popularly known as "healthy highways," was introduced in 1996 across 200 sites spread over 19 states. The intervention sites were either trans-shipment locations (places where trucks are unloaded and reloaded, or halt for maintenance and replenishing supplies) or roadside cafes along the highway.[9–11] An evaluation of the healthy highways intervention in 2000 revealed that only 43% of truckers and 29% of helpers reported consistent condom use with nonregular female partners.[12] An independent survey among health care providers indicated that STI care management in the healthy highways intervention lacked attention, particularly in physical examination, prescription of standard medicines and regimen, counseling on condom use, and partner referral for STI treatment.[13] Subsequently, a few small-scale interventions engaged peer educators as part of their behavior change communication strategy.[14–17] These programs focused on the distribution of educational materials on safe sex practices, condom promotion, and treatment for STI-related symptoms at STI clinics run by the program. In the late 1990s, the Bhoruka Public Welfare Trust established "free tea parlors" at major truck halt points where truckers were encouraged to utilize STI clinic services.[18]

However, the healthy highways and other small-scale interventions supported by the government and donor agencies worked independently without any coordinated efforts to scale up the program. Further, most of these programs were mainly driven by the peer education strategy to change the behavior of truckers, which may have resulted in low outreach among these men, given their high degree of mobility. In order to reach the target population at scale, the Bill and Melinda Gates Foundation initiated a comprehensive nationwide intervention for long-distance truckers in 2004 known as Kavach (meaning "shield" in Hindi/Urdu).[19] The highlight of the Kavach intervention was to adopt a successful business model to increase the effectiveness of the HIV prevention program. The program was founded on the basic principles of how an intervention can be designed to reach a highly mobile population like truckers, and how innovative communication mechanisms can be designed to sustain behavior change in this group. This paper describes the intervention and discusses how the challenges were addressed through a redesign process with the adoption of a business model. Further, it examines the program outputs in terms of coverage and service utilization by long-distance truckers.

Materials and methods

Intervention

The Kavach intervention was initiated in 2004 by contracting 34 local nongovernmental organizations with prior experience of working with truckers to cover various trans-shipment locations across the country. The program implemented activities similar to those used for healthy highways and other small-scale interventions.

An assessment of the program monitoring data in 2005 revealed that only 4% of those who accessed STI services were indeed long-distance truckers, which was significantly lower than the expected project target. Further, half the individuals who accessed program services were either short-haul truckers or workers in the trans-shipment locations. Qualitative discussions with local nongovernmental organizations and other stakeholders revealed that the main reason for suboptimal performance of the program was inappropriate allocation of services/resources. Several other factors were identified, including lack of standardization of services, continued communication fatigue, limited branding and visibility, the short attention span of truckers, and the need for message reinforcement. The program management decided to redesign its strategy in 2006 in order to improve the utilization of services and coverage of the target population.

Implementation of redesigned program

The redesigned intervention strategy was adapted from the well known McDonald's business franchise model, which is based on the concept of a uniform look and service across all franchise outlets.[20,21] Therefore, the redesigning process focused mainly on creating convenience of access through intelligent placement of services, standardization of service delivery, and a uniform look and feel across network clinics. A surround sound communication approach was used, where the number of service touch points was increased within a trans-shipment location to ensure message reinforcement and

recall. Further, peer educators from the trucking community were engaged to create awareness about HIV, STIs, and condom use through different innovative interpersonal communication tools. Allocation of service points at optimal locations was done by reducing the number of intervention sites. Trans-shipment locations were selected based on information such as volume of truckers visiting the site (10,000 truckers per month), geographic location, and the average time spent by truckers at the site. In addition, a broker/transporter census was conducted in 2006 which enumerated 766,028 truckers, of whom 451,699 were long-distance truckers. Based on this information, 17 sites (15 trans-shipment locations and two check posts) were identified for intensive intervention in the redesigned phase of the program. These sites were strategically located on the golden quadrilateral highway route connecting the metropolitan cities of Delhi, Kolkata, Chennai, and Mumbai (Figure 1).

Provision of STI treatment

In the redesigned intervention approach, efforts were made to achieve high clinic visibility, efficiency, and accessibility. Two types of clinics were set up static clinics (one at each intervention site) and satellite/mobile clinics (six clinics at each intervention site). Static clinics were located at a fixed location in the trans-shipment location, while satellite clinics were organized in natural traffic areas of the trans-shipment location. Around 80 satellite clinics were set up initially, most of which were in the offices of brokers/transporters, with 120 hours of clinical services provided per site per month. Clinics were branded as "Khushi" clinics (Khushi meaning "happiness" in Hindi) with a distinctive logo consisting of two flowers, indicating happiness; these clinics were positioned as general health clinics rather than as exclusive STI clinics to reduce the stigma associated with such clinics. To ensure clinical services had a uniform look and feel, all clinics were painted yellow and blue and a standardized interface of services was developed across the intervention sites. Truckers visiting a Khushi clinic for the first time were issued a diary (called a Khushi passport) in which details of the client's medical history, diagnosis, and medication provided at each clinic visit were recorded. Truckers were instructed to carry this diary with them during clinic visits. The diary also contained the addresses of all Khushi clinics across the country to encourage truckers to access services while on the move.

Figure 1 Map of India showing trans-shipment locations and operating routes among long-distance truck drivers.
Abbreviation: TCIF, Transport Corporation of India Foundation.

Enhanced communications activity

One of the important strategies in the redesigned phase was the adoption of a surround sound communication approach, which is an integrated and multilayered behavior change communication strategy. Outreach workers were replaced with peer educators, who were either active truckers or ex-truckers, to conduct interpersonal communication sessions with fellow truckers. Peer educators were given intensive training on the use of participatory tools and audiovisual aids, including flip books, flash cards, and discussion guides. The training sessions emphasized dialog-based communication designed to generate audience participation and interesting interaction. Trainings were organized at the site level to enable hands-on training. Peer educators facilitated discussions in a group of 10–12 fellow truckers on HIV, STIs, common misconceptions, and the importance of condom use. Typically, group participatory sessions lasted 60–90 minutes. In addition, a multilayered communication strategy was used to ensure message recall and synchronization across locations by street plays, health games, film shows, and distribution of audio cassettes. A series of selected themes related to common misconceptions on STI/HIV transmission among truckers were identified for the communication strategy. Presentation styles of theme messages were standardized to ensure uniform messaging across sites. Theme messages were updated every 6 months to keep them new and contextual. Therefore, while designing communication activities, the views expressed by truckers during focus group discussions were taken into account.

Data

The data used to examine progress in program outputs were drawn from two sources: program monitoring data and two rounds of behavioral tracking survey.

Program monitoring data

Program monitoring data were collected in paper formats on a monthly basis by program implementing nongovernmental organizations at the site level, which were then aggregated and computerized at the national level. Truckers who accessed services from the Kavach intervention were assigned a unique identification number to track their service utilization in any site across the country. Data on program coverage and service utilization were collected in this system from 2004 to 2010 (Figure 2). Examples of key indicators for which information was generated include number of truckers contacted, number of truckers visiting Khushi clinics, number of truckers diagnosed with STIs, and number of condoms socially marketed.

Behavioral tracking survey

The behavioral tracking survey is a cross-sectional survey conducted in multiple rounds to assess program exposure, service utilization, effectiveness of communication activities, knowledge and risk perceptions about HIV, condom use, and treatment-seeking behaviors among truckers. We used data from two rounds of the behavioral tracking survey conducted during January–February 2008 and July–August 2009 to examine program coverage and service utilization among truckers. Six intervention sites were purposefully selected to represent different regions of the country. The selected sites were located at Ghaziabad and Delhi (representing northern India), Indore (representing central India), Mumbai and Pune (representing western India), and Bengaluru (representing southern India). A combined sample size of 1400 across the six sites was fixed for each round of the survey. The total sample size was distributed across the six survey locations according to the total population of truckers in those sites.

Samples were drawn using a two-stage sampling process; in the first stage, clusters were formed based on the parking areas for trucks. In the second stage, respondents were randomly selected from selected clusters after screening them for eligibility. The eligibility criteria for participation in the study were males who were 18 years or older, had worked as a trucker for at least 2 years, and had worked in a truck with a national permit (ie, permission from the government to carry goods across the country). The number of interviews to be conducted in a cluster was decided proportionately according to the proportion share of number of truckers in the cluster with respect to the number estimated in the site. The registration number of trucks parked in each cluster on the day of the survey was listed and a systematic random sampling approach was used to select the trucks. The drivers or helpers of the selected trucks were approached to participate in the survey. If a respondent was not found to be eligible, he was replaced with another respondent selected from the same cluster following the systematic random sampling approach. The same process was followed in the event that a respondent refused to participate in the survey. At the end of the survey, 1403 and 1407 truckers, respectively, in round 1 and round 2, completed the questionnaire.

This behavioral study was conceived as routine program monitoring to improve the program implementation and its outcomes. Therefore, the study was not formally reviewed and approved by any institutional review board. However, ethical principles were followed in conducting the study, including the use of a consent form in the questionnaire. In order to protect the confidentiality of the respondents,

National AIDS control program, phase 2 (2000–2006)		Program monitoring data
2004	• Intervention initiated in 11 sites	
2005	• Intervention expanded to 34 sites	
	• Assessment of service delivery using program monitoring data	
	• Qualitative assessment of program coverage and service utilization at selected sites	
2006	• Redesign of intervention strategy based on McDonald's franchise model	
	• Intervention sites reduced to 17 trans-shipment locations and check posts	
National AIDS control program, phase 3 (2007–2012)		
2008	• Behavioral tracking survey, round 1 conducted in January 2008	
2009	• Behavioral tracking survey, round 2 conducted in July 2009	
2010	• Transition of program to national AIDS control organization initiated	

Figure 2 Time lines of occurrence of important program activities during Kavach intervention.

we did not collect any identifiers (name or address) in the questionnaire or any other research document, and the participant was informed of the same. All participants were told the possible harms and benefits associated with their participation before the start of the interview. To maintain privacy, interviews were either conducted inside the truck or in a secluded public area such as road corners where others would not be able to listen to the interview. Participants were not given any monetary compensation for participation in the study. Only participants who consented voluntarily were interviewed in the study. Trained research investigators used a structured questionnaire to collect data after taking consent of individuals. Research investigators were graduates in social science and native speakers of the local language of the survey site. The questionnaires were developed in English and then translated into the local language of the survey site. Study investigators who were fluent in both English and the local language reviewed the translated questionnaires. These translated questionnaires were pretested in similar settings before the start of the survey.

Measures

The following key indicators from program monitoring data were used to examine program coverage and the extent of service utilization: number of truckers contacted per month per site, number of truckers visiting the Khushi clinic per month, number of condoms socially marketed, and number of condoms sold per trucker. Definitions of these indicators are presented in Table 1.

The behavioral tracking survey collected information on truckers' sociodemographic characteristics, program coverage, and service utilization using a structured questionnaire. Single item questions were used to gather information on different program coverage and service utilization indicators. The key measures used to examine program coverage in the 12 months prior to the survey were: visited a Khushi clinic, watched street plays, participated in health exhibitions and film shows, and attended trucker festivals. Service utilization by truckers in the 12 months prior to the survey was assessed using the following measures: percentage of truckers who received health cards/condoms/one-one counseling, attended health camps, and were referred to an integrated counselling and testing center or detoxification center. All these measures were coded as "1" if respondents reported in the affirmative, or else coded as "0". Three outcome indicators were assessed, ie, awareness of STI-related symptoms, experience of STI-related symptoms in the 12 months prior to the survey, and treatment-seeking from Khushi clinics for STI-related symptoms.

Spontaneous multiple response questions were asked to assess awareness of STI-related symptoms. Responses included commonly occurring STI symptoms among men, such as urethral discharge, genital ulcers, and sores, swelling in the scrotal (groin) area, burning/pain on urination, and inability to retract the foreskin. Respondents answering to any of these symptoms were classified as being aware of STI-related symptoms and coded as "1", or else considered as not aware of STI symptoms (coded as 0). Respondents were categorized as having experienced STI-related symptoms (coded as 1) if they reported experience of any of the following STI symptoms in the 12 months prior to the survey: urethral discharge, genital ulcers, and sores, swelling in the scrotal (groin) area, burning/pain on urination, and inability to retract the foreskin, or else they were considered not to have experienced any STI symptoms and coded as "0". Respondents who experienced any STI-related symptoms were asked if they had sought treatment for their symptoms. Responses to this question were multiple, with Khushi clinics as one of the response categories. Respondents who reported seeking treatment from a Khushi clinic provider were considered to have sought treatment from a Khushi clinic and coded as "1".

Statistical analyses

Program monitoring data are presented either in terms of absolute numbers or a percentage relative to a base indicator. Bivariate and multivariate analyses were used to demonstrate the changes in program exposure, behavioral outcome, and service utilization from two rounds of behavioral tracking survey data. A pooled data set of round 1 and round 2 of the behavioral tracking survey was prepared, with an indicator variable indicating the survey round (round 1, 0; round 2, 1). Multiple logistic regression models were fitted, with the survey round as the key independent variable and exposure to communication activities and service utilization as the dependent variables. Multivariate models were adjusted for age, education, marital status, duration of trucking industry, and route category where the trucker operates, and the results are presented in terms of adjusted odds ratios (AOR) with the corresponding 95% confidence interval (CI). All bivariate and multivariate analyses were carried out using STATA version 12 (StataCorp, College Station, TX, USA).

Results

The intervention was started with eleven sites in 2004 and scaled up to 34 sites, with one clinic per site, in 2005 (Table 2). With the redesign of the program, the number

Table 1 Definition of program monitoring indicators

Indicators	Definition
Number of truckers contacted at least once a month per site	Represents the number of unique long-distance truckers who were contacted by the outreach team in a month. This indicator was derived after taking the average for all 12 months in a year divided by the number of intervention sites.
Number of individuals (truckers + nontruckers) utilizing clinical services per month per clinic	Represents the number of unique individuals utilizing clinical services at Khushi clinics in a month. This was calculated as the average for all 12 months in a year divided by the number of clinics in operation.
Percentage of truckers among total Khusi clinic attendees	Calculated as the number of truckers utilizing clinical services in a month divided by the total number of individuals (truckers + nontruckers) utilizing clinical services at Khushi clinics in the same month multiplied by 100.
Percentage of truckers treated for STI-related symptoms	Represents the number of truckers treated for STI-related symptoms in the reporting period divided by the number of truckers utilizing clinical services at Khushi clinics in that reporting period.
Percentage of truckers who bought medicines	Represents the number of truckers buying medicine from Khushi clinic outlets in a reporting period divided by the number of truckers treated with STI-related symptoms in that reporting period.
Number of condoms socially marketed	Represents the number of condoms socially marketed through traditional, nontraditional outlets and condom vending machines within the trans-shipment locations.
Number of condoms sold per trucker in a year	Calculated as total number of condoms socially marketed divided by number of truckers who bought condoms.

Abbreviation: STI, sexually transmitted infection.

of intervention sites was reduced to 17, with at least two clinics per site after the redesign process. Post redesign, the number of truckers contacted per month per site increased multi-fold each year. The proportion of truckers using clinical services also increased; initially, only about two-thirds of the individuals were truckers, which improved significantly after the redesign of intervention. Those reporting STI-related symptoms declined over the years from 44% in 2004 to 16% in 2010. A considerable increase in the number of condoms socially marketed was also noted (eight condoms sold per trucker in 2004 to 53 condoms sold per trucker in 2010).

The independent cross-sectional surveys support the observations made from the program monitoring data (Table 3). There was a seven-fold increase in visitors to Khushi clinics in the 12 months between January 2008 and July 2009 (21% to 63%, AOR 6.7, 95% CI 5.6–7.9). Exposure to different communication activities increased multi-fold from round 1 to round 2, including attendance at street plays (10% to 56%, AOR 11.3, 95% CI 9.2–14.0), participation in health exhibitions (6% to 35%, AOR 8.6, 95% CI 6.7–11.1), and participation in film shows (4% to 24%, AOR 7.8, 95% CI 5.8–10.6). A significant improvement was also observed in service utilization by truckers. More than one-tenth (13%) had received a health card at the time of the round 1 survey compared with more than one-fifth (22%) in round 2, indicating a two-fold increase between the survey rounds (AOR 1.8, 95% CI 1.5–2.2). Improvements in service utilization from round 1 to round 2 were also noted with regard to receipt of condoms from the program (13% to 22%, AOR 1.8, 95% CI 1.5–2.2) and attendance at one-one counseling sessions (15% to 21%, AOR 1.5, 95% CI 1.3–1.9).

Table 4 suggests that the truckers surveyed in round 2 were 20% more likely to experience STI-related symptoms as compared with those in round 1 (27% versus 22%, AOR 1.2, 95% CI 1.0–1.5). During the two rounds of the survey, treatment-seeking from Khushi clinics for STI-related problems increased about six times from 16% in round 1 to 50% in round 2 (AOR 5.6, 95% CI 3.8–8.2).

Discussion

This redesigned intervention strategy has demonstrated an increase in program coverage and service utilization among long-distance truckers even though the number of intervening sites was reduced by half. The program's redesigned approach offered services at selected trans-shipment locations, supported by uniform branding of clinical services and innovative communication activities. The two independent cross-sectional surveys supported by program monitoring data documented a multi-fold increase in program coverage and service utilization among truckers. The study findings on program exposure are supported by an independent evaluation of trucker programs in India, which indicates that truckers' exposure to HIV prevention intervention increased from 14% in 2007 to 30% in 2009.[7] Another assessment of a truckers program in India suggests that communication activities such as mid-media and interpersonal communication used in the Kavach program contributed significantly to increased condom use with paid and unpaid female sexual partners.[22] The findings from this study corroborated by other studies suggest that optimum placement of service at few locations can yield better outcomes in HIV prevention programs among truckers.

This redesigned intervention demonstrates that successful business models can be adopted for health service delivery. Influenced by the business franchise model of McDonald's,[20,21] the Khushi clinics were branded with a

Table 2 Program exposure and service utilization as observed in the program monitoring data, 2004–2010

Indicators	Pre redesign stage of intervention		Post redesign stage of intervention				
	2004	2005	2006	2007	2008	2009	2010
Number of sites (as of December of the respective year)	11	34	17	17	17	15	12
Number of static clinics	11	34	34	34	34	30	24
Estimated number of truckers	43,535	270,549	322,566	295,000	295,000	285,000	311,667
Number of truckers contacted at least once a month per site[$]	374	580	910	2791	3576	4045	4327
Number of individuals (truckers + nontruckers) utilizing clinical services per month per clinic[$]	90	253	382	515	641	682	717
Percentage of truckers among total Khushi clinic attendees per month per clinic[$]	63.3	67.0	78.9	89.9	95.2	94.4	90.7
Percentage of truckers treated for STI-related symptoms	44.4	33.1	26.0	23.1	22.8	21.4	16.1
Percentage of truckers who bought medicines from Khushi clinic	0.0	0.0	7.0	74.7	91.2	95.1	97.8
Number of condoms socially marketed	33,510	465,149	704,511	1,306,837	1,609,553	1,959,525	2,738,411
Number of condoms sold per trucker in a year	8	24	46	28	26	32	53

Note: [$]Calculated as average of 12 months in the year of observation.
Abbreviation: STI, sexually transmitted infection.

uniform look and service across trans-shipment locations. Empirical evidence suggests that franchise models have the potential to increase access to services and ensure standardized quality of services through a recognized brand.[23–26]

Table 3 Change in level of program exposure and service utilization among long-distance truck drivers from January 2008 to July 2009, according to behavioral tracking surveys

	Round 1[a] (n = 1402)	Round 2[b] (n = 1407)	Adjusted OR[c] (95% CI)
Program exposure in last 12 months			
Visited Khushi clinic	20.5	62.8	6.7 (5.6–7.9)
Watched street plays	10.4	56.1	11.3 (9.2–14.0)
Participated in health exhibitions	6.3	34.8	8.6 (6.7–11.1)
Participated in film shows	4.1	23.7	7.8 (5.8–10.6)
Attended trucker festival	12.4	24.7	2.4 (2.0–3.0)
Received audio cassettes	14.1	28.5	2.5 (2.0–3.0)
Service utilization in last 12 months			
Received health card	13.1	21.7	1.8 (1.5–2.2)
Attended health camp	6.2	18.9	3.7 (2.8–4.8)
Received condoms	13.4	22.0	1.8 (1.5–2.2)
Received one-one counseling	15.4	20.8	1.5 (1.3–1.9)
Referred to ICTC, detoxification center	2.3	8.7	4.1 (2.7–6.1)

Notes: [a]Survey round 1 was conducted in January 2008, n = 1402; [b]survey round 2 was conducted in July 2009, n = 1407; [c]odds ratio adjusted for age, education, marital status, duration of experience in the industry, and route category.
Abbreviations: CI, confidence interval; ICTC, integrated counseling and testing centers; OR, odds ratio.

Franchising models of clinics have been successfully adopted to provide reproductive health and family planning services.[23,25,26] A social franchising clinic model in Vietnam to provide reproductive health and family planning services demonstrated that such a social franchise model can help to increase the use of reproductive health and family planning services in smaller public sector clinics.[23] However, the use of franchise models in HIV prevention programs is rare. The branding of Khushi clinics in terms of uniform look and color helped truckers to identify these clinics in different intervention locations. Moreover, this strategy was very effective in drawing the attention of truckers given the low literacy and high frequency of mobility. Although the findings suggest that the franchise model of service provision can be highly successful in HIV prevention programs, it requires extensive advertising through innovative communication channels. Further, a similar approach has been used to provide STI services to female sex workers and clients of female sex workers in different parts of India. The findings of this intervention can serve as a stepping stone in evaluation of such interventions in the future. Moreover, providing STI services through a chain of uniform STI clinics may be highly successful among migrants in India, who are now being recognized as a major source of HIV infection transmission from destination areas to source areas.[27]

Table 4 Change in level of awareness of STI-related symptoms, experience of STI-related symptoms, and treatment-seeking behavior from January 2008 to July 2009

Outcome indicators	Round 1[a] (n = 1402)	Round 2[b] (n = 1407)	Adjusted OR[c] (95% CI)
Aware of STI-related symptoms	74.8	82.4	1.5 (1.3–1.9)
Experienced STI-related symptoms in last 12 months	22.4	27.4	1.2 (1.0–1.5)
Sought treatment from Khushi clinic for STI[d]	15.9	49.9	5.6 (3.8–8.2)

Notes: [a]Survey round 1 was conducted in January 2008, n = 1402; [b]survey round 2 was conducted in July 2009, n = 1407; [c]odds ratio adjusted for age, education, marital status, duration in the trucking industry, and route category; [d]analyzed among respondents who had STI-related symptoms in the 12 months prior to the survey.
Abbreviations: CI, confidence interval; STI, sexually transmitted infection; OR, odds ratio.

The branding of Khushi clinic resulted in a sharp increase in the utilization of clinical services by truckers over the years, which is evident from both the program monitoring and survey data. In addition to the uniform look and feel of Khushi clinics, packaging of these clinics as general health clinics helped in reducing the stigma associated with STI clinics and could also have translated into increased clinical service utilization. The decision to establish clinics near brokers' premises also resulted in an increase in the number of truckers accessing clinic services. The steady increase in the volume of truckers visiting clinics over the years indicates that truckers are strongly motivated to visit these clinics due to the quality of services being offered. Moreover, the existence of strong social networking among individuals would also have contributed to increased clinic outflow over the years.[23]

Consistent with the increase in program coverage over the years, the two rounds of cross-sectional surveys also demonstrated a significant improvement in truckers' participation in different communication activities, which is most likely due to systematic peer outreach activity in conjunction with a surround sound communication strategy. The use of peer educators has been demonstrated to be successful in previous interventions for truckers in India.[14–17] Discussion between peer educators and fellow truckers helped in understanding the attitude and expectation of truckers towards STI/HIV services offered through the Kavach program. The concerns expressed in those discussions were addressed and helped in designing innovative communication materials according to the needs of the trucking community. One of the challenges faced by the program was the high turnover rate of peer educators; in cases where peer educators dropped out, new peer educators were immediately recruited and provided with the necessary training. Further, the increase in exposure to communication activities resulted in improved safe sex behavior.[22]

The trend emerging from the program monitoring data suggests that there was a significant increase in program coverage and service utilization from 2004 to 2005. This is due to the increase in number of intervention sites which went from 11 in 2004 to 34 in 2005. However, with the redesigned strategy in place since 2006, most service utilization indicators have showed improvement or remained stable over the years. Further, the redesigned strategy ensured higher usage of services by trucker population rather than by individuals from the nontrucking community as was the situation prior to 2006. These trends suggest that approaches used in the redesigned intervention can be effective for increasing service utilization among truckers, who are recognized as a highly mobile population group in India and elsewhere.[7] Further, the services offered in Kavach program were aligned to guidelines prescribed by the National AIDS Control Program (NACP). Moreover, there was a change in guidelines for national HIV prevention programs during the intervention period, because there was a transition from NACP phase 2 (2000–2006) to phase 3 (2007–2012). The NACP-2 prioritized STI diagnosis and treatment services whereas in NACP-3 the focus was on referral to integrated counseling and testing centers alongside STI diagnosis and treatment.[3] As a result of these policy-level changes, the efforts towards referral to integrated counseling and testing centers was poor prior to 2006, and more intensive efforts were made starting only in 2007. These efforts resulted in a four-fold increase in referral to integrated counseling and testing centers from 2008 to 2009.

The findings of this study should be viewed in the light of certain limitations. The cross-sectional surveys used to assess service utilization were conducted after the redesign of the intervention; hence round 1 of the survey is not a true baseline. However, post hoc comparison with selected indicators for which information was collected prior to the redesign suggests that service utilization was poorer before the redesign, and improvement was significantly associated with the redesign process. For example, only 4% of truckers had visited a clinic in the 12 months prior to redesign compared with 21% and 63%, respectively, in survey round 1 and 2. Further, the intervention had no control group, so one can argue that the changes observed were merely temporal rather an outcome of the intervention. Post hoc analysis suggests that truckers who had never visited Khushi clinics

were less likely to be exposed to communication activities and receive program services, indicating the role of the intervention in improving service utilization. There could also be some degree of bias because of use of program monitoring data. In the first year of intervention, although a standardized data collection tool was developed and shared with local nongovernmental organizations, some did not collect data as per the suggested guidelines, resulting in some bias. However, in subsequent years, training was conducted for personnel in charge of monitoring systems at local nongovernmental organizations, which improved data quality.

In summary, adoption of a business franchise model for an HIV prevention program among truckers resulted in better program coverage and utilization of services. Implementing the program among a highly mobile population like truckers in a limited number of high-impact locations in combination with branding and standardization of services could help in saturating the coverage and optimum utilization of available resources. The lessons learnt from this intervention could be extremely useful for HIV prevention programs throughout India and in other geographic settings. Similar franchise models for clinics can be established in HIV prevention programs targeted at migrant populations. Male migrants make both interstate and intrastate moves, and are prone to negative health effects, including STIs, in their destination areas. Establishing clinics with a uniform look and services will enable migrants to locate and access these clinics easily. Further, a consolidated national presence through network clinics and an integrated approach to programming rather than a stand-alone approach are crucial for maintaining sustained engagement with mobile populations, such as truckers and migrants.

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Disclosure

The authors report no conflicts of interest in this work.

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HIV risk behaviours among injecting drug users in Northeast India following scale-up of a targeted HIV prevention programme

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Abstract

Background: In the Northeast Indian states of Manipur and Nagaland there has been an ongoing HIV epidemic among injecting drug users (IDUs) since the mid-1990s. Project ORCHID is an Avahan-funded HIV prevention project that has been working in selected districts of Manipur and Nagaland since 2004. It supports local partner non-government organisations (NGOs) to deliver a range of harm reduction interventions, and currently reaches approximately 14,500 IDUs across the two states. To assess changes in HIV risk behaviours two Behavioural Tracking Surveys (BTS) were undertaken among IDUs in 2007 and 2009.

Methods: The BTS used respondent driven sampling (RDS) to recruit adult male IDUs (18 years of age and above) from Ukhrul and Chandel districts in Manipur, and Kiphire and Zunheboto districts in Nagaland. This paper reports on analysis of socio-demographics, drug use and injecting practices, sexual behaviour and condom use, knowledge of HIV, and exposure to interventions. Descriptive data were analysed using RDSAT, and odds ratios were calculated in SPSS.

Results: The proportion of IDUs reporting NOT sharing needles / syringes at last injection increased substantially in Ukhrul (59.6% to 91.2%) and Zunheboto (45.5% to 73.8%), remained high in Chandel (97.0% to 98.9%), and remained largely unchanged in Kiphire (63.3% to 68.8%). The use of condoms with regular partners was low in all districts at both time points. In Ukhrul, Kiphire and Zunheboto the proportion of IDUs using condoms during sexual intercourse with a casual partner increased substantially to approximately 70-85%, whilst in Chandel the increase was only marginal (57.4% to 63.6%). Exposure to NGO HIV prevention interventions was significantly associated ($p<0.05$) with lower odds of sharing needles during the previous month (Nagaland, OR=0.63; Manipur, OR 0.35).

Conclusion: Despite district-level differences, the results from this BTS study indicate that exposure to HIV prevention services, predominately delivered in this region by NGOs, is associated with a reduced likelihood of engaging in HIV risk behaviours. IDUs using HIV prevention services are more likely to engage in safe injecting and sexual practices, and effort is required to sustain / increase opportunities for IDUs to access these services. These outcomes are a noteworthy achievement in a very challenging context.

Background

Injecting drug users (IDUs) are at high risk of infection with blood-borne viruses including HIV, hepatitis B and hepatitis C, and are increasingly being targeted by policies aimed at preventing the spread of HIV [1]. Approximately 10% of HIV infections worldwide are attributable to injecting drug use [2], and many countries in Asia, including Thailand, Myanmar, Indonesia, Bangladesh, Nepal and India are confronting serious HIV epidemics among IDUs [3].

In the Northeast Indian states of Manipur and Nagaland, approximately 2% of the population injects drugs [4], most commonly heroin and Spasmoproxyvon (SP, a synthetic opioid analgesic that contains dextropropoxyphene, dicyclomine hydrochloride and paracetamol). Consequent to sharing of injecting equipment during

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drug use, Manipur and Nagaland are two states that consistently report a high HIV prevalence, and in the case of Manipur, the highest in India. According to 2009 sentinel surveillance figures, HIV prevalence among the general population in Manipur was 1.4%, and in Nagaland was 0.8% [5]. Among IDUs, HIV prevalence was 29% in Manipur (2008) and 1.9% in Nagaland (2007) [6]. An Integrated Biological and Behavioural Assessment (IBBA) conducted in 2006 in Manipur and Nagaland reported comparable HIV prevalence figures (23.1% and 32.3% in Bishnupur and Churachandpur in Manipur, and 1.1% and 1.8% in Phek and Wokha in Nagaland) [7]. The prevalence of hepatitis C infection was very high in Manipur (56% in Bishnupur and 78% in Churachandpur), but lower in Nagaland (5.4% in Phek and 16.7% in Wokha). The IBBA study also found widespread sharing of injecting equipment with between 35% and 70% of IDUs reporting that they sometimes engaged in receptive sharing of needles and syringes.

Northeast India is an ethnically distinct and geographically isolated part of the country characterised by a longstanding civil insurgent struggle, poverty and unemployment. Many communities are located in geographically difficult-to-reach areas. The response to HIV and injecting drug use in this geo-politically complex environment was historically punitive and coercive, but a harm reduction approach has been government policy since the mid 1990s [8]. This currently includes provision of needle and syringe exchange programs, condom distribution, opioid substitution therapy (recently evaluated [9]), treatment for sexually transmitted infections (STIs), and behaviour change communication.

The HIV prevention response in these two states is coordinated by the government through the National AIDS Control Organization (NACO) and the respective State AIDS Control Societies (SACS). Alongside this, Avahan (Bill & Melinda Gates Foundation in India) has funded Project ORCHID to provide HIV prevention interventions in selected districts of Manipur and Nagaland over a ten year period (2004-13) [10]. Project ORCHID is a partnership of the Emmanuel Hospital Association, New Delhi, India and the Australian International Health Institute, University of Melbourne, Australia. Regardless of funding source, most of the targeted HIV prevention interventions in Manipur and Nagaland are delivered in the field by local non-government organizations (NGOs).

To assess changes in HIV risk behaviours two Behavioural Tracking Surveys (BTS) were undertaken among IDUs in 2007 and 2009. This paper reports on the comparison between baseline (2007) and follow-up (2009) BTS data obtained from IDUs in two districts of Manipur (Ukhrul and Chandel) and two districts of Nagaland (Kiphire and Zunheboto) where Project ORCHID NGOs are operational. The objectives are: 1) to quantify changes over time with respect to the characteristics of injecting drug users, HIV risk behaviours, awareness of HIV, and exposure to harm reduction interventions, and 2) to estimate associations between exposure to interventions and needle sharing, condom usage and participation in HIV testing.

Methods

Study design

The BTS is a cross-sectional survey that collects behavioural data via an interviewer-administered questionnaire, which was repeated at two different time points (2007 and 2009) in two districts of Manipur and two districts of Nagaland. Ethics approval for this study was obtained from the Institutional Review Board of the Emmanuel Hospital Association Research Ethics Committee, New Delhi.

Sampling method

Respondent driven sampling (RDS) was used to recruit IDUs for participation in the BTS. RDS is a validated probability sampling method devised for use with hidden populations such as sex workers, men who have sex with men, and IDUs, [11] that is based on social network theory and builds on conventional snowball sampling. RDS has previously been used to recruit participants in many HIV biological and behavioural surveillance studies [12]. It uses peer networks for recruitment of participants and involves payment of purposively recruited 'seed' participants, who then refer other participants. RDS data are analysed using RDSAT software that generates appropriately weighted estimated proportions with confidence intervals [11,13]. The weights are designed to account for patterns of recruitment. For this study, a sample size of 400 was estimated based on an ability to detect changes in proportions of 15% at follow-up surveys from estimated baseline values of 50% (which yield the biggest sample size), an alpha level of 0.05 for a two-sided test, and a power of 90%. A design effect of 1.5 was applied to account for intra-class correlation [14].

Data collection

Participants responded to an extensive interviewer-administered questionnaire that was adapted from the one used in the previously mentioned IBBA study undertaken among high risk groups in India [7,15]. This questionnaire has been well-described elsewhere [16]. The adapted BTS questionnaire gathered information on socio-demographics, drug use and injecting practices, sexual behaviour and condom use, knowledge of HIV, and exposure to interventions. Field pre-testing of the questionnaire was undertaken prior to baseline

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measurement. Site supervisors, interviewers, coupon managers and screeners were provided with training to effectively undertake their respective roles.

To be eligible to participate in the study IDUs needed to be 18 years of age or older, and have injected drugs for non-medical purposes at least once within the last six months. Screeners with good knowledge of the local injecting drug use context were employed to ensure participants met the eligibility criteria. To start the RDS sampling chain, four seeds in each of the districts were purposively selected to reflect a diversity of demographic characteristics, particularly; age, drug use pattern, geographical location, marital status and employment status. Each seed was provided with three coded coupons to distribute to the participants they recruited, and each subsequent participant was also handed three coded coupons to distribute amongst their peers. This process continues in waves until the desired sample size is attained. This approach potentially results in recruitment of IDUs who attend Project ORCHID NGO services, those who attend non-Project ORCHID services, and those who do not use any services.

Statistical analysis

Data were entered using CSPro Software and transferred to SPSS and Excel for cleaning and variable construction. Descriptive analysis was undertaken using RDSAT (version 6.0) to generate adjusted proportion estimates with 95% confidence intervals. Logistic regression analyses were conducted using SPSS version 18.0 to estimate the strength of association between exposure to interventions and needle sharing, condom usage and HIV testing; the data for this analysis are grouped at the state (rather than district) level. Odds ratios are presented with their respective 95% confidence intervals and are adjusted for the following variables; district, age, ever been married, literacy, age at initiation into injecting drug use, most commonly used drug, and frequency of drug use during the previous week. These adjusted odds ratios were derived from unweighted estimates. Unfortunately there is no consensus among statisticians as to whether data gathered through RDS can be appropriately weighted for multivariate analysis, and we encourage policy planners to interpret these regression findings with some caution [17].

Results

Participant characteristics

The desired minimum sample size of 400 was achieved through RDS in all four districts at both baseline and follow-up. Some of the participants recruited at follow-up reported participating in the baseline survey; 13.3% (n=56) in Ukhrul, 22.9% (n=95) in Chandel, 29.7% (n=127) in Kiphire, and 28.1% (n=126) in Zunheboto.

The characteristics of IDU participants did not change substantially between round 1 and round 2 except with respect to age (Table 1). The sample was predominantly under the age of 35 years in all four districts at both time points. At baseline and follow-up a large proportion of participants were under 25 years of age in Ukhrul (65.5% and 41.2%), Kiphire (84.1% and 61.0%), and Zunheboto (61.4% and 45.8%). However, the proportion of those aged under 25 years had fallen in these districts indicating a moderately older profile among the participants at follow-up.

Across all four districts a relatively small proportion of participants were employed, and the majority were literate and sexually experienced. In Ukhrul, Kiphire and Zunheboto most had been married, whereas in Chandel only approximately half had been married. The most commonly used drug in Manipur was heroin, whilst in Nagaland the most commonly used drug was Spasmoproxyvon. More than two-thirds reported first injecting drugs for non-medical purposes when they were under the age of 25 years in Ukhrul, Kiphire and Zunheboto; approximately half were under the age of 25 years in Chandel.

HIV risk behaviours

Manipur

In Manipur (Table 2), the proportion of IDUs reporting that they injected at least once daily increased in Ukhrul (36.2% to 58.1%) and decreased in Chandel (96.1% to 75.6%). There was a large improvement in safe injecting practices in Ukhrul evidenced by a substantial increase in the proportion of IDUs that did not share needles with anyone during the past month (59.6% to 91.2%) or at the last injection (71.1% to 97.0%). Additionally, there was a decrease in the proportion of IDUs that drew up drug solutions from a common container at last injection (26.0% to 10.3%), or used to but had stopped (5.6% to 16.9%), between baseline and follow-up. In Chandel, very few IDUs reported sharing needles at last injection and during the past month at both baseline and follow-up, however, there was an increase in the proportion having drawn up drug solutions from common containers at last injection (6.6% to 24.6%). The majority of IDUs in Ukhrul and Chandel had between 1 and 3 female sexual partners in the 12 months preceding both baseline and follow-up questionnaires. The proportion of IDUs using condoms at last sex was higher with casual partners than with regular partners in both Manipur districts. There was little change in the proportion of IDUs using condoms at last sex, except in Ukhrul where a greater proportion using condoms with casual partners at follow-up (60.2% to 80.7%). The proportion of IDUs self-reporting STI symptoms decreased in Ukhrul (37.3% to 21.3%) and increased in Chandel (8.0% to 16.4%).

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Table 1 Socio-demographic profile

	Manipur				Nagaland			
	Ukhrul		Chandel		Kiphire		Zunheboto	
	(%)		(%)		(%)		(%)	
	2007	2009	2007	2009	2007	2009	2007	2009
N *(All respondents)*	421	421	420	415	417	427	422	449
Age								
18-24	65.5	41.2	23.8	26.5	84.1	61.0	61.4	45.8
25-34	26.1	42.3	53.9	46.9	13.1	36.3	30.3	43.6
35+	8.3	16.3	22.1	26.5	2.8	2.6	8.3	10.4
Literacy								
Cannot read and write	0.2	6.4	25.9	6.1	34.0	12.8	24.7	19.3
Can read only	1.9	3.2	2.2	1.7	4.3	9.0	3.3	13.1
Can read and write	97.7	90.3	71.7	88.6	61.6	78.1	71.9	67.5
Occupation								
Unemployed	55.4	42.6	14.9	23.1	26.9	37.2	58.9	63.4
Student	24	8.1	4.4	8.4	26.4	19.2	7.1	13.3
Employed	6.2	13.0	21.5	25.2	10.2	19.2	11.9	12.3
Other[a]	14.4	36.1	58.9	43.2	35.4	24.2	22.1	10.6
Ever been married								
Yes	16.0	27.1	49.8	49.8	19.4	24.6	13.1	29.5
No	83.9	72.8	50.1	48.8	80.6	75.3	86.6	70.4
Age at first injection								
Younger than 18	23.3	27.8	3.4	2.4	19.6	8.7	13.8	1.2
18-24	68.7	69.1	49.2	49.3	75.8	75.0	64.3	70.5
25-34	7.3	1.2	36.7	35.8	4.6	16.3	19.0	25.3
35 or older	0.6	2.1	10.8	12.5	0.0	0.0	2.9	3.0
Two most commonly used drugs[b]								
Heroin	77.0	86.1	97.9	96.2	11.1	44.4	–	8.6
SP	77.3	25.9	9.2	8.9	99.2	98.4	–	97.0
Ever had sexual intercourse								
Yes	81.1	89.9	75.0	83.8	82.7	86.6	71.5	90.2
No	18.5	10.1	24.9	16.1	17.3	13.3	28.4	9.7

[a] Other category includes agricultural, small time business, and unskilled labour.

[b] Multiple responses allowed.

– Data unavailable for analysis.

Nagaland

In Nagaland (Table 2), the proportion of IDUs injecting at least once daily decreased in Kiphire (43.0% to 28.8%) and Zunheboto (36.6% to 26.7%). Mixed results were obtained with respect to changes in the practice of sharing needles / syringes. In Zunheboto, the proportion of IDUs that did not share at the last injection increased substantially (45.5% to 73.8%), while the proportion sharing at least once during the past month remained largely unchanged (68.7% to 72.0%). In Kiphire, the proportion of IDUs that did not share needles in the past month decreased from 85.4% to 64.1%, whilst the proportion not sharing needles at the last injection remained largely unchanged (63.3% to 68.8%). There was a modest increase in the proportion drawing up drug solutions from common containers at last injection in both Kiphire (30.7% to 46.8%) and Zunheboto (41.3% to 53.8%). Very few IDUs in Kiphire and Zunheboto had no female sexual partners in the 12 months preceding both baseline and follow-up questionnaires; approximately one third had between 2 and 3 sexual partners. A greater proportion of IDUs used condoms with casual partners at last sex at follow-up in both Kiphire (44.6% to 73.6%) and Zunheboto (44.9% to 86.0%). However, there was a decrease in the proportion using condoms with regular partners at last sex in both Kiphire (47.3% to 38.1%) and Zunheboto (52.4% to 33.4%). The proportion of IDUs self-reporting STI symptoms decreased in Zunheboto (21.1% to 11.4%) and increased in Kiphire (9.5% to 19.4%).

Exposure to interventions and knowledge of HIV

Table 3 presents indicators of exposure to interventions and awareness of HIV. The general overall trend was an increase in IDUs accessing NGO services and a greater awareness of HIV, although some district level variation was evident. The proportion of IDUs accessing NGO services during the previous 6 months increased substantially in Ukhrul (43.2% to 81.8%) and Kiphire (54.7% to 76.6%), remained high in Chandel (84.5% to 84.4%), and did not improve in Zunheboto (56.2% to 61.5%). There was an increase in IDUs registering with ORCHID NGOs

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Table 2 Profile of injecting drug use and sexual practices

	Manipur			
	Ukhrul		Chandel	
	Baseline % (95% CI)	Follow-up % (95% CI)	Baseline % (95% CI)	Follow-up % (95% CI)
Frequency of injecting in the last week				
At least once daily	36.2 (29.2 – 43.0)	58.1 (0.50 – 65.9)	96.1 (93.5 – 97.7)	75.6 (70.1 – 81.0)
4-6 times a week	17.7 (12.8 – 22.0)	10.7 (6.6 – 16.0)	0.7 (0.2 – 1.4)	5.4 (3.4 – 7.7)
2-3 times a week	34.0 (27.8 – 39.4)	18.2 (12.6 – 25.1)	1.5 (0.6 – 2.9)	8.5 (5.4 – 12.0)
Only once	10.9 (7.3 – 17.4)	12.6 (7.6 – 17.4)	1.8 (0.7 – 3.1)	10.5 (6.4 – 14.3)
Don't know / remember	1.2 (0.3 – 2.6)	0.3 (0.1 – 0.7)	–	–
Did NOT share needles / syringes during past month	59.6 (53.6 - 65.2)	91.2 (88.0 – 94.0)	96.3 (94.2 – 98.0)	95.3 (92.7 – 97.5)
Did NOT share needles / syringes at last injection	71.1 (66.4 – 76.0)	97.0 (95.1 – 98.2)	97.0 (95.4 – 98.4)	98.9 (97.9 – 99.7)
Drew up drug solutions from a common container at last injection	26.0 (22.1 – 30.9)	10.3 (6.9 – 13.9)	6.6 (4.5 – 8.8)	24.6 (19.1 – 29.9)
Number of female partners had sex with in the past 12 months				
None	3.8 (1.6 – 6.5)	12.7 (8.7 – 19.0)	9.6 (6.4 – 13.1)	20.3 (16.7 – 25.9)
1	34.4 (28.9 – 41.7)	40.3 (32.3 – 45.5)	73.6 (66.7 – 78.1)	67.0 (60.9 – 72.3)
2-3	37.3 (31.1 – 43.1)	22.5 (17.4 – 29.0)	11.6 (8.3 – 16.4)	11.6 (7.3 – 15.2)
>3	24.5 (19.5 – 28.9)	24.5 (19.1 – 30.9)	5.2 (2.8 – 8.8)	1.1 (0.4 – 1.9)
Condom use at last sex				
Regular partner	40.5 (29.0 – 44.2)	48.0 (36.4 – 57.4)	34.7 (23.5 – 45.7)	27.4 (18.6 – 34.2)
Casual partner	60.2 (55.9 – 72.2)	80.7 (67.9 – 87.1)	57.4 (37.3 – 77.1)	63.6 (51.5 – 85.6)
STI symptoms during past 12 months	37.3 (32.5 – 41.9)	21.3 (16.4 – 25.8)	8.0 (5.8 – 10.6)	16.4 (12.5 – 20.5)
	Nagaland			
	Kiphire		**Zunheboto**	
	Baseline % (95% CI)	Follow-up % (95% CI)	Baseline % (95% CI)	Follow-up % (95% CI)
Frequency of injecting in the last week				
At least once daily	43.0 (38.5 – 51.9)	28.8 (22.8 – 33.1)	36.6 (29.3 – 43.4)	26.7 (20.7 – 33.9)
4-6 times a week	28.0 (22.1 – 32.8)	24.6 (18.8 – 29.3)	30.6 (24.1 – 36.2)	52.0 (45.7 – 59.0)
2-3 times a week	22.7 (17.3 – 26.4)	33.7 (28.7 – 41.8)	32.1 (26.4 – 40.2)	13.6 (10.6 – 17.8)
Only once	5.6 (2.4 – 8.4)	12.9 (8.2 – 18.6)	0.7 (0.0 – 1.7)	7.0 (3.6 – 8.2)
Don't know / remember	–	–	–	0.7 (0.0 – 1.5)
Did NOT share needles / syringes during past month	85.4 (81.7 – 94.0)	64.1 (59.1 – 68.8)	68.7 (61.6 – 75.1)	72.0 (66.8 – 76.6)
fDid NOT share needles / syringes at last injection	63.3 (18.3 – 87.7)	68.8 (63.7 – 73.5)	45.5 (30.7 – 50.8)	73.8 (68.6 – 78.3)
Drew up drug solutions from a common container at last injection	30.7 (26.8 – 35.1)	46.8 (40.9 – 52.8)	41.3 (35.9 – 45.5)	53.8 (47.9 – 59.1)
Number of female partners had sex with in the past 12 months				
None	3.5 (1.9 – 6.0)	0.0 (0.0 – 0.0)	3.7 (1.8 – 5.1)	0.3 (0.0 – 0.06)
1	45.6 (39.9 – 51.3)	38.1 (24.9 – 36.6)	42.7 (32.8 – 47.1)	54.2 (50.1 – 61.8)
2-3	33.2 (27.3 – 38.0)	31.0 (24.9 – 36.6)	27.5 (22.3 – 33.4)	29.7 (24.7 – 36.1)
>3	17.7 (14.6 – 21.3)	30.9 (25.4 – 37.0)	26.1 (23.7 – 34.6)	15.8 (10.2 – 17.3)
Condom use at last sex				
Regular partner	47.3 (41.2 – 58.3)	38.1 (31.1 – 46.2)	52.4 (47.2 – 61.5)	33.4 (27.0 – 41.0)
Casual partner	44.6 (36.7 – 57.2)	73.6 (64.2 – 83.2)	44.9 (17.1 – 64.6)	86.0 (73.8 – 90.2)
STI symptoms during past 12 months	9.5 (7.3 – 12.5)	19.4 (15.5 – 23.4)	21.1 (17.2 – 26.0)	11.4 (8.7 – 14.8)

in the two Manipuri states of Ukhrul (31.7% to 69.5%) and Chandel (26.3% to 70.9%), but minimal changes in the Nagaland districts of Kiphire (21.1% to 29.7%) and Zunheboto (48.5% to 39.8%). A larger proportion of IDUs reported usually obtaining needles from the needle and syringe program (NSP) at follow-up in both Ukhrul (27.4% to 67.6%) and Kiphire (38.0% to 71.0%), whilst the proportion remained relatively high in Chandel (86.5% to 68.0%), and there was little improvement in Zunheboto (36.5% to 35.9%). The proportion of IDUs who personally knew someone with HIV increased in Ukhrul (76.1% to 94.1%), Chandel (37.8% to 63.0%), and Kiphire (11.3% to 38.4%), and decreased in Zunheboto (23.3% to 6.0%). There was a reduction in the proportion of IDUs rating themselves at no risk of getting HIV infection in all four districts; Ukhrul (28.3% to 17.9%), Chandel (34.6% to 26.3%), Kiphire (31.0% to 4.9%) and Zunheboto 23.0% to 9.7%). A greater proportion of IDUs reported having had an HIV test at follow-up in Ukhrul (20.2% to 41.1%), Kiphire (10.6% to 52.0%) and Zunheboto (23.2% to 51.9%), and remained much the same in Chandel (41.9% to 45.8%).

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Table 3 Exposure to interventions and awareness of HIV

	Manipur			
	Ukhrul		Chandel	
	Baseline % (95% CI)	Follow-up % (95% CI)	Baseline % (95% CI)	Follow-up % (95% CI)
Registered with an ORCHID NGO	31.7 (26.9 – 37.4)	69.5 (64.8 – 75.7)	26.3 (22.5 – 32.6)	70.9 (65.6 – 76.2)
Accessed NGO services in last 6 months	43.2 (37.9-49.3)	81.8 (76.3 – 87.2)	84.5 (80.7 – 88.7)	84.4 (79.8 – 88.8)
Usually obtain needles from needle / syringe program	27.4 (23.5 – 33.9)	67.6 (62.1 – 74.3)	86.5 (82.9 – 90.4)	68.0 (63.1 – 76.7)
Personally know someone with HIV	76.1 (71.8 – 80.3)	94.1 (91.9 – 97.6)	37.8 (33.0 – 44.8)	63.0 (57.7 – 68.0)
Rate risk of HIV infection	24.9 (20.9 – 28.8)	37.8 (32.0 – 42.9)	6.0 (3.8 – 8.3)	8.8 (6.2 – 12.0)
High	10.8 (8.1 – 13.8)	15.9 (12.1 – 20.2)	10.6 – 7.6 – 13.1)	10.1 (7.1 – 12.7)
Moderate	16.9 (13.2 – 20.2)	24.4 (2.0 – 29.7)	43.5 (38.4 – 48.8)	50.7 (45.4 – 55.8)
None	28.3 (23.9 – 33.3)	17.9 (14.0 – 21.9)	34.6 (29.5 – 39.4)	26.3 (21.9 – 31.7)
Don't know	18.6 (14.4 – 23.1)	4.0 (1.7 – 6.3)	5.3 (3.3 – 8.3)	4.1 (1.9 – 6.8)
Ever undergone HIV test	20.2 (16.5 – 24.8)	41.1 (36.3 – 46.8)	41.9 (36.3 – 47.3)	45.8 (40.4 – 51.0)
	Nagaland			
	Kiphire		**Zunheboto**	
	Baseline % (95% CI)	Follow-up % (95% CI)	Baseline % (95% CI)	Follow-up % (95% CI)
Registered with an ORCHID NGO	21.1 (17.1 – 25.2)	29.7 (24.3 – 36.1)	48.5 (42.3 – 54.8)	39.8 (33.3 – 46.3)
Accessed NGO services in last 6 months	54.7 (48.9 – 60.9)	76.6 (71.9 – 81.1)	56.2 (50.4 – 63.0)	61.5 (56.5 – 69.3)
Usually obtain needles from needle / syringe program	38.0 (34.3 – 44.1)	71.0 (65.9 – 76.3)	36.5 (31.5 – 44.3)	35.9 (29.1 – 45.6)
Personally know someone with HIV	11.3 (8.9 – 14.7)	38.4 (33.1 – 43.2)	23.3 (19.2 – 28.7)	6.0 (3.9 – 8.6)
Rate risk of HIV infection				
High	17.4 (12.0 - 21.9)	12.1 (8.9 – 15.1)	2.5 (1.2 – 4.1)	12.0 (8.7 – 15.1)
Moderate	22.4 (16.9 – 27.8)	32.1 (28.0 – 37.4)	8.6 (5.7 – 10.8)	26.4 (22.8 – 30.8)
Low	11.4 (8.3 – 17.2)	43.9 (38.9 – 48.7)	53.7 (48.7 – 59.1)	39.9 (35.3 – 45.1)
None	31.0 (22.7 – 37.1)	4.9 (2.8 – 7.1)	23.0 (19.5 – 27.3)	9.7 (7.2 – 12.9)
Don't know	17.8 (13.3 – 24.6)	5.8 (3.5 – 8.5)	12.2 (8.5 – 15.7)	10.2 (7.2 – 12.4)
Ever undergone HIV test	10.6 (5.9 – 13.5)	52.0 (46.5 – 56.7)	23.2 (19.2 – 28.3)	51.9 (46.1 – 57.0)

Associations between exposure to interventions and HIV risk behaviours of IDUs

Analyses were conducted on follow-up data at state level to estimate the strength of association between exposure to interventions and: needle sharing, condom usage and HIV testing. Odds ratios presented in Table 4 were adjusted for district, age, having ever been married, literacy, age at initiation into injecting drug use, most commonly used drug, and frequency of drug use during the previous week.

Evidence supporting an association between program exposure and: reduced needle sharing, increased condom use, and increased HIV testing emerged.

In Nagaland, registration with an ORCHID NGO was significantly associated ($p<0.05$) with: lower odds of sharing needles during the previous month (OR=0.63) and at the last injection (OR=0.57); and higher odds of condom use during the last sexual encounter with regular partners (OR=1.87). Similarly, accessing NGO services in the last six months and usually obtaining needles from the needle and syringe program was associated with: reduced odds of sharing needles at the last injection (OR=0.53 and 0.67 respectively); and higher odds of using a condom at last sex with a casual partner (OR=3.98 and 2.75 respectively). Participation in HIV testing was unaffected by program exposure in Nagaland.

In Manipur, registration with an ORCHID NGO was significantly associated with higher odds of condom use during the last sexual encounter with a regular partner (OR=2.75). Having accessed NGO services in the last 6 months was associated with: lower odds of sharing needles during the previous month (OR=0.35); and higher odds of condom use at last sex with a regular partner (OR=3.00). Additionally, usually obtaining needles from the needle syringe program was associated with: lower odds of sharing needles during the past month (OR=0.32); and higher odds of condom use for last sex with a regular partner (2.94). In Manipur, the odds of having had an HIV test increased for those IDUs registered with an ORCHID NGO (OR=1.49) and those usually obtaining needles from the needle syringe program (OR=1.62).

Discussion

While the findings from this study present a mixed picture in relation to changes in HIV risk behaviours and

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Table 4 Association between programme exposure and HIV risk behaviours of IDUs at follow-up (2009)

	Adjusted odds ratios (95% CI)				
	Shared needles / syringes at last injection	**Shared needles / syringes during the past month**	**Condom last sex (regular partner)[a]**	**Condom last sex (casual partner)[b]**	**HIV test**
	Manipur				
Accessed NGO services in last 6 months	0.51 (0.14 - 1.90)	0.35** (0.17 - 0.74)	3.00** (1.45 - 6.22)	1.19 (0.44 - 3.26)	1.52 (0.88 - 2.63)
Registered with an ORCHID NGO	0.47 (0.16 - 1.29)	0.59 (0.32 - 1.08)	2.75*** (1.63 - 4.64)	1.49 (0.78 - 3.00)	1.49* (1.01 - 2.19)
Usually obtain needles from NSP	0.42 (0.15 - 1.17)	0.32*** (0.18 - 0.57)	2.94*** (1.77 - 4.91)	0.66 (0.32 - 1.36)	1.62* (1.10 - 2.39)
	Nagaland				
Accessed NGO services in last 6 months	0.53** (0.35 - 0.79)	0.78 (0.52 - 1.15)	1.15 (0.69 - 1.92)	3.98** (1.80 - 8.76)	1.27 (0.87 - 1.85)
Registered with an ORCHID NGO	0.57** (0.41 - 0.87)	0. 63* (0.44 - 0.90)	1.87* (1.13 – 3.07)	1.61 (0.86 – 2.98)	0.89 (0.64 - 1.25)
Usually obtain needles from NSP	0.67* (0.46 - 0.98)	0.96 (0.68 - 1.42)	1.35 (0.83 - 2.19)	2.75** (1.35 – 6.00)	0.77 (0.55 - 1.10)

[a] Only IDUs who had a regular partner were included in this analysis; 422 in Manipur, 486 in Nagaland.

[b] Only IDUs who had a casual partner were included in this analysis; 246 in Manipur, 313 in Nagaland.

* p<0.05, ** p<0.01, *** p<0.001.

Note: Odds ratios were adjusted for the following variables; district, age, ever been married, literacy, age at initiation into injecting drug use, most commonly used drug, and frequency of drug use during the previous week.

HIV prevention service usage among IDUs in two districts of Manipur and two districts of Nagaland, the overall trend is a positive one. Consistent associations between exposure to NGO HIV prevention services, including Project ORCHID services, and reduced risk of engagement in HIV risk behaviours are clearly evident. Additionally, exposure to interventions was associated with increased chance of HIV testing in Manipur.

Profile of injecting drug users

An important aspect of the demographic profile is that a substantial proportion of IDUs in all four districts were less than 25 years of age, comparable to IBBA findings in four other districts of Manipur and Nagaland [7]. Additionally, the majority of IDUs first injected drugs before the age of 25 years in Ukhrul, Kiphire and Zunheboto; in Chandel approximately half of IDUs had first injected at this young age. Many of these men are entering into injecting drug use during their adolescent years, and studies have demonstrated that younger age and earlier age of initiation into injecting are associated with HIV infection [18-21]. This raises policy and programming challenges, some of which may be sensitive in this very conservative context. Adopting a youth and equity lens [22,23] is important to ensure: 1) adolescents have access to HIV prevention resources (i.e. condoms, needles, etc), 2) that drug services and sexual and reproductive health services are "youth-friendly" i.e. they engage with and respond to the information and treatment needs of young people, 3) that information and education on drug use and sexual and reproductive health is widely available to adolescents, and 4) that opportunities to interrupt the transition to injecting drug use (e.g. life skills programs) are explored through further research and programming.

HIV prevention service usage

A recent (2009) document produced by a collaboration between WHO, UNODC and UNAIDS [24], identified a range of coverage targets and impact indicators for HIV prevention programs working with IDUs. One coverage indicator is the percentage of IDUs regularly reached by NSPs. Coverage is judged to be high if >60% of IDUs are regularly being reached by NSPs. On the basis of this indicator, the IDUs in Ukhrul, Chandel and Kiphire were all receiving high coverage by 2009. Even though the proportion of IDUs attending HIV prevention services generally increased between the two BTS rounds, some points of concern were noted and possibly warrant programmatic adjustment, including a decrease in the proportion of IDUs obtaining needles from NSPs in Chandel, and consistently poor uptake of services in Zunheboto.

IDU participation in HIV testing is an important part of HIV prevention. The recommended coverage target for HIV testing among IDUs is 75% of IDUs each year [24]. Despite marked increases in the proportion of IDUs who had been HIV tested between the two BTS

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rounds, the IDUs in Manipur and Nagaland are a long way from achieving the recommended coverage target for HIV testing. At follow-up, only around half reported ever having had an HIV test. The poor uptake of HIV testing among IDUs in these states was also reported in the IBBA study [7], and is the result of a constellation of factors including poor health system infrastructure to support HIV testing, geographically remote communities, and lack of perceived risk. In Chandel in 2009, 77% of IDUs judged themselves to be at no or low risk of HIV, as did 42% in Ukhrul, 49% in Kiphire and 49% in Zunheboto. More research is required to fully understand why IDUs in Manipur and Nagaland do not participate in HIV testing, so that programs can be designed to encourage better uptake.

Changes in injecting behaviours of IDUs

High risk injecting behaviours were common at baseline in Ukhrul, Kiphire, and Zunheboto, with approximately 30-50% of IDUs sharing needles at last injection. Risky injecting behaviour has been found to be common among IDUs in other districts of Manipur and Nagaland [7] and elsewhere in India [25]. One of the impact indicators identified in the WHO/UNODC/UNAIDS document is an increase in the percentage of IDUs reporting use of sterile injecting equipment the last time they injected [24]. Based on the responses to the BTS question about not sharing needles and syringes at the time of last injection (a roughly equivalent indicator), an increase to almost 100% was reported in Ukhrul and a similarly high level of safe injecting was maintained in Chandel. A substantial increase in the percentage of IDUs (from 45% to 74%) reported not sharing at the time of last injection in Zunheboto, but in Kiphire there was no real improvement in the percentage not sharing with their last injection – where one third of IDUs consistently reported sharing at their last injection, and the proportion sharing in the last month had increased over time.

The proportion of IDUs drawing up drug solutions from common containers at the time of their last injection is a major cause for concern as this is an effective route of transmission for hepatitis C virus [31]. In three of the four districts the proportion reporting this practice increased between the two BTS rounds (Ukhrul was the exception), and between 10-54% of IDUs, depending on district, reported doing this in 2009. This is particularly concerning given the background prevalence of hepatitis C infection in Manipur in particular, which was 56% in Bishnupur and 78% in Churachandpur districts in 2006 [7]. In a development context where treatment of hepatitis C is not supported in the same way that ART is, and most IDUs could never afford to pay for the treatment, hepatitis C prevention is at least as important as HIV prevention.

Sharing injecting equipment is associated with a number of factors including the type of drug being injected, place of injection, availability of clean injecting equipment and awareness of the risks of sharing. Rhodes et al [29] apply a broader understanding of risk to examine the social structural production of HIV risk behaviour, identifying the inseparability of micro, meso and macro-level factors that shape the environment in which risk is produced beyond a focus on the individual. Under this paradigm risk environments are shaped by factors external to the individual such as trade, migration, neighbourhood disadvantage and transition, injecting environments, the criminal justice system, social norms and networks, social capital, law enforcement, and armed conflict.

A recent study among HIV positive IDUs in Manipur identified some important local socio-structural influences on injecting risk behaviours including inadequate coverage of needle / syringe programs (including in prisons), limited access to pharmacy-sold equipment, IDUs avoiding carrying clean injecting equipment due to fear of harassment by police and anti-drug groups, and withdrawal symptoms superseding health concerns [30]. A number of other studies have highlighted the ways in which social networks influence the extent to which IDUs engage in risky injecting behaviours. IDUs are more inclined to share injecting equipment when they are a member of a social network that is large, long-standing and dense (meaning many ties between network members), and when sharing injecting equipment is normative and an expression of social bonding [26,27]. These are features of many IDU groupings in Manipur and Nagaland [28]. Further research is required to better understand the broader socio-structural drivers of HIV risk in Manipur and Nagaland to support interventions that create local environments that support individual, group and community-level changes.

Changes in sexual behaviours of IDUs

Reaching IDUs with safe sex messages is in many ways a greater challenge for harm reduction programs than promoting safe injecting behaviours. The WHO / UNODC / UNAIDS document indentified an increase in the percentage of IDUs reporting the use of a condom the last time they had sex as an impact indicator [24]. For the IDUs in this study there was overall no real increase in the proportion reporting condom use during the last sexual encounter with regular partners, but an increase in the proportion using condoms in the last sexual encounter with casual partners was evident

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in all districts except Chandel. Programmatic focus on the prevention of sexual transmission of HIV in drug use settings is important [32]. This is particularly the case in Nagaland where around half of the IDUs had more than one sexual partner in the last year, and where the 2006 IBBA study highlighted a high syphilis prevalence among IDUs in Nagaland (7% and 19% in Phek and Wokha districts respectively) [7], indicating sexual risk taking and possible co-infection of HIV and an ulcerative STI, increasing the risk of HIV transmission to sexual partners. Further research and analysis of behavioural data is required to more comprehensively understand the sexual behaviours of IDUs in Northeast India and to better appreciate the sex-related risks of HIV transmission among this group.

Association between exposure to HIV prevention services and HIV risk behaviours

Our state-level analysis found consistent associations between exposure to HIV prevention services and a reduced likelihood of sharing needles and an increased likelihood of using condoms. Exposure to HIV prevention services was also associated with increased likelihood of participation in HIV testing in Manipur; there was no similar association in Nagaland. The strength of the full impact of the HIV prevention services on HIV risk behaviours is difficult to gauge due to the nature of the cross-sectional study design, but in our analysis it appears to be substantial. In Nagaland the likelihood of sharing needles over the past month was reduced by approximately 40% among IDUs who were registered with an ORCHID NGO. In Manipur, IDUs who had NOT accessed an NGO service during the past 6 months were almost three times more likely to have shared a needle during the past month. The likelihood of using condoms with regular partners during the last sexual intercourse was tripled among IDUs in Manipur who had accessed NGO services during the past 6 months, and nearly doubled among IDUs in Nagaland who were registered with an ORCHID NGO. These results provide evidence of an association between exposure to HIV prevention services and a reduced likelihood of engaging in HIV risk behaviours.

Inter and intra-state variations

The findings from this BTS study varied considerably between states, and between districts within states. The patterning of HIV risk behaviours and HIV prevention service usage in this complex setting is influenced by a constellation of factors including the supply and types of drugs used, awareness of risks associated with sharing injecting equipment, the social norms among local networks of IDUs in relation to sharing, the effectiveness of the NGOs offering the programs, the availability of clean needles and syringes, the freedom to access the NSPs without harassment from police or pressure groups, geographical accessibility of the NSPs, and the extent of empowerment among IDU networks.

The differences between the two states are not surprising as the pattern of drug use, and the maturity of the HIV epidemic and the response to it, are very different when the two states are compared. Manipur IDUs inject mainly heroin, while the Nagaland IDUs inject mainly pharmaceuticals (especially Spasmoproxyvon or SP). SP is often taken orally, and it is not uncommon for SP users to move in and out of injecting depending on the availability of the drug i.e. they are more likely to inject at times of drug shortage (but when in an injecting phase, SP users may inject up to 10 times/day). Additionally, SP is very injurious to veins, so it is difficult to inject every day for sustained periods of time. In contrast, dependant heroin users are much more likely to consistently inject every day over extended periods, even decades. As the HIV epidemic in Manipur is more severe and long-standing compared with Nagaland, the Manipuri NGOs are more experienced in delivering programs, and awareness of HIV is greater. Communities are more geographically isolated in Nagaland, and the political situation is more unstable in Manipur – and both of these factors interfere with the delivery of HIV prevention services. Similar types of variation are evident between districts within states as well. This sort of complexity contributes to the variability in outcomes observed in this study, and highlights the importance of NGO capacity to monitor what is happening locally, and to adjust the program accordingly.

Limitations

These study findings are subject to several limitations. The use of RDS methods to recruit participants creates limitations for multivariate analysis; guidelines for multivariate analysis of RDS data are still under development and require validation. Despite this limitation, RDS results in probability based estimates of various participant characteristics. Reporting of certain behaviours may have been influenced by recall and social desirability bias with the result that socially unacceptable behaviours may have been under-reported. As with all cross-sectional study designs causal relationships can't be firmly determined due to the difficulty in determining the temporal relationship between the predictors and the outcomes. With this study design it is hard to confirm that exposure to services causes a change in risk behaviours among IDUs; it is possible that the types of IDUs who attend services are less likely to engage in risk behaviours. However, the multivariate analysis in this paper highlights consistent associations between exposure to NGO HIV prevention services, including

Project ORCHID services, and reduced risk of engagement in HIV risk behaviours. It is important to note that socio-structural factors influence HIV risk behaviours and these have not been reported on in this paper; for example, place of injection, access to clean injecting equipment, harassment by policy and anti-drug groups, incarceration, and poverty. Further analysis of the BTS and other data sources is required to comprehensively describe the socio-structural drivers of risk behaviours.

Conclusion

Despite district-level differences, the results from this BTS study indicate that exposure to HIV prevention services, predominately delivered in this region by NGOs, is associated with a reduced likelihood of engaging in HIV risk behaviours. IDUs using HIV prevention services are more likely to engage in safe injecting and sexual practices, and effort is required to sustain / increase opportunities for IDUs to access these services. These outcomes are a noteworthy achievement in a very challenging context. Programmatic adjustments are required: 1) to further increase participation in HIV testing, 2) to deliver interventions that target the risk of sexual transmission of HIV and STIs, and 3) to improve awareness of the risk of Hepatitis C transmission associated with drawing drug solutions from common containers.

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Authors' contributions

All authors contributed to interpretation of the findings and development of the manuscript. GA and MK undertook the statistical analysis and wrote the first draft of the manuscript. CH coordinated the collection of data. All authors read and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

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III Vulnerabilities of high-risk groups

Vulnerabilities of female sex workers

RESEARCH HIGHLIGHTS

Vulnerabilities of female sex workers

- In view of the growing number of sex workers using cell phones to solicit clients, prevention programs must expand their focus to include the places where these sex workers engage in sex, such as lodges. Further, strategies could use this new technology to strengthen prevention efforts and reach this hard-to-reach group. This strategy is suggested because sex workers who use cell phones to solicit clients are more at risk of HIV than others; they engage in unprotected sex, experience symptoms of sexually transmitted infections, drink alcohol prior to sex and lack the ability to negotiate condom use (Jain et al., 2012; Mahapatra et al., 2012).

Intensive HIV prevention programs with female sex workers have been one of the effective social interventions in reducing HIV. However, evidence suggests that the changing scenario of sex work and associated HIV risks in India demand renewed, innovative and consistent program focus with this sub-population group.

- Sex workers who move from one place to another for sex work need special attention. Programs need to link them to local prevention and crisis response services, provide them information on local preventive health services, and mobilize them to form community networks to address violence, reduce alcohol consumption and promote condom use along their routes of mobility. The evidence suggests that sex workers who travel frequently across districts and states for sex work are more likely to engage in unprotected sex with clients, experience physical violence and drink alcohol prior to sex than others (Saggurti et al., 2011). Sex workers who are mobile for work and experience violence are at higher risk of acquiring HIV than others (Ramesh et al., 2012).

- IEC materials in sex worker programs need to emphasize the importance of using condoms in all sexual encounters, not only with occasional clients, but also with regular clients and non-paying partners. Peer educators should enable sex workers to accurately assess their own risk of acquiring HIV based on their sexual relationships. As reported by Jain et al. (2011), sex workers' perceptions of acquiring HIV differ by type of partner; unprotected sex with regular clients and non-paying partners is not considered risky.

- Communication messages need to emphasize the need for safe sex practices during anal sex. Special attention is needed in programs to build the skills of sex workers to negotiate safe sex with clients demanding anal sex. Evidence indicates that a significant proportion of sex workers practice anal sex; those who engage in anal sex are at increased risk of acquiring sexually transmitted infections (Patra et al., 2012).

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The Extent and Nature of Fluidity in Typologies of Female Sex Work in Southern India: Implications for HIV Prevention Programs

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These authors examine the nature and extent of fluidity in defining the typology of female sex work based on the place of solicitation or place of sex or both places together, and whether sex workers belonging to a particular typology are at increased risk of HIV in southern India. Data are drawn from a cross-sectional survey conducted during 2007–2008 among mobile female sex workers (N = 5301) in four Indian states. Findings from this study address an important policy issue: Should programmatic prevention interventions be spread to cover all places of sex work or be focused on a few places that cover a large majority of sex workers? Results indicate that most female sex workers, including those who are usually hard to reach such as those who are mobile or who use homes for soliciting clients or sex, can be reached programmatically multiple times by concentrating on a smaller number of categories, such as street-, lodge-, and brothel-based sex workers.

KEYWORDS condom use, female sex workers, HIV, India, typology of sex work

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INTRODUCTION

Female sex workers (FSWs) are at high risk of acquiring and transmitting HIV due to the nature of their work, which includes multiple concurrent partners and inconsistent condom use (Hearst & Chen, 2004; National AIDS Control Organisation [NACO], 2007; Reiss & Leik, 1989). Understanding the nature of female sex work has become central to both research and HIV prevention programs in India and elsewhere (Harcourt & Donovan, 2005; Raj, Saggurti, Lawrence, Balaiah, & Silverman, 2010) because the typology of sex work is found to be associated with differential HIV risk (Buzdugan et al., 2010; Ramesh et al., 2008). Numerous studies reveal that FSWs at high risk of acquiring and transmitting HIV infection can be identified on the basis of characteristics associated with high inconsistent condom use, including reasons for entering sex work (Wawer, Podhisita, Kanungsukkasem, Pramualratana, & McNamara, 1996), such as economic hardship (Hargreaves, 2002; Tladi, 2006; Wojcicki, 2005); consumption of alcohol prior to sex (Fisher, Cook, & Kapiga, 2010; Verma, Saggurti, Singh, & Swain, 2010; Zablotska et al., 2006); or experience of sexual violence (Beattie et al., 2010; Campbell et al., 2008; Kalichman, Williams, Cherry, Belcher, & Nachimson, 1998; Molitor, Ruiz, Klausner, & McFarland, 2000; Zierler, Witbeck, & Mayer, 1996).

It is not useful to categorize and reach FSWs with HIV prevention messages based on these characteristics because this would require first contacting FSWs to collect the required information. For programmatic purposes, one would need to use easily identifiable characteristics, rather than having to contact FSWs to collect the information required for classification. Geographic characteristics like places of solicitation and places used for sex do not require prior contact with FSWs, and once used to create a typology can be used to contact groups of FSWs sharing the same geographic characteristics.

To expand the reach of HIV prevention programs, in 2006 a panel of experts in India recommended using the primary place where clients are solicited as the basis for grouping FSWs into six categories: brothel-based, street-based, home-based, lodge-based (overnight stay hotels), *dhaba*-based (road side eating places and small hotels), and highway-based (NACO, 2007). A subsequent review of the literature on the organization of sex workers into different typologies, based on research and programmatic studies in India, found the typology developed by the Indian NACO (2007) to be comprehensive (Buzdugan, Halli, & Cowan, 2009). However, it recommended the addition of three categories to provide a complete description of the settings in which women solicit clients: cell phone–based, indirect-primary (e.g., bar-based), and indirect-secondary (e.g., agricultural or construction sites–based). Despite these suggested categorizations, empirical support for this proposed typology is scarce in the literature. The only empirical study published so far on the typology of sex work used data from a cross-sectional survey

conducted in the state of Karnataka in India (Buzdugan et al., 2010), which may not be applicable to female sex work in other states of India.

The categorization of FSWs based on places where sex is solicited requires regular mapping of sex workers, as such places may change with an increase in the volume of sex work, presence of male migrant workers, organization of *jatras* (religious gatherings), or changes in the political situation of the city or state. While typologies of sex work in reality are not confined to mutually exclusive categories, past research studies have listed places where sex workers are most likely to solicit clients (Chandrasekaran et al., 2006; Chattopadhyay & McKaig, 2004; Dandona et al., 2006; Harcourt & Donovan, 2005; NACO, 2007; Ramesh et al., 2008). However, few published studies have indicated the specific advantages of considering places where FSWs engage in sex for the implementation of HIV prevention interventions (Blanchard et al., 2005; Halli et al., 2010; Halli, Ramesh, O'Neil, Moses, & Blanchard, 2006).

Previously published work on the typology of sex work has unfortunately raised questions among researchers and program managers on the overall utility of using a single question for defining typology, and its linkages with HIV risk behaviors in other contexts, such as different states and mobile FSWs who travel to different places for sex work. Some important questions include: How does a typology based on the place where clients are solicited differ from one based on the place where FSWs engage in sex? Do these typologies differ from a typology based on places of both solicitation and sex? Do FSWs use two or more places (fluidity) to solicit clients and for sex? If yes, which are the most prevalent combinations of places? How do these typologies and indicators of fluidity vary by state? How does HIV risk vary by fluidity and typology?

We attempt to answer these research questions using data from a cross-sectional survey conducted in four southern states identified as high HIV prevalence states in India. This study specifically examines the extent and nature of fluidity in defining the typology of female sex work based on the place of soliciting clients (referred to as "place of solicitation" in this article) or the place where FSWs engage in sex (referred to also as "place of sex" interchangeably in this article) or both. We also attempt to understand whether sex workers who use multiple places or belong to a particular typology are at increased risk of HIV than others. The exploration of the extent and nature of fluidity in sex work is important in addressing an important policy question: Should programmatic efforts be spread to cover all typologies of sex work, or should such programs focus on a smaller number of places?

METHODS

Sample

This study is based on data from a cross-sectional behavioral survey conducted in 2007–2008 among mobile FSWs (women who regularly sell sex in

exchange for cash/kind) in 22 high in-migration districts across four states in southern India (Andhra Pradesh, Karnataka, Tamil Nadu, and Maharashtra), identified as high epidemic states by NACO prior to 2005 (Karnataka Health Promotion Trust & Population Council, 2008; Population Council, 2008a, 2008b, 2008c). These study districts were identified using unpublished mapping and enumeration data on FSWs collected independently by the State AIDS Control Society and Avahan (the India AIDS Initiative of the Bill and Melinda Gates Foundation).

A two-stage sampling procedure was used to select FSWs from both brothel and non-brothel sites. For brothel sites, two-stage systematic sampling was used. In the first stage, lanes or small areas were systematically selected, and in the second stage, brothel houses in each lane/small sub-area were selected. All FSWs in the selected brothel houses were interviewed using a screening tool to identify mobile FSWs. In the case of non-brothel sites, two-stage time location sampling was used. In the first stage, sex workers' cruising points or homes were selected, and in the second stage, the day and timing of visits were systematically selected. All FSWs found during the selected time, day and cruising sites/homes were interviewed using a screening tool (Verma et al., 2010).

About 94% (or 9475) of FSWs who were initially contacted ($N = 10{,}075$) agreed to provide information required to complete the screening questionnaire. Of these, 5611 (59 %) were found eligible for the detailed interview according to the study definition of mobile FSWs: those who moved to two or more different locations for sex work during the previous two years, one of which included a move across districts.

Of the total eligible FSWs (5611), 87 were excluded: 15 were not interviewed because they were below age 18, 21 refused to participate in the study, and 51 withdrew during the course of the interview. Of those who completed the interview (5524), 223 were excluded because of incomplete information. Data on socioeconomic variables were missing for 26 FSWs, while data on either the place where clients are solicited or the place for sex were missing for 197 FSWs. This resulted in a total analytical sample of 5301 FSWs, including 1295 brothel-based FSWs and 4006 non–brothel-based FSWs according to the definition used in this study for selecting the sample of FSWs.

Ethical Procedures

Ethical approval for the study was obtained from the institutional review boards (IRBs) of the Population Council and the University of Manitoba, Canada. Verbal consent was obtained from all respondents prior to participation in the interview and steps were taken to ensure their confidentiality. For ethical considerations, only those FSWs who were at least 18 years of age were interviewed. Participants were not provided any compensation for their

time in the study but were given information on local organizations that provide services for treating sexually transmitted infections and condoms.

Interviews were conducted by trained researchers with multilingual fluency. All the researchers had at least 5 years of experience and a graduate or master's degree in sociology, anthropology, and/or statistics. Participants were asked to respond to a 45-minute interviewer-administered survey in the local language. Instruments were developed in English, translated into four local languages, and then reviewed by study investigators who were fluent in English and the local language. Discrepancies were resolved in consultation with the principal investigator from the Population Council.

Interviews were conducted in private or public locations depending on the preference of the respondent. Locations for street-based FSWs included street corners, gardens, parks, and areas outside cinema halls. Data were collected using handheld Palmtop Digital Accessories (PDAs) in the states of Maharashtra, Andhra Pradesh, and Tamil Nadu and using printed questionnaires in Karnataka. In order to facilitate the acceptance of PDAs, respondents were told about the interviewing technique and shown how a PDA works. A customized PDA program was used to ensure the confidentiality of the data collected in the field and to reduce errors in data entry using a PDA. Data quality control and management of questionnaires involved immediate review by field staff after interviews to ensure accuracy and completion, same-day review by the field supervisor, and weekly transportation of survey forms to the data management team. Trained data entry officers then entered the survey data weekly and processed it monthly to verify consistency and accuracy, using SPSS software (Version 16.0; SPSS Inc, Chicago, IL). The consistency and quality of the data collected through the use of PDAs was assessed weekly using SPSS.

Measures

The primary variable of interest in this study—the typology of sex work—was based on two questions asked during the survey: What were the common places that FSWs used to solicit clients, and what were the common places where FSWs engaged in sex with most of their clients? Multiple responses to these questions, as recommended by previous studies (NACO, 2007; Nag, 2006), were captured by 14 response options on the survey. These responses to the question on place of solicitation were collapsed into eight categories based on the places where clients were solicited. These included the six categories defined by NACO (2007): brothel-based, street-based, home-based, lodge-based (including hotels), *dhaba*-based, and highway-based (including vehicles)—and two additional categories, bar or nightclub-based and cell phone–based. The street-based category includes FSWs who reported soliciting clients on the roadside, at railway stations/bus stands, market areas, cinema halls, and labor *naka* (place where men congregate for

contract work). The home-based category includes those who reported using their own home, clients' homes, or rented rooms for soliciting clients and having sex. Except for the brothel-based category, all the other categories are non–brothel-based. However, cell phones can be used by brothel- and non–brothel-based FSWs for soliciting clients.

Similarly, responses to the question on the places where FSWs engaged in sex were recorded by 13 response options, which apart from the cell phone option are consistent with the places for soliciting clients. These 13 options were then collapsed into seven categories (excluding cell phones) using the same classification used earlier to define places for soliciting clients.

The dependent variables used in this study include the relative importance of the categories, the extent of fluidity, the nature of fluidity, and the risk of HIV acquisition. The relative importance of the categories was measured by the percentage of FSWs who mentioned ever using a place to solicit clients or to engage in sex and the percentage of FSWs who mentioned using such a place exclusively. The extent of fluidity was measured by the percentage of FSWs who used two or more places to solicit clients or to engage in sex and the average number of places used for solicitation and sex. The nature of fluidity was measured by the percentage of FSWs who reported using a specific combination of two places among those who used two or more places to solicit clients or to engage in sex.

Exposure to the risk of acquiring HIV (HIV risk) was defined as the inconsistent use of condoms and was measured by a variable created from responses to items regarding condom use in the last week and at the last time sex with occasional and regular clients, and with nonpaying partners. Three variables were created for each type of client: occasional, regular, and non-paying. FSWs who reported always using a condom in the last week and condom use at the last time sex were coded as 0 (consistent condom use) and those who reported always using condom in the last week but did not use a condom at the last time sex or reported sometimes or never using a condom in the last week were coded as 1 (inconsistent condom use). A binary variable indicating overall inconsistent condom use was created by combing the three variables on inconsistent condom use during sex with each type of partner. Consistent condom use (coded as 0) includes those FSWs who reported always using condoms with all types of clients in the last week as well as using condoms at the last time sex with each of these clients/partners. All other FSWs were coded as 1 to indicate overall inconsistent condom use.

The independent variables or covariates used in this study included the respondents' age and education level, duration of sex work, state where FSWs practiced sex work, and program exposure. Demographics were assessed via single items regarding age (grouped into five categories: 19–24, 25–29, 30–34, 35–39, 40+ years), education (grouped into four categories: illiterate or no formal schooling; primary school, 1-5 years of education; secondary school, 6-8 years of education; high school, 9 years and above),

duration of sex work (grouped into four categories: 0–2, 3–5, 6–10, 11+ years), and state where FSWs were practicing sex work (Maharashtra, Andhra Pradesh, Karnataka, and Tamil Nadu) . A binary variable representing program exposure was constructed based on FSWs' self-report of access to free or subsidized condoms at the current place of sex work, as this was one of the key components of the HIV prevention program. FSWs who reported having access to either free or subsidized condoms were categorized as exposed to the program and were coded as 1, and those who did not report access to free and subsidized condoms were categorized as not exposed to the program and were coded as 0.

Statistical Analysis

The importance of specific typologies of sex work was assessed by calculating the percentage of FSWs who had ever used that place and the percentage of FSWs who had used that place exclusively. The extent of fluidity was assessed by calculating the percentage of FSWs who used multiple places for solicitation and sex, and the average number of places used for solicitation and sex. The nature of fluidity was assessed by calculating the percentage of FSWs who used a specific combination of places among those who used two or more places for solicitation and sex. The variation among states in typologies, and the extent and nature of fluidity were assessed by calculating these percentages separately for each state.

Logistic regression models were constructed to estimate crude odds ratios (ORs) and 95% confidence intervals (CIs) to assess the observed effect of each covariate on the extent of fluidity (multiple places for solicitation) and inconsistent condom use. Multiple logistic regression models were constructed to estimate adjusted odds ratios (AORs) and 95% CIs to assess the independent effect of each covariate on the extent of fluidity, and the independent effect of fluidity, typology of sex work and each covariate on inconsistent condom use. Three separate multivariate regression models were constructed to assess: (a) the independent effect of each covariate on fluidity; (b) the independent effect of fluidity on inconsistent condom use among all mobile FSWs; and (c) the independent effect of the specific typology of sex work on inconsistent condom use among mobile FSWs who solicited clients from only one location. The key sociodemographic covariates included in these models were respondents' age, education level, duration of sex work, program exposure, and the state where they were practicing sex work. All statistical analyses were conducted using SPSS Version 16.0.

RESULTS

Table 1 shows the typology by place where FSWs solicit clients, place where they engage in sex, and both places together. The most common category

for soliciting clients based on responses to the question of ever using that place was street-based (65%) sex work; other less common categories include home-based (29%), lodge-based (26%), and brothel-based (24%) sex work. In comparison, the most common categories for engaging in sex based on responses to the question of ever using that place were lodges (58%) and homes (54%); less common categories were streets (32%) and brothels (27%). When places for solicitation and sex were included together, the most common categories of sex work included those who ever solicited clients on the street and ever used lodges for sex (44%), homes for sex (40%), or streets for sex (30%). Other common categories included home-to-home (27%), lodge-to-lodge (23%), and brothel-to-brothel (23%) sex work. A substantial proportion of FSWs (about 22%) used cell phones to solicit clients; however, most of them also used other places for solicitation. Those who solicited clients using cell phones used streets (46%), homes (41%), and lodges (35%) for sex and, to a much lesser degree, brothels (13%), highways (9%), and *dhabas* (4%).

Close to one-half of FSWs in this study reported using multiple places for soliciting clients as well as for engaging in sex. On average, FSWs reported using close to two places for sex work (for soliciting clients 1.90 ± 1.0; for sex 1.93 ± 1.0). About 58% of FSWs used two or more places for solicitation and the remaining (42%) used one place exclusively, with 23% street-based and 12% brothel-based. In comparison, about 43% used two or more places for engaging in sex and the remaining 57% used one place exclusively: 19% used homes, 17% used lodges, and 14% used brothels.

Table 2 shows the fluidity and the overlapping nature of FSW categories based on the main places for soliciting clients or engaging in sex. The top panel presents data on FSWs who reported using at least two places for soliciting clients. Streets were the most common place for soliciting clients among FSWs who mentioned at least two places for solicitation. The percentage of FSWs who mentioned streets ranged from 49% among those who also mentioned brothels or cell phones; to more than 90% among those who mentioned *dhabas,* bars and highways for soliciting clients. However, those who solicited clients on the streets also did so from lodges (42%) and homes (38%); those who solicited clients from homes also did so on the streets (64%) and from lodges (45%); and those who solicited clients from lodges also did so on the streets (68%) and in homes (44%). In addition to streets, other common places for soliciting clients among those who used at least two places included homes and lodges.

The bottom panel of Table 2 shows similar data for FSWs who mentioned at least two places where they engage in sex. Lodges were the most common place for sex among FSWs who mentioned at least two places for sex. The percentage of FSWs who mentioned lodges ranged from 50% among those who also mentioned highways to 81% among those who also mentioned brothels or homes. About 60% of FSWs who used lodges for sex

TABLE 1 Typology of Sex Work Based on Place of Soliciting Clients, Place of Sex and Both Places in Four Southern States of India

Typology* based on place of solicitation	Typology* based on place of sex							% FSWs ever used the place† for solicitation	Average number of places used for solicitation	% FSWs used the place for solicitation exclusively	Total
	Brothel	Street	Home	Lodge	*Dhaba*	Highway	Bar				
Brothel-based	22.6	2.7	7.3	8.7	2.3	0.5	0.3	24.4	1.85 ± 1.0	11.5	
Street-based	8.8	30.2	39.7	44.1	8.0	9.5	1.6	64.6	2.09 ± 1.1	23.1	
Home-based	5.2	9.9	26.7	15.5	3.4	2.3	0.7	28.6	2.86 ± 1.1	3.7	
Lodge-based	5.0	10.9	15.6	23.3	3.4	2.1	1.1	26.4	2.91 ± 1.2	1.2	
Dhaba-based	2.0	7.1	4.5	5.4	6.5	5.6	0.4	12.0	3.68 ± 1.3	0.5	
Highway-based	0.4	4.8	4.1	4.0	1.9	3.8	0.2	6.8	3.22 ± 1.3	0.1	
Bar-based	1.4	3.7	3.7	3.9	1.2	0.6	1.5	5.3	2.68 ± 1.2	0.3	
Cell phone-based	3.3	5.3	14.2	14.0	1.3	1.5	0.3	22.1	2.49 ± 1.0	1.5	
% FSWs ever used the place† for sex	26.7	31.8	54.4	57.6	10.1	10.3	2.2				193.1
Average number of places used for sex (mean ± SD)	1.99 ± 1.2	2.71 ± 1.0	2.35 ± 1.0	2.33 ± 1.0	3.36 ± 1.2	2.66 ± 1.4	3.30 ± 1.2				1.93 ± 1.0
% FSWs used the place for sex exclusively	13.6	4.4	18.7	16.8	0.6	2.7	0.2				57.0
Total								190.2	1.90 ± 1.0	41.9	5301

*This typology includes NACO's categorization (2007) and additional categories recommended in other studies. Typologies based on each place separately are shown by percentages; percentages shown in each cell indicate the typology based on ever use of a place for solicitation and a place for sex; overall percentages are shown in the right hand corner. Street-based category includes: on the road side, railway station/bus stand, market areas, cinema halls, labor *naka* (for solicitation), and park/bushes (for sex); home-based category includes own home, client's home, rented room; lodge-based category also included hotels; the highway-based category includes: vehicle; and the bar-based category also includes night clubs. *Dhabas* are roadside resting places for truck drivers and other long distance motorists.

†Includes FSWs who used the place exclusively.

All percentages are based on the total number of FSWs (5301). Percentages do not add to 100 due to multiple responses regarding places of solicitation as well as places for sex.

SD = Standard deviation.

TABLE 2 FSWs Reporting a Particular Combination of Place for Solicitation or for Sex as a Percentage of Those Reporting the Use of at Least Two Places for Solicitation or for Sex

	Place of solicitation								
Typology Based on Place of Solicitation*	Brothel	Street	Home	Lodge	*Dhaba*	Highway	Bar	Cell Phone	No. of FSWs†
Brothel	100.0	49.1	37.7	32.5	12.4	2.8	3.9	22.7	684
Street	15.3	100.0	38.1	41.5	25.6	14.7	11.1	24.4	2198
Home	19.6	63.5	100.0	44.5	9.7	13.0	7.1	36.1	1319
Lodge	16.7	68.5	44.1	100.0	13.1	13.0	10.1	30.4	1331
Dhaba	13.9	91.7	20.9	28.4	100.0	23.2	12.6	8.3	613
Highway	5.4	92.6	49.1	49.4	40.6	100.0	6.6	30.9	350
Bar	10.1	91.0	35.2	50.6	28.8	8.6	100.0	9.4	267
Cell phone	14.2	49.1	43.5	37.0	4.7	9.9	2.3	100.0	1094
	Place of Sex								
Typology Based on Place of Sex*	Brothel	Street	Home	Lodge	*Dhaba*	Highway	Bar		No. of FSWs†
Brothel	100.0	25.1	54.7	81.2	20.8	5.8	3.6	NA	693
Street	12.0	100.0	47.5	71.2	22.1	20.3	4.8		1451
Home	23.6	42.9	100.0	81.4	14.6	10.7	3.6		1607
Lodge	26.1	47.8	60.5	100.0	15.7	9.3	3.5		2161
Dhaba	28.6	63.5	46.6	67.3	100.0	28.8	3.8		504
Highway	9.9	73.0	42.7	49.9	36.0	100.0	2.2		403
Bar	23.6	65.1	54.7	70.8	17.9	8.5	100.0		106

*This typology includes NACO's categorization (2007) and additional categories recommended in other studies. Street based category includes: on the road side, railway station/bus stand, market areas, cinema halls, labor *naka* (for solicitation), and park/bushes (for sex); home-based category includes own home, client's home, rented room; lodge-based category also included hotels; the highway-based category includes: vehicle; and the bar-based category also includes night clubs. *Dhabas* are roadside resting places for truck drivers and other long distance motorists.

†Those who reported two or more places. Row percentages are based on the numbers of FSWs. Total percent in each row is greater than 100 because of multiple places used for solicitation as well as for sex.

also used homes, and 70% of those who used highways for sex also used streets. In addition to lodges, other common places for sex among those who used at least two places included homes, streets, and brothels.

There are important state-level differences in the places FSWs use for sex work (Table 3). For example, the percentage of FSWs who used only one place to solicit clients ranged from 20% in Andhra Pradesh to 59% in Maharashtra, and those who used only one place for sex ranged from 28% in Andhra Pradesh to 83% in Karnataka. Fluidity among FSWs was highest in Andhra Pradesh for both solicitation and sex, and lowest in Maharashtra for solicitation and lowest in Karnataka for sex. The use of cell phones by FSWs to solicit clients was far more common in Andhra Pradesh and Karnataka than in Maharashtra and Tamil Nadu.

Table 4 shows the typology of sex work based on the places where clients are solicited, where FSWs engage in sex, and both places together for each of the four southern states. The typology of sex work based on the place where clients are solicited in Andhra Pradesh was similar to the typology based on the place of engaging in sex and the typology based on both of these places: FSWs in this state mainly used streets, homes, and lodges to both solicit clients and to engage in sex. FSWs in Karnataka used streets and cell phones to solicit clients but lodges for sex. FSWs in Maharashtra used brothels and streets to solicit clients but brothels and lodges for sex. Consequently, the most common categories based on both places were brothel to brothel and street to lodge for sex work. FSWs in Tamil Nadu, on the other hand, mainly used streets to solicit clients, but homes and lodges and, to a lesser degree, streets for sex. Consequently, the most common categories based on both places in Tamil Nadu were street to lodge, street to home, and street to street.

The extent of fluidity varied by FSWs' characteristics as indicated by the crude ORs as well as AORs shown in Table 5. Moreover, FSWs who used multiple places for soliciting clients were exposed to greater HIV risk than those who used only one place. The use of multiple places for solicitation was relatively more common among FSWs who were 25 to 34 years of age, had at least a high school education, had not been exposed to programmatic interventions, and were practicing sex work in Andhra Pradesh or Karnataka.

Utilizing the multiple regression analysis, the study findings show that HIV risk is relatively higher among FSWs who use multiple places for solicitation or who use streets for solicitation in comparison to brothels. For example, after controlling for FSWs' characteristics, inconsistent condoms use was higher among FSWs who used multiple places to solicit clients than among those who used only a single place to solicit clients (AOR = 1.4, 95% CI 1.2–1.7, $p < .01$; Table 6). Further, among FSWs who used only one place to solicit clients, inconsistent condom use was higher among street-based FSWs than brothel-based FSWs (AOR 1.3, 95% CI 1.0–1.7, $p = .06$). Among FSWs who used one place to solicit clients, 70% used

TABLE 3 Percentage of FSWs Reporting Ever Use or Exclusive Use of a Particular Place for Solicitation or for Sex by State

Typology based on place of solicitation*	% FSWs ever used the place for solicitation				% FSWs who exclusively used the place for solicitation			
	Andhra Pradesh (*N* = 1514)	Karnataka (*N* = 1378)	Maharashtra (*N* = 1166)	Tamil Nadu (*N* = 1243)	Andhra Pradesh (*N* = 311)	Karnataka (*N* = 522)	Maharashtra (*N* = 687)	Tamil Nadu (*N* = 680)
Brothel-based	21.6	18.1	56.2	5.1	1.8	13.3	32.5	1.8
Street-based	68.9	45.5	53.3	91.3	13.9	12.7	20.7	48.4
Home-based	51.4	23.1	5.9	28.2	2.8	7.5	1.5	2.7
Lodge-based	36.8	24.5	16.8	24.8	0.1	3.2	0.8	1.0
Dhaba-based	20.7	14.6	7.1	3.3	0.1	0.2	1.7	0.0
Highway-based	8.8	4.7	1.5	11.4	0.0	0.4	0.0	0.2
Bar-based	9.4	1.3	4.4	5.6	0.0	0.0	1.2	0.0
Cell phone–based	23.4	39.6	9.2	13.4	1.8	2.8	0.6	0.6
% Who used only one for solicitation					20.5	40.1	59.0	54.7
Average number of places used for solicitation	2.41 ± 1.1	1.71 ± 0.7	1.54 ± 0.8	1.83 ± 1.2				

Typology based on place of sex*	% FSWs ever used the place for sex				% FSWs exclusively used the place for sex			
	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu
Brothel-based	23.1	18.7	62.8	6.1	1.8	17.7	36.4	2.1
Street-based	56.0	17.1	9.3	39.6	5.6	4.5	1.8	5.2
Home-based	82.0	23.5	25.6	71.2	17.6	23.5	7.4	25.4
Lodge-based	61.5	43.2	54.6	71.7	2.3	27.6	16.6	22.8
Dhaba-based	21.9	4.5	8.1	3.8	0.1	0.5	1.8	0.0
Highway-based	8.9	15.4	2.9	13.3	0.0	9.4	0.0	1.0
Bar-based	3.1	0.1	3.5	2.0	0.0	0.0	0.7	0.1

% Who used only one place for sex					27.5	83.2	64.7	56.6
Average number of places used for sex	2.56 ± 1.1	1.32 ± 0.6	1.67 ± 0.9	2.07 ± 0.8				

*This typology includes NACO's categorization (2007) and additional categories recommended in other studies. Street based category includes: on the road side, railway station/bus stand, market areas, cinema halls, labor *naka* (for solicitation), and park/bushes (for sex); home-based category includes own home, client's home, rented room; lodge-based category also included hotels; the highway-based category includes: vehicle; and the bar-based category also includes night clubs. *Dhabas* are roadside resting places for truck drivers and other long distance motorists.

TABLE 4 Typology of Sex Work Based on Places of Soliciting Clients and Having Sex for Four Southern States in India

Places for	Andhra Pradesh (N = 1514)	Karnataka (N = 1378)	Maharashtra (N = 1166)	Tamil Nadu (N = 1243)
Soliciting clients				
	Street (69%)	Street (46%)	Brothel (56%)	Street (91%)
	Home (51%)	Cell phone (40%)	Street (53%)	Home (28%)
	Lodge (37%)	Lodge (25%)		
Having sex				
	Home (82%)	Lodge (43%)	Brothel (63%)	Lodge (72%)
	Lodge (62%)	Home (24%)	Lodge (55%)	Home (71%)
	Street (56%)			Street (40%)
Both				
	Street to home (54%)	Street to lodge (24%)	Brothel to brothel (55%)	Street to lodge (69%)
	Street to street (52%)	Lodge to lodge (23%)	Street to lodge (42%)	Street to home (66%)
	Home to home (47%)	Phone to lodge (23%)		Street to street (39%)
	Street to lodge (44%)	Home to home (22%)		

Percentages in each state are based on the number of FSWs in that state.
Percentages do not add up due to multiple responses on places of solicitation as well as sex.

TABLE 5 Characteristics Associated with Use of Multiple Places for Solicitation of Clients among FSWs

	Multiple places for solicitation of clients			
Characteristic	%	*N*	Crude OR (95% CI)	AOR (95% CI)
Age group				
19–24	53.0	753	Referent	Referent
25–29	61.2	1,944	1.4 (1.1–1.7)	1.4 (1.2–1.7)
30–34	59.5	1,310	1.3 (1.1–1.6)	1.4 (1.1–1.7)
35–39	58.1	829	1.2 (1.0–1.5)	1.3 (1.0–1.7)
40+	47.3	465	0.8 (0.6–1.0)	1.0 (0.8–1.4)
Education				
Illiterate	58.7	1,817	Referent	Referent
Primary school	60.5	933	1.1 (0.9–1.3)	1.2 (1.0–1.4)
Secondary school	54.6	2,162	0.8 (0.7–0.9)	1.2 (0.9–1.2)
High school and above	66.9	387	1.4 (1.1–1.8)	1.8 (1.4–2.3)
Duration of sex work				
0–2 years	59.8	1,046	Referent	Referent
3–5 years	56.8	2,359	0.9 (0.8–1.0)	0.9 (0.8–1.1)
6–10 years	57.9	1,493	0.9 (0.8–1.1)	1.1 (0.9–1.3)
11+ years	59.6	403	1.0 (0.8–1.3)	1.3 (0.9–1.7)
Program exposure				
Yes	55.9	1,707	Referent	Referent
No	58.9	3,594	1.1 (1.0–1.3)	1.4 (1.2–1.7)
State				
Maharashtra	41.1	1,166	Referent	Referent
Andhra Pradesh	79.5	1,514	5.5 (4.7–6.6)	5.5 (4.6–6.5)
Karnataka	59.9	1,378	2.1 (1.8–2.5)	2.6 (2.1–3.2)
Tamil Nadu	45.3	1,243	1.2 (1.0–1.4)	1.1 (0.9–1.4)

streets in Andhra Pradesh and Tamil Nadu; there were no differences in inconsistent condom use in these states by typology. In Karnataka and Maharashtra, street-based FSWs were at higher HIV risk than brothel-based FSWs; the difference between the two was statistically significant (AOR = 1.4, 95% CI 1.2–1.6).

DISCUSSION

While fluidity in the categories of female sex work has been previously recognized (NACO, 2007), this empirically grounded study documents for the first time the extent and nature of fluidity in the typologies of female sex work–based one place of solicitation and place of sex. It also highlights several advantages in considering the place of sex in addition to place of solicitation to define the typology of sex work. Our study results show that such a consideration of places of sex work identified lodges as an important place for expanding programmatic interventions. Utilizing the multiple regression analysis, our study findings indicate that the extent and nature of fluidity

TABLE 6 Characteristics Associated with Inconsistent Condom Use among FSWs Overall and among Those Who Use Only One Place for Solicitation

	Overall (*N* = 5301)			Among those who use only one place for solicitation (*N* = 2230)		
	Inconsistent condom use			Inconsistent condom use		
Characteristics	%	Crude OR (95% CI)	AOR (95% CI)	%	Crude OR (95% CI)	AOR (95% CI)
Age group						
19–24	52.1	Referent	Referent	53.1	Referent	Referent
25–29	54.4	1.1 (0.9–1.3)	0.9 (0.8–1.2)	46.7	0.8 (0.6–1.0)	0.8 (0.6–1.2)
30–34	42.9	0.7 (0.6–0.8)	1.1 (0.9–1.2)	34.3	0.5 (0.4–0.6)	0.9 (0.6–1.3)
35–39	26.2	0.3 (0.2–0.4)	0.9 (0.7–1.2)	25.1	0.3 (0.2–0.4)	1.2 (0.8–1.8)
40+	19.6	0.2 (0.1–0.3)	0.9 (0.7–1.3)	16.3	0.2 (0.1 -0.3)	0.9 (0.6–1.6)
Education						
Illiterate	45.1	Referent	Referent	42.4	Referent	Referent
Primary school	58.5	1.7 (1.4–2.0)	1.3 (1.1–1.6)	48.2	1.3 (1.0–1.6)	0.9 (0.7–1.3)
Secondary school	37.6	0.7 (0.6–0.8)	0.8 (0.7–1.0)	31.8	0.6 (0.5–0.7)	0.7 (0.5–0.9)
High school and above	35.9	0.7 (0.5–0.9)	0.7 (0.5–0.9)	31.3	0.6 (0.4–0.9)	0.5 (0.3–0.9)
Duration of sex work						
0–2 years	64.3	Referent	Referent	55.7	Referent	Referent
3–5 years	47.1	0.5 (0.4–0.6)	0.7 (0.6–0.9)	42.0	0.6 (0.5–0.7)	0.7 (0.5–0.9)
6–10 years	29.3	0.2 (0.1–0.3)	0.6 (0.5–0.7)	24.4	0.3 (0.2–0.3)	0.6 (0.4–0.8)
11+ years	24.3	0.2 (0.1–0.2)	0.5 (0.3 – 0.6)	20.9	0.2 (0.1–0.3)	0.5 (0.3–0.8)
Program exposure						
Yes	33.8	Referent	Referent	26.8	Referent	Referent
No	64.6	3.6 (3.2–4.0)	1.4 (1.2–1.6)	60.2	4.1 (3.4–4.9)	1.0 (0.7–1.3)
State						
Maharashtra	30.2	Referent	Referent	26.9	Referent	Referent
Andhra Pradesh	38.5	1.4 (1.2–1.7)	1.3 (1.1–1.6)	37.9	1.6 (1.2–2.2)	1.5 (1.1–2.0)
Karnataka	89.9	20.6 (16.6–25.5)	24.8 (19.2–32.1)	83.9	14.1 (10.6–18.7)	14.3 (9.8–20.9)
Tamil Nadu	11.7	0.3 (0.2–0.4)	0.3 (0.2–0.4)	12.2	0.4 (0.3–0.5)	0.4 (0.3–0.6)

Use of multiple places for solicitation of clients						
No	38.1	Referent	Referent	N/A	N/A	N/A
Yes	47.9	1.5 (1.3–1.7)	1.4 (1.2–1.7)			
Typology of sex work						
Brothel				40.8	Referent	Referent
Street				30.6	0.6 (0.5–0.8)	1.3 (1.0–1.7)
Home				55.8	1.8 (1.3–2.5)	1.2 (0.8–1.8)
Lodge				64.2	2.6 (1.5–4.4)	1.5 (0.7–3.0)
Cell phone				58.8	2.1 (1.3–3.3)	1.4 (0.8–2.6)
Others				51.1	1.5 (0.8–2.7)	2.4 (1.2–4.7)

vary by state and FSWs' characteristics and that fluidity also increases HIV risk in India.

FSWs who use streets exclusively for solicitation are exposed to a higher degree of HIV risk compared to those who use only brothels for soliciting clients. Furthermore, by analyzing the most common combination of places used for sex work, our study was able to address an important policy issue: Should programmatic interventions be spread to reach all categories of sex workers or focus on a smaller number of places? Our results show that it is not necessary to consider a comprehensive typology of sex work or to dilute programmatic efforts by trying to cover all places of sex work. Instead a programmatic focus on a small number of places, for example: streets, lodges, and brothels, will not only reach the large majority of FSWs but will reach most FSWs multiple times.

NACO (2007) recommends using the primary place where clients are solicited for sex in considering a particular typology of sex work. Our study of mobile FSWs shows that less than half of FSWs mentioned only one place for soliciting clients, which means that more than half used at least two places to solicit clients. Furthermore, our study findings show that streets are the most common place for soliciting clients but lodges and homes are the two most common places for engaging in sex. For example, consistent with previous research studies in India, our study also found that 60% of mobile FSWs across the study states use streets for solicitation of clients (NACO, 2007; Ramesh et al., 2010). The current study supplements this information by documenting that approximately one-fourth of FSWs mentioned streets as exclusive places for solicitation of clients and an additional two-fifths reported streets in combination with other places for solicitation. Moreover, streets were reported as one of the most common places to solicit clients in all four states. These findings corroborate the results of previous studies, which indicate that 56% of FSWs in southern India solicited clients in open spaces, mostly streets and highways (Indian Council of Medical Research & Family Health International, 2009). However, with changing technology, the large majority of FSWs are contacting clients through cell phones, which has replaced the need for middle men such as pimps and other facilitators (Buzdugan et al., 2010) and less use of open spaces (Saggurti et al., 2011). The changing typology of sex work combined with mobility of FSWs can be deemed as one of the main programmatic challenges to HIV prevention work with this population, as it becomes difficult to contact, follow-up, or treat FSWs under any program ambit (Verma et al., 2010).

Our study identifies lodge-based and home-based FSWs as the two most common categories based on place of engaging in sex. To reach sex workers who solicit clients on the phone and are highly mobile, place of engaging in sex adds an important dimension to the typology of female sex work. For example, the extension of programmatic interventions to lodges will be important in all states because it is the most common place for

engaging in sex as well as solicitation of sex, especially among FSWs who use multiple places for sex work. Our study shows that close to one half of FSWs used multiple places to solicit clients as well as for sex, and FSWs use on an average two places for solicitation and sex. While home-based sex workers are difficult to reach with programmatic interventions, interventions focused on streets, lodges, and brothels would reach most of these FSWs; only a small percentage of FSWs (4%), who use homes exclusively as a place to solicit sex, would be difficult to reach with these interventions.

Our study documenting state-level variations in the typology and the extent and nature of female sex work reaffirm the need to consider the local context in designing programmatic interventions for FSWs (Saggurti et al., 2011). The use of cell phones as an important means to solicit clients, especially in Andhra Pradesh and Karnataka, indicates the importance of finding ways to reach FSWs with preventive messages through this emerging mode of communication. While a focus on brothel-based FSWs can pay dividends in Maharashtra, such a focus in the other three study states is likely to miss most FSWs because brothels are not among the most common places reported either for soliciting clients or engaging in sex in these states. In Andhra Pradesh and Tamil Nadu, home-based solicitation is not as important as home-based sex; street-based solicitation of clients is the most common category in these states. When considering place of sex as the basis of the typology, lodges are among the most common places for engaging in sex in all four states. These results suggest the need to initiate interventions in lodges across the states for the promotion of safe sex practices.

The need to establish mutually exclusive categories of sex work is important for research and analyses, especially when using multivariate analysis. We have shown how one can address this issue by undertaking two separate multivariate analyses: one using multiple versus single places as an independent or dependent variable, and another using type of sex work among FSWs who use only one place for solicitation as an independent variable. Using multiple regression analysis, our study findings show that a higher proportion of FSWs in Andhra Pradesh and Karnataka used multiple places to solicit clients than in the other two study states; they were also at higher risk of acquiring and transmitting HIV than those who used only one place to solicit clients. Furthermore, inconsistent condom use among street-based FSWs in Karnataka and Maharashtra was significantly higher than among those who used brothels to solicit clients.

For all four states together, the variation in inconsistent condom use by type of sex work among those who used only one place to solicit clients was not found to be statistically significant because of the relationship between the typology of sex work and state of residence. It is only in Karnataka and Maharashtra that a significant proportion of FSWs exclusively used either streets or brothels for soliciting clients. In these two states, a statistically significant relationship was found between inconsistent condom use and type

of sex work. Inconsistent condom use among street-based FSWs was higher than among those who used brothels to solicit clients. Strengthened intervention focus is required among FSWs who solicit clients either in the street or in the places where they have sex, such as lodges. Further, the lack of program exposure was positively associated with multiple places for solicitation of clients. Those FSWs who were not exposed to the program were more likely to use multiple places for soliciting clients, and were also more likely to use condoms inconsistently in sex with clients than others. Interventions need to be strengthened to reach FSWs who use multiple places for solicitation, so that their HIV risk can be reduced.

Although the findings of this analysis based on empirical evidence from the typology of female sex work and its linkages with HIV risk have important programmatic implications, they must be interpreted with caution because the study population included only mobile FSWs and did not cover nonmobile FSWs. It is possible that the inclusion of nonmobile FSWs may change the degree of fluidity as well as the relative importance of each category, especially because the brothel-based category is likely to be higher among nonmobile FSWs than mobile FSWs. However, the inclusion of nonmobile FSWs is unlikely to change the basic typology of female sex work and the validity of the findings, as most FSWs are concentrated in four categories: street-based, brothel-based, home-based, and lodge-based. Another limitation of this study is that the extent and nature of fluidity were assessed from multiple spontaneous responses regarding the common places for soliciting clients and engaging in sex. A better way to measure the extent of fluidity in future research and programs would perhaps be to ask two questions on each place; that is, the primary place and the secondary place for soliciting clients and engaging in sex.

Further research studies in this area should explore the links between state-level differences in the way sex work is organized (in terms of the typology and the extent and nature of fluidity), state-level differences in the way FSWs perceive their own risk of acquiring HIV, and state-level differences in the stage of the HIV epidemic. Future research should also explore the ever-changing locations used by sex workers and their implications for HIV prevention work in India. Research is also needed to confirm the increasing use of cell phones by FSWs for solicitation of clients and their higher chances of unsafe sex behaviors irrespective of their primary place of solicitation. The current study results, however, point to the fact that most FSWs who solicit clients using cell phones are likely to have sexual activity in lodges. If program coverage is extended to lodges, a greater proportion of FSWs who solicit clients using cell phones can be covered.

All these findings suggest that programmatic interventions focused on street-, lodge-, and brothel-based FSWs are likely to cover more than 90% of FSWs, and most of them multiple times. However, the nature of the interventions would need to differ by state and typology of sex work. The difference

in the nature of sex work between the states would also have important implications for the effectiveness of ongoing HIV prevention interventions.

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Research Article Open Access

HIV Risk Behaviors among Female Sex Workers Using Cell Phone for Client Solicitation in India

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Abstract

Background: With the emerging technological revolution in India, the use of cell phone among female sex workers (FSWs) for client solicitation has increased rapidly in the recent past. This study examines the association between FSWs' cell phone use and their HIV risk behaviors.

Methods: Data were drawn from a cross-sectional behavioral survey conducted across 22 districts of southern and western India during 2007-08. The analytical sample consisted of 3028 FSWs. Bivariate and multivariate methods were used to examine the association between use of cell phone and HIV risk behaviors.

Results: One-fourth (25%) FSWs used cell phones to solicit clients. Results from the multivariate analyses suggest that FSWs who use cell phones than those who do not use cell phones, were more likely to report inconsistent condom use with occasional clients (Adjusted Odds Ratio (AOR):1.9, 95% confidence interval (CI):1.5-2.3), inconsistent condom use with regular clients (AOR:1.6, 95% CI:1.3-2.0), experience of STI-related symptoms (AOR:2.4, 95% CI:1.9-3.1), consumption of alcohol prior to sex (AOR:1.7, 95% CI:1.4-2.0) and difficulty in negotiating condom use with clients (AOR:2.1, 95% CI:1.7-2.6). Except for home-based, the use of cell phone had a multifold effect on FSWs' HIV risk behaviors in other typologies of sex work.

Conclusion: Use of cell phone is associated with increased HIV risk behaviors among FSWs, independent of their place of solicitation. These findings document the need for developing new strategies to reach FSWs, particularly those who use cell phones or newer technologies for client solicitation.

Keywords: Cell phone; HIV; Female sex worker; Sexual behavior; Condom

Introduction

Globally, the face of sex work is dramatically changing with advances in technology [1] and female sex workers (FSWs) are increasingly using the cell phones for client solicitation [2]. The use of cell phones by FSWs has affected the traditional methods of sex work practice where sex workers congregate at hotspots and wait for prospective clients [2-4]. With the use of cell phones, clients can directly contact sex workers as well as FSWs can contact their known clients directly which can form a closed sexual network with undisclosed sexual activity [5]. FSWs using cell phones are likely to have complex sexual networks, as it has been argued in social network research that use of cell phone can enable an individual to build network in which some members are rapidly added or removed [5] while others are always present [6]. Studies conducted in India suggest that FSWs' place of sex work is fluid which is associated with their HIV risk behavior [3,4]. These studies suggest that the success of HIV prevention interventions would largely depend on the extent to which FSWs are profiled by their typology [3,7] and the way programs are implemented in the context of changing typology [4]. There is evidence that FSWs' use of cell phone is increasingly becoming common in India [3]. Studies in Andhra Pradesh in India showed that the use of cell phones by FSWs to solicit clients has increased from 3% in 2006 to 9% in 2009 [8,9] and to 27% in 2011 [10].

Due to a shift in the nature of client solicitation from traditional places such as brothels, homes, and streets to the use of cell phones, FSWs are increasingly becoming hard to reach for outreach and providing STI services, which has been recognized as a programmatic challenge in the coming years [3,4]. While the research highlighted that FSWs who use cell phones for client solicitation are at risk for HIV [4], their relative vulnerability in the context of other traditional ways of soliciting clients is not yet known in India. Moreover, there is little evidence to date in India about the HIV risk behaviors of FSWs who use cell phone [4]. Such research would be particularly relevant for India, in the light of increasing cell phone use both among high risk populations and the general population in India. Therefore, this study examines the association between use of cell phones by FSWs and their HIV risk behaviors such as inconsistent condom use, experience of STI-related symptoms, alcohol consumption prior to sex and perceived difficulty in condom use negotiation with clients. Secondarily, this study examines the association between the traditional typology (home-based, street-based, brothel-based and lodge-based) of sex work and HIV risk behaviors among FSWs who use cell phones.

Methods

Data

This study is based on data from a cross-sectional survey conducted among FSWs in 22 high in-migration districts across four states in

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southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India [11]. The study districts were identified using mapping and enumeration data on FSWs in each state; districts with more than 2,000 estimated FSWs were chosen (5 districts each in the states of Andhra Pradesh, Karnataka and Tamil Nadu and 7 districts in Maharashtra). The mapping and enumeration data at district level indicated large variations in the size of hotspots (place of sex work activities) which included brothel areas and soliciting places such as roads, highways, bus stands, railway stations and market areas. This list of hotspots formed the sampling frame and was used to prepare a list of clusters. Clusters were formed by combining small hotspots or by segmenting large hotspots such that each cluster has approximately 500 FSWs. Three such clusters from each district were randomly selected to obtain a minimum of 150 eligible participants per district. The number of FSWs to be interviewed was proportionately allocated according to the size of brothel-based and non-brothel-based FSWs. Independent sampling strategies were adopted for selecting brothel-based and non-brothel-based FSWs due to differences existing in the nature of sex work practice.

For selection of FSWs in brothel-based areas, a two-stage systematic sampling procedure was used. First, a list of lanes/small pockets/areas within a brothel site in a cluster was prepared. About 20% of the lanes or small areas were systematically selected in the first-stage sampling. In the second-stage sampling, brothel houses were systematically selected from selected lanes, with the first house selected randomly and subsequent houses selected based on a calculated interval. All FSWs in the selected brothel houses were interviewed using a screening tool to confirm their eligibility for the survey.

For selection of FSWs in non-brothel-based hotspots, a time location sampling procedure was adopted. Based on the information on peak day, peak time, lean day and lean time, a list of time linked hotspots was created where one hotspot can occur more than once depending on the variation in operation of sex work activities in a day. Time linked hotspots were selected using a systematic sampling approach. Thus, for each area, time slots were fixed for the interviewers to visit the site. Interviewers visited each of those sites as per the allotted time slot and waited for sex workers. FSWs who came to the site at the defined times were selected for interview using a screening tool.

About 94% (9475) of FSWs who were initially contacted (10075) agreed to participate in the study screening. Of these, 5611 (59%) FSWs were found eligible for detailed interview according to the study definition of mobile FSWs: those who had moved to two or more different locations for sex work during the previous 2 years, one of which included a move across districts. Of the total eligible FSWs (5611), 113 were excluded: 15 were not interviewed because they were below age 18 years, 21 refused to participate, 51 withdrew during the interview and for an additional 26 FSWs data were missing on socio-demographic variables. This resulted in a sample of 5498 FSWs at the end of the survey. Interviews were conducted by multilingual research assistants trained and experienced in different data collection techniques.

Ethical approval for the study was obtained from the institutional review boards (IRBs) of the Population Council and the University of Manitoba, Canada. Verbal consent was obtained from all respondents prior to participation in the survey. For ethical reasons, only FSWs who were at least 18 years of age were finally interviewed.

Measures

HIV risk behaviors in the study were measured using the following indicators: inconsistent condom use, experience of STI-related symptoms, alcohol consumption prior to sex and difficulty in condom use negotiation. These variables and its categories considered in this study were consistent with previous research recommendations [3,4,11-14].

Inconsistent condom use was assessed separately for occasional and regular clients. For each of these types of clients, participants were asked the frequency of condom use (indicated by 1=always, 2=sometimes, 3=never) during sex in the past one week and condom use at last sex. FSWs who had "always" used condoms in the last week and reported using a condom at last sex were coded as zero (consistent condom users) and the rest were coded as 1 (inconsistent condom users).

To determine the experience of STI-related symptoms, participants were asked whether they had experienced any of the following four symptoms in the six months prior to the survey: ulcers/sores in the genital area, swelling in the groin area, pain during intercourse and frequent painful urination. Those responding "yes" to any of these symptoms were classified as having experienced STI symptoms (1=yes, 0=no).

Alcohol consumption prior to sex with clients was assessed based on a single item question asked to all survey participants. Response categories included "yes-always", "yes-sometimes" and "no". The categories of "yes-always" and "yes-sometimes" were combined to define alcohol use prior to sex and was coded as 1, the category of "no" was coded as 0. Similarly, perceived difficulty on condom use negotiation was assessed using a single item question where FSWs who responded "yes" were coded as "1" (faced difficulty in condom negotiation); and "no" were coded as "0".

Sex work typology: The key independent variable in this study was use of cell phone for client solicitation. Respondents were asked about the places where and how they generally solicit clients. Spontaneous multiple responses were recorded in 14 categories with cell phone as one of the response categories. Based on this, FSWs were categorized into two groups: those who used versus those who did not use cell phones for solicitation. As seen in Table 1, irrespective of cell phone use for solicitation, FSWs also solicited at traditional places of solicitation like brothels, homes and streets. In order to examine the effect of cell phone use on HIV risk behavior in the context of these traditional sex work typologies, we defined sex work typology (also known as place of solicitation) as recommended by the Indian National AIDS Control Organization (NACO). NACO recommended the following six categories of sex work typology: brothel-based, street-based, lodge-based, *dhaba*-based, home-based and highway-based [15]. However, in this study, taking into consideration the similarity in the nature of sex work and to ensure sufficient cell frequencies in each category without distorting the similarity in the nature of solicitation, we

Place of solicitation	Not using cell phone for solicitation (N=4266)	Using cell phone for solicitation (N=1232)
	% (n)	% (n)
Home-based[1]	25.6 (1091)	20.8 (256)
Street-based[2]	69.6 (2969)	18.1 (223)
Brothel-based[3]	32.2 (1375)	8.4 (104)
Lodge-based[4]	33.7 (1439)	14.0 (173)

[1]Home-based sites include client's home, rented room and own home.
[2]Street-based sites include on the road sites, railway station/bus stands, market areas, cinema halls, labor nakas and vehicles.
[3]Brothel-based sites include brothels and bar/night clubs.
[4]Lodge-based sites include hotels, lodges and dhabas.

Table 1: Distribution of FSWs' typology of sex work by use of cell phone for solicitation.

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Background characteristics	Not using cell phone for solicitation (N=2272)	Using cell phone for solicitation (N=756)	P-Value
	% (n) or Mean(SD)	% (n) or Mean(SD)	
Age, Mean (SD)	30.3 (6.3)	28.2 (4.4)	<0.001
Education			
No formal education	34.3 (779)	24.5 (185)	<0.001
Primary schooling	17.1 (390)	25.6 (194)	<0.001
Secondary or higher schooling	48.6 (1103)	49.9 (377)	0.529
Marital Status			
Never married	14.0 (318)	21.6 (163)	<0.001
Currently married	36.6 (831)	16.9 (128)	<0.001
Formerly married	49.4 (1123)	61.5 (465)	<0.001
Sex work related characteristics			
Income only from sex work	57.2 (1299)	67.2 (508)	<0.001
Age at sex work debut, Mean (SD)	24.3 (5.2)	23.9 (3.8)	0.031
Place of solicitation			
Home-based[1]	10.5 (239)	33.9 (256)	<0.001
Street-based[2]	57.8 (1312)	29.5 (223)	<0.001
Brothel-based[3]	27.6 (626)	13.8 (104)	<0.001
Lodge-based[4]	4.2 (95)	22.9 (173)	<0.001

SD: Standard deviation
[1]Home-based sites include client's home, rented room and own home.
[2]Street-based sites include on the road sites, railway station/bus stands, market areas, cinema halls, labor nakas and vehicles.
[3]Brothel-based sites include brothels and bar/night clubs.
[4]Lodge-based sites include hotels, lodges and dhabas.

Table 2: Profile of FSWs by use of cell phone for solicitation in four states of India (N=3028).

grouped sex workers into the following four categories of sex work typology: brothel-based, home-based, street-based and lodge-based. In this classification, *dhaba*-based category was grouped with lodge-based and highway-based sex workers were merged with the street-based typology. According to the suggested classification, home-based settings included client's home, respondent's home and rented room; street-based included road side, railway station, bus stand, market area, cinema hall, labor *naka* (a place where daily wage laborers congregate) and vehicle; lodge-based included hotel, lodge and *dhaba*; and brothels include brothel and bar/night club.

Socio-demographic and sex work related variables: Information on socio-demographic variables like age (continuous), marital status (currently married, never married and formerly married), sources of income (only from sex work or any other source), education (no formal education, formal education) and age when initiated sex work (continuous) were assessed using single item questions. These variables were used as covariates in the multiple logistic regression analyses while predicting the risk associated with the use of the cell phones for different HIV risk behaviors.

Statistical analyses

Descriptive statistics were obtained for socio-demographic variables and covariates. The test for differences in proportion was used to examine the differences in socio-demographics of FSWs who used cell phones versus those who did not use cell phones for solicitation. A series of multiple logistic regression models were generated, first to examine the effect of cell phone use on HIV risk behaviors and then to understand the association between cell phone use and HIV

HIV risk behaviors (*dependent variables*)		Using cell phone for solicitation		Place of solicitation			
		No	Yes	Street-based[3]	Brothel-based[4]	Lodge-based[5]	Home-based[6]
Inconsistent condom use with occasional client in past week[1]							
	% (N)	23.9 (2255)	52.0 (750)	22.9 (1520)	24.4 (729)	59.9 (267)	49.9 (489)
	Model 1: AOR (95% CI)	Referent	2.7 (2.2-3.2)				
	Model 2: AOR (95% CI)	Referent	1.9 (1.5-2.3)	Referent	0.8 (0.6-1.0)	2.7 (1.9-3.6)	2.1 (1.7-2.7)
Inconsistent condom use with regular client in past week[2]							
	% (N)	32.1 (2134)	59.5 (738)	28.5 (1480)	36.2 (657)	75.4 (256)	56.6 (479)
	Model 1: AOR (95% CI)	Referent	2.4 (2.0-2.9)				
	Model 2: AOR (95% CI)	Referent	1.6 (1.3-2.0)	Referent	0.9 (0.7-1.2)	4.3 (3.0-6.0)	2.1 (1.6-2.6)
Experienced STI-related symptoms, past six months							
	% (N)	65.7 (2272)	85.1 (756)	69.3 (1535)	64.7 (730)	79.9 (268)	78.0 (495)
	Model 1: AOR (95% CI)	Referent	2.6 (2.1-3.2)				
	Model 2: AOR (95% CI)	Referent	2.4 (1.9-3.1)	Referent	0.8 (0.6-1.0)	1.0 (0.7-1.4)	1.1 (0.8-1.4)
Consumed alcohol prior to sex							
	% (N)	51.4 (2272)	63.8 (756)	53.4 (1535)	53.6 (730)	58.2 (268)	57.4 (495)
	Model 1: AOR (95% CI)	Referent	1.7 (1.4-2.0)				
	Model 2: AOR (95% CI)	Referent	1.7 (1.4-2.0)	Referent	1.1 (0.9-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.2)
Faced difficulty in condom negotiation							
	% (N)	21.7 (2272)	47.5 (756)	20.3 (1535)	24.8 (730)	48.9 (268)	46.1 (495)
	Model 1: AOR (95% CI)	Referent	2.8 (2.3-3.4)				
	Model 2: AOR (95% CI)	Referent	2.1 (1.7-2.6)	Referent	1.1 (0.9-1.4)	2.2 (1.6-2.9)	2.2 (1.7-2.8)

AOR: Adjusted Odds Ratio, CI: Confidence Interval
Model 1 and Model 2 were adjusted for participant's age (continuous), educational status, marital status, income only from sex work and age at initiation of sex work (continuous).
[1]Computed among FSWs who had occasional clients; N=3005; [2]Computed among FSWs who had regular clients; N =2872.
[3]Street-based sites include on the road sites, railway station/bus stands, market areas, cinema halls, labor nakas and vehicles.
[4]Brothel-based sites include brothels and bar/night clubs.
[5]Lodge-based sites include hotels, lodges and dhabas.
[6]Home-based sites include client's home, rented room and own home.

Table 3: Unadjusted percent and adjusted odds ratios predicting effect of cell phone use and typology of sex work on inconsistent condom use, sexually transmitted infection (STI), alcohol consumption prior to sex and difficulty in condom use negotiation among FSWs in four states of India (N=3028).

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risk behaviors within FSWs' typology of sex work. To examine the effect of use of cell phone on HIV risk behaviors, we fitted two sets of logistic regression models; model 1 with use of cell phone as the key independent variable and other socio-demographic variables added in the model as controlled covariates and model 2 was similar to model 1 with place of solicitation also controlled in the model along with other socio-demographic variables. Results from the logistic regression were presented in the form of odds ratios (OR) and their corresponding 95% confidence intervals (CI). All the analyses were performed using STATA 11.1.

Methodological consideration: Table 1 indicates a considerable overlap between places of solicitation of FSWs. In such a scenario, one cannot control for the effect of place of solicitation in the multivariate model while examining the effect of cell phone use on HIV risk behaviors. Therefore, we excluded observations from the analysis who reported more than one place of solicitation irrespective of their cell phone use. This resulted in an analytical sample of 3028 FSWs who reported only one place of solicitation.

Results

About two-fifths (43%) of FSWs recruited in the survey had a cell phone. One-fourth (25%) of FSWs reported using a cell phone for soliciting clients. FSWs who used cell phones to solicit clients were younger, better educated, never married and more dependent on income from sex work than others (Table 2). A large proportion of FSWs using cell phones were soliciting clients primarily in home- or lodge-based settings than those not using cell phones for solicitation.

Adjusted regression analyses (Table 3) suggest that FSWs who used cell phones for client solicitation were more likely to report inconsistent condom use with occasional clients (52% vs. 24%; adjusted odds ratio (AOR):2.7, 95% CI:2.2-3.2), inconsistent condom use with regular clients (60% vs. 32%; AOR:2.4, 95% CI:2.0-2.9), experience of STI-related symptoms (85% vs. 66%; AOR: 2.6, 95% CI:2.1-3.2), alcohol consumption prior to sex (64% vs. 51%; AOR:1.7, 95% CI:1.4-2.0) and difficulty in condom negotiation (48% vs. 22%; AOR: 2.8, 95% CI:2.3-3.4) than those who did not use cell phones to solicit clients. The effect of cell phone use on HIV risk behaviors remained the same even after controlling for place of solicitation. Further, lodge- or home-based FSWs were more likely to report inconsistent condom use with occasional clients, inconsistent condom use with regular clients and difficulty in condom negotiation as compared to street-based FSWs.

As the use of cell phone was associated with the place of solicitation, we further examined the effect of cell phone use on HIV risk behaviors among FSWs within each typology (Table 4). Results indicate that apart from home-based typology, in all other typologies of sex work FSWs who used cell phone as compared to those who did not use cell phones were more likely to report inconsistent condom use with their occasional and regular clients and difficulty in condom use negotiation. For example, the odds of using condoms inconsistently with occasional clients was higher among FSWs who used cell phones for solicitation in street-based (40% vs. 20%, AOR: 2.0, 95% CI: 1.4-2.8), brothel-based (56% vs. 19%, AOR: 4.5, 95% CI: 2.8-7.1) and lodge-based settings (69% vs. 43%, AOR: 2.5, 95% CI: 1.4-4.3) than those who did not use cell phones for solicitation. Similarly, the odds of experiencing STI-related symptoms and consumption of alcohol prior to sex were higher among FSWs who used cell phones for solicitation than who did not use cell phones irrespective of their place of solicitation. Furthermore, among cell phone users, HIV risk behaviors were more likely to be reported by lodge-based FSWs compared to those from other typologies.

Discussion

The current study, to the best of our knowledge, is the first to examine the association between use of cell phone for solicitation and HIV risk behaviors in its entirety among FSWs. The practice of FSWs using cell phones appears to be common in India, as the current study conducted in 2007-08 indicates that one-fourth of FSWs used cell phones to solicit clients. The findings further indicate that FSWs using cell phone for solicitation, as compared to those not using cell

HIV risk behaviors (*dependent variables*)		**Place of solicitation**							
		Street based[1]		**Brothel based[2]**		**Lodge based[3]**		**Home based[4]**	
		Not using cell phone (N=1312)	**Using cell phone (N=223)**	**Not using cell phone (N=626)**	**Using cell phone (N=104)**	**Not using cell phone (N=95)**	**Using cell phone (N=173)**	**Not using cell phone (N=239)**	**Using cell phone (N=256)**
Inconsistent condom use with occasional client in past week	% (n)	20.1 (262)	39.5 (86)	19.2 (120)	56.3 (58)	42.6 (40)	69.4 (120)	50.6 (118)	49.2 (126)
	Adjusted OR (95% CI)	Referent	**2.0 (1.4-2.8)**	Referent	**4.5 (2.8-7.1)**	Referent	**2.5 (1.4-4.3)**	Referent	0.8 (0.5-1.1)
Inconsistent condom use with regular client in past week	% (n)	26.0 (327)	43.0 (95)	31.7 (177)	61.6 (61)	61.8 (55)	82.6 (138)	55.3 (126)	57.8 (145)
	Adjusted OR (95% CI)	Referent	**1.7 (1.2-2.3)**	Referent	**3.0 (1.9-4.7)**	Referent	**1.8 (0.9-3.6)**	Referent	0.8 (0.5-1.2)
Experienced STI-related symptoms in past six months	% (n)	67.3 (883)	81.2 (181)	60.7 (380)	88.5 (92)	59.0 (56)	91.3 (158)	72.8 (174)	82.8 (212)
	Adjusted OR (95% CI)	Referent	**1.8 (1.3-2.6)**	Referent	**4.2 (2.2-7.9)**	Referent	**7.5 (3.7-15.2)**	Referent	**1.8 (1.1-2.9)**
Consumed alcohol prior to sex	% (n)	52.2 (685)	60.1 (134)	49.5 (310)	77.9 (81)	46.3 (44)	64.7 (112)	54.0 (129)	60.6 (155)
	Adjusted OR (95% CI)	Referent	**1.4 (1.0-1.8)**	Referent	**3.3 (2.0-5.4)**	Referent	**2.1 (1.2-3.6)**	Referent	**1.5 (1.0-2.2)**
Faced difficulty in condom negotiation	% (n)	18.2 (239)	32.7 (73)	19.0 (119)	59.6 (62)	37.9 (36)	54.9 (95)	41.4 (99)	50.4 (129)
	Adjusted OR (95% CI)	Referent	**1.9 (1.4-2.6)**	Referent	**5.3 (3.3-8.5)**	Referent	**1.9 (1.1-3.4)**	Referent	1.3 (0.8-1.8)

OR: Odds Ratio, CI: Confidence Interval

Multivariate models adjusted for respondent's age, educational status, marital status, income only from sex work and age at initiation of sex work.

[1]Street-based sites include on the road sites, railway station/bus stands, market areas, cinema halls, labor nakas and vehicles. Analysis was limited to a sub-sample of 1535 FSWs who solicit only in street-based sites irrespective their use of cell phone.

[2]Brothel-based sites include brothels and bar/night clubs. Analysis was limited to a sub-sample of 730 FSWs who solicit only in brothel-based sites irrespective their use of cell phone.

[3]Lodge-based sites include hotels, lodges and dhabas. Analysis was limited to a sub-sample of 268 FSWs who solicit only in lodge-based sites irrespective their use of cell phone.

[4]Home-based sites include client's home, rented room and own home. Analysis was limited to sub-sample of 495 FSWs who solicit only in home-based sites irrespective their use of cell phone.

Table 4: Unadjusted percent and adjusted odds ratios predicting inconsistent condom use, sexually transmitted infection (STI), alcohol consumption prior to sex and difficulty in condom use negotiation within FSWs' primary typology with use of cell phone as the predictor variable among FSWs in four states of India.

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phones, were more likely to report inconsistent condom use, experience STI-related symptoms, consume alcohol prior to sex and face difficulty in condom use negotiation independent of their traditional places of solicitation. Furthermore, among FSWs using cell phone, lodge-based FSWs were more likely to engage in high HIV risk behaviors than FSWs practicing sex work in brothels, streets or homes.

Evidence from past research suggests that FSWs' condom use practices are influenced by several factors such as the degree of intimacy with sexual partners [16-18], charges per sex act [19-22], condom negotiation skills [19,23, 24] and alcohol consumption [11,25-27]. The current research shows that such behaviors are more likely to occur among FSWs using cell phones for solicitation than others, leading into higher inconsistent condom use with both occasional and regular clients. FSWs using cell phones for solicitation may be entertaining clients with whom they have established rapport and trust. In such circumstances, FSWs may not be able to insist on condom use because of their familiarity with the client, or more money being earned or their inability to negotiate condom use. Consistent with other studies, the current research also indicates that inconsistent condom use with clients is higher among FSWs who solicit clients in lodges as compared to other sex work typologies [3]. It is possible that though sex workers' primary place of solicitation is the lodge, they may have solicited client on the cell phone; the choice of a lodge for engaging in sex may have been based on the client's preference and may not be the same as their primary place of solicitation. In such a scenario, FSWs' negotiation skills could be hampered to a large extent by the unfavorable environment at the place of sex.

The fact that sex workers who use cell phones for solicitation appear to be at increased risk of STI/HIV can be an indication that this sub-group of women needs special programmatic attention. Although FSWs who use cell phones are better educated, younger and more dependent on income from sex work than others, their exposure to HIV prevention programs may be limited, as indicated by their high HIV risk behaviors. Further, with the increasing use of cell phone, FSWs may not visit traditional venues like streets, lodges and brothels to solicit clients [3,4]. Such dynamics can pose several challenges to program planners when designing outreach strategies for FSWs. This finding calls for future research to understand whether FSWs using cell phones for solicitation are reached by HIV prevention programs, and if so, the extent of such coverage. Further, in-depth research is needed to understand the network structure among FSWs using cell phones. Investigations should be carried out on the type of sexual exchange and degree of intimacy between sexual partners and FSWs who use cell phones. It is also important to conduct further research to understand the profile of clients solicited through cell phones and whether they are different from clients who are solicited in traditional places of solicitation.

The current research, further, indicates that FSWs use cell phone only as a medium to contact clients; they primarily solicit from locations like brothels, lodges, homes or streets. Therefore, one can argue that FSWs' HIV risk behaviors may not be due to the use of cell phone but rather due to the risk associated with the sex work setting, as indicated in past research [3,28,29]. Analyses examining the association between HIV risk behaviors and the use of cell phones within sex workers' typology indicated that FSWs using cell phone were at increased risk of HIV independent of their place of solicitation. However, we did not find any effect of cell phone use on HIV risk behaviors among home-based FSWs, apart from the experience of STIs. Home-based sex workers practice sex work through a network of known clients even before cell phone came into use. Further, a careful look at the sub-sample of FSWs using cell phone suggests that the lodge-based sex workers compared to home-based FSWs were more likely to report inconsistent condom use and experience of STI-related symptoms. Contrary to earlier research conducted among sex workers [28-30], the current research observes that among cell phone users, the HIV risk behaviors of home- and brothel-based FSWs do not differ, suggesting that the pattern of sexual behavior of FSWs is largely influenced by the use of cell phone rather than the typology of sex work.

Although the findings of this analysis provide important insights into the HIV risk behaviors of FSWs who use cell phones and those who do not use cell phones to solicit clients, the results should be interpreted with caution in the light of certain study limitations. First, the results of this study are based on a selective group of FSWs who were mobile (moved to at least two places in the past two years); hence, findings should not be generalized to all FSWs in India. However, given the nature of solicitation among mobile FSWs using cell phones for client solicitation, there are reasons to believe that non-mobile FSWs using cell phones may be engaging in similar sexual risk behaviors. To this end, further research is required to confirm this argument. Second, the analytical sample was limited to a group of FSWs who had reported only one place of solicitation. Post-hoc analyses among 5498 FSWs (all surveyed FSWs) suggest that the relationship between use of cell phone and HIV risk behaviors does not alter. Third, the key independent variable "use of cell phone for solicitation" used in this study was collected using a spontaneous multiple response question. This could have under-estimated the proportion of FSWs reporting use of cell phone for solicitation. Fourth, the indicators used in the current research are based on self-reports and there is a likelihood of certain degree of social desirability bias. In order to reduce such bias, interviews were conducted in a private place to ensure confidentiality of the respondents. Another limitation of the current research is related to the degree of cell phone use for sex work. The survey did not collect information on the extent and duration of cell phone use. Future research is, therefore, needed to understand the extent to which FSWs are dependent on cell phone use for client solicitation.

The widespread use of cell phone by FSWs has undoubtedly changed the structure of sex work, resulting in fewer traditional sex work venues in the recent years [2-4]. Nevertheless, our study shows that the use of cell phone for solicitation is currently in combination with other traditional sex work venues; however, those using cell phones are more likely to have high sexual risk behaviors than those not using cell phone for client solicitation. These results suggest that outreach programs for FSWs needs to be strengthened with special attention to those FSWs who use cell phones. In addition, HIV prevention programs should develop a network of sex workers through which outreach services to such FSWs using cell phone can be enhanced. Further, mapping of FSWs should be undertaken at regular intervals to understand the changing dynamics of sex work. An effective way of providing communication messages to FSWs who use cell phone may be through text messaging, which needs further research to understand the types of messages that FSWs would be comfortable receiving. Such communication messages can be either individually customized or group-targeted and could emphasize to improve knowledge about HIV/AIDS, information on HIV risk reduction, sexual negotiation skills, proper condom use, and development of partner norms supportive of consistent condom use. For better acceptance of communication messages, voice of a leader or peer acceptable to sex worker's community can be used to record those messages. Further, a toll-free helpline can be set up to provide counseling services and instant information on HIV prevention services

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available at locations near the sex worker's locality. In summary, with the growing use of cell phone for solicitation, appropriate HIV prevention programs need to be developed that use technology to promote sexual risk reduction among FSWs in India and elsewhere.

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Authors' Contribution

BM led the study design, conception, data analysis and preparation of the manuscript. NS led in study design and data collection and assisted in finalizing analysis plan and interpretation of the findings. SS assisted in writing of manuscript and interpretation of study findings. AKJ provided overall guidance with analytical approach and interpretation of study findings. All authors read and approved the final manuscript.

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ORIGINAL PAPER

Indicators of Mobility, Socio-Economic Vulnerabilities and HIV Risk Behaviours Among Mobile Female Sex Workers in India

Niranjan Saggurti · Anrudh K. Jain · Mary Philip Sebastian · Rajendra Singh · Hanimi Reddy Modugu · Shiva S. Halli · Ravi K. Verma

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Abstract This paper examines the relationship between indicators of mobility, socio-economic vulnerabilities, and HIV risk behaviours among 5,498 mobile female sex workers (FSWs) living in the four high HIV prevalence states in India. Female sex workers with greater degree of mobility reported significantly more often than the FSWs with lesser degree of mobility that they experienced physical violence, and consumed alcohol prior to sex. Further, FSWs with greater degree of mobility reported significantly more often than the FSWs with lesser degree of mobility that they had inconsistent condom use in sex with clients, even after controlling for several demographic characteristics and socio-economic vulnerabilities including experiences of violence. Additionally, short duration visits and visit to the *Jatra* (religious fairs) places found to have significant association with their inconsistent condom use in sex with clients as well as continuation of sex despite having STI symptoms. These findings suggest the need for screening FSWs for higher degree of mobility and to mobilize them to form community networks so as to deal with violence, reduce alcohol use and promote consistent condom use along the routes of mobility. HIV prevention interventions aimed at FSWs require an increased attention to address the socio-economic vulnerabilities including alcohol use, with particular emphasis on those FSWs who are on the move in India and elsewhere.

Keywords Mobility · HIV · STIs · Condom use · FSWs · Violence · Alcohol use · India · Sex workers

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Introduction

Mobility is widely recognized as key facilitating factor in HIV spread around the world [1–8]. Several African studies have documented that men and women who had travelled or migrated recently are at higher risk for HIV and other sexually transmitted infections (STIs) than people who did not travel or migrate [4, 8–10]. The reasons for such heightened risk among highly mobile populations are attributed to low access to care [11] and other social services [4, 12, 13].

Globally as well as in India, female sex workers (FSWs) are believed to be the recipient as well as transmitter of HIV infection [5, 14–16]. Indian FSWs were found to be at higher risk due to increased inconsistent condom use [2, 17] and other vulnerability factors such as violence and migration [1, 5, 18]. Recent studies in India indicate that many sex workers move [5] often as frequently as every 2 weeks [19–22]. The frequent mobility of sex workers is the result of their search for work and also considered as response to escape the social stigma from family and community members [19–22] who in turn increases risk for HIV and contribute to the spread of this infection [23, 24]. Moreover, both HIV and sex work are highly stigmatized

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in India like in many other countries [25]. Sex workers are often subjected to blame, labeling as bad women, strong disapproval and discriminatory treatment [26]. Mobility to avoid stigma has implications for changing sex work venues [3, 26, 27], thus make these FSWs extremely hard to reach with prevention programs.

Though the mobility of sex workers has been identified as the critical component of HIV transmission, limited attention has been paid to investigate the relationships between different indicators of mobility and HIV risk behaviours within the context of socio-economic vulnerabilities. Few existing micro-level studies only have examined this issue, however, they have done so by taking one factor at a time: mobility and HIV risk [5]; violence and HIV risk [28–30]; and migration and lack of access to STI care [7]. The results of these studies cannot be generalized to mobile FSWs because these studies do not control for the effects of socio-economic vulnerabilities which affect both mobility as well as HIV risk behaviours. Hence, research is needed to confirm the link between mobility, socio-economic vulnerabilities and HIV risk behaviours to deepen the insight into factors that can be influenced through programmatic interventions. The present study therefore seeks to: (1) examine the relationship between mobility and current socio-economic vulnerabilities (such as violence, alcohol use prior to sex, under debt); and (2) examine the independent effects of mobility, current socio-economic vulnerabilities on HIV risk behaviors. This study is part of a large scale research project on mobility and HIV risks among FSWs from four high HIV prevalence states of India.

Methods

The present study is based on data from a cross-sectional behavioural survey conducted among FSWs in 22 districts with high in-migration across four states in southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India, identified as high epidemic states by the Indian National AIDS Control Organisation prior to the year 2005 [19–22]. These study districts were identified by using unpublished mapping and enumeration data on FSWs collected independently by the State AIDS Control Society and Avahan (India AIDS Initiative of the Bill & Melinda Gates Foundation).

A two-stage sampling procedure was used to select FSWs from both brothel and non-brothel sites. For brothel sites, two-stage systematic sampling was used: at the first stage, lanes/small pockets/areas were selected systematically; and at the second stage, brothel houses in each lane/small sub-area were selected. All FSWs in the selected brothel houses were interviewed by using a screening tool to identify mobile FSWs. In the case of non-brothel sites, two-stage time location sampling was used: at the first stage, the sites of sex worker cruising points or homes were selected; and at the second stage, the day and timing of visits were systematically selected. All FSWs found during the selected time, day, and cruising sites/homes were interviewed by using a screening tool [5].

About 94% (or 9475) of FSWs who were contacted (10075) initially had agreed to be administered the screening questionnaire. Of these 5611 (59%) FSWs were found eligible for detailed interview according to the study definition of mobile FSWs: those who moved to two or more different locations for sex work during the previous 2 years and one of which included a move across districts.

Ethical approval for the study was obtained from the institutional review boards (IRBs) of Population Council; and the University of Manitoba, Canada. Verbal consent was obtained from all respondents prior to participation at each stage. For ethical considerations, only those FSWs who were at least 18 years of age were finally interviewed. Of the total eligible FSWs (5,611), 113 were excluded: 15 were not interviewed because they were below age 18 years, 21 have refused to participate, 51 withdrawn from interview in the middle, and for additional 26 the data was missing on socio-economic variables. This resulted into a total analytical sample of 5,498 FSWs.

The detailed survey was conducted by multilingual research assistants trained and experienced in qualitative and quantitative data collection techniques. Face-to-face interviews were conducted in private or public locations depending upon the preference of the respondent. The data was collected using handheld PDAs (Palmtop Digital Accessories) in the states of Andhra Pradesh, Maharashtra, and Tamil Nadu; and through printed questionnaires in Karnataka. This was the first time that PDAs were used for survey among FSWs in India [19, 20, 22]. In order to facilitate the acceptance of PDA, respondents were explained about the interviewing technique and shown how the PDA works. The PDA program was used to ensure confidentiality of large scale sensitive data collected in the field. The consistency and quality of data collected through the use of PDAs were assessed weekly by using SPSS. The quality assurance and management of data collected via questionnaires involved immediate review by field staff after completing interviews to ensure accuracy and completeness, same day review by the field supervisor, and weekly transfer of data to the data management team in Dharwad, Karnataka where data were entered and processed monthly to verify consistency and accuracy.

Measures

HIV risk behaviors are measured by using two indicators: (a) reported inconsistent use of condoms, and (b) continued

to have sex while experiencing STI symptoms (ulcers/sores in genital area, swelling in groin area, pain during intercourse, and frequent painful urination). The inconsistent condom use was assessed for each of the following types of sex partners: occasional clients and regular clients. For each of these types of partners, participants were asked the frequency of condom use (indicated by 1 = always, 2 = sometimes, 3 = never) they had sex with partners in the past 1 week and condom use at last time sex. These items were used to create a single variable on inconsistent use of condoms with paying partners. To determine the continuation of sex while experiencing STI symptoms, participants were asked whether they had experienced any of the following four symptoms: ulcers/sores in genital area, swelling in groin area, pain during intercourse, and frequent painful urination. Those indicating yes to any of these symptoms were classified as having experienced STI symptoms in the past 6 months prior to the survey. This variable was combined with answer to another question about whether or not the FSW continued to have sex while experiencing these symptoms (1 = yes, 0 = no). The final index was coded as 1 (continued to have sex while experiencing at least one of the four STI symptoms), and 0 (did not have sex while experiencing at least one of the four symptoms, or did not experience any STI symptom during last 6 months).

Mobility is measured from the responses to four questions reflecting the degree and nature of mobility: moved to four or more places during 2 years prior to the survey (no = 0, yes = 1), stayed for 1 month or less at previous two places (no = 0, yes = 1), visited *jatra* ('special religious festivals') place (no = 0, yes = 1), and visited a place frequented by seasonal male migrant workers (no = 0, yes = 1).

Pre-existing vulnerabilities of FSWs include their education, caste, age at entry into sex work, reason for entry into sex work and marital status at the time of sex work entry. These factors reflect conditions that existed before FSWs entered sex work, and are assumed to influence their mobility as well as their condom use behavior. These variables are controlled in the analyses to examine the relationship between mobility, current socio-economic vulnerabilities and HIV risk behaviors.

Current socio-economic vulnerabilities of FSWs include their experiences of physical violence and/or sexual violence in the last 6 months prior to survey (no = 0, yes = 1), alcohol use before sex in the current place (no = 0, yes = 1), and currently under debt (no = 0, yes = 1). Information collected in the survey on experiences to physical violence and sexual violence separately were combined at the time of analyses to compute a single variable on "Whether or not the individual has experienced any kind of violence (either physical or sexual violence)". Further, information on last time they have experienced violence was used to compute the variable on experience of violence in 6 months prior to the survey.

Program exposure of FSWs includes information about their contacts with outreach workers from government, Avahan funded programs, and/or non-governmental organisations (NGOs) in the current place. Those indicating no contacts with outreach workers were coded as "0, no exposure" and those indicating contact were coded as "1, exposed to the HIV prevention program". This measure was used as a controlling variable in the statistical analyses.

Statistical Analyses

Univariate analysis was used to calculate percentages on mobility and HIV risk indicators. Bi-variate analyses were used to understand the association between the indicators of mobility and HIV risk and Chi-square statistic was used to test their significance. The level of significance for all analyses was set at $P < 0.05$. A series of multiple logistic regression models were used to examine the effects of mobility and current socio-economic vulnerabilities on HIV risk behaviors. All statistical analyses were conducted using STATA version 8.2 [31].

Results

Of the sample of 5,498 mobile FSWs interviewed, 3,811 (69%) visited four or more places in the past 2 years, 1,673 (30%) visited *jatra* place and 435 (8%) visited places frequented by seasonal male migrant workers for sex work in the last 2 years prior to the survey (Table 1). These dimensions of mobility are not mutually exclusive. There is a considerable overlap among them. For example, 4% of FSWs are classified as mobile on all the three dimensions, i.e., they visited 4 or more places within last 2 years and visited *jatra* place as well as visited the places frequented by seasonal migrants; 22% were classified mobile on 2 of 3 dimensions; and 51% were classified as mobile on one of the three dimensions of mobility. The remaining 23% were classified as less-mobile on all the three dimensions, i.e., they visited 2–3 places during past 2 years and did not visit *jatra* place and did not visit a place frequented by male migrant workers. The degree of mobility was high among FSWs who entered into sex work for economic reasons (72%) and among those who entered into sex work in 2 years preceding the survey (76%). Relatively a higher proportion of FSWs from Karnataka (94%), Tamil Nadu (74%) and Andhra Pradesh (69%) moved to 4 or places in 2 years prior to the survey when compared to FSWs in Maharashtra (34%).

Table 1 Socio-demographic profile and indicators of mobility for mobile female sex workers, India

Characteristics	Percent	Number of moves in the past 2 years		Average duration of stay in a visit		Visit to Jatara areas		Visited seasonal migrant places	
		2–3 moves	4 or more moves	More than 1 month	One month or less	No	Yes	No	Yes
Sample size	5498	1687	3811	1401	4097	3825	1673	5063	435
Total %	100.0	30.7	69.3	25.5	74.5	69.6	30.4	92.1	7.9
Current age									
35+ years	24.2 (1329)	33.6	66.4	29.1	70.9	71.3	28.7	91.5	8.5
Less than 35 years	75.8 (4169)	29.8	70.2	24.3	75.7	69.0	31.0	92.3	7.7
Education									
High school or higher	47.7 (2620)	27.5	72.5	21.6	78.4	76.0	24.0	92.7	7.3
Less than high school	52.3 (2878)	33.6	66.4	29.0	71.0	63.7	36.3	91.5	8.5
Caste									
Non-SC/ST	55.3 (3039)	27.7	72.3	20.3	79.7	72.3	27.7	92.9	7.1
SC/ST	44.7 (2459)	34.4	65.6	31.9	68.1	66.2	33.8	91.1	8.9
Reason for entering into sex work									
Own choice/tradition	11.0 (607)	47.9	52.1	40.5	59.5	69.5	30.5	91.9	8.1
Force/economic/other reasons	89.0 (4891)	28.5	71.5	23.6	76.4	69.6	30.4	92.1	7.9
Marital status									
Divorced/widowed	51.9 (2853)	28.0	72.0	25.4	74.6	64.0	36.0	91.4	8.6
Unmarried	14.5 (795)	33.5	66.5	33.6	66.4	75.7	24.3	94.5	5.5
Married	33.6 (1850)	33.5	66.5	22.2	77.8	75.5	24.5	92.2	7.8
Duration into sex work									
11+ years	7.6 (416)	39.2	60.8	38.9	61.1	64.7	35.3	90.9	9.1
6–10 years	27.7 (1522)	35.5	64.5	28.1	71.9	65.9	34.1	89.5	10.5
3–5 years	44.7 (2456)	29.3	70.7	25.1	74.9	70.7	29.3	92.5	7.5
0–2 years	20.1 (1104)	23.9	76.1	17.8	82.2	73.9	26.1	95.2	4.8
State									
Tamil Nadu	23.2 (1276)	26.0	74.0	13.6	86.4	87.4	12.6	95.1	4.9
Andhra Pradesh	27.9 (1533)	31.5	68.5	9.9	90.1	55.8	44.2	85.2	14.8
Karnataka	27.3 (1500)	5.9	94.1	2.6	97.4	69.1	30.9	94.3	5.7
Maharashtra	21.6 (1189)	65.9	34.1	87.2	12.8	68.9	31.1	95.0	5.0

Almost all the mobile FSWs (99.2%) in the survey reported to have sex with at least one occasional client, 94 percent reported sex with at least one regular client in the last 1 week prior to the survey. The reported inconsistent condom use with these two types of clients was 29% with occasional clients and 37% with regular clients. Overall, about 38% (2088/5498) of FSWs reported inconsistent condom use in sex with at least one of the two types of clients: occasional and regular clients. Little more than half of the mobile FSWs reported at least one of the following STI symptoms: ulcers/sores in genital area (11%, 605/5498), swelling in groin area (16%, 876/5498), pain during intercourse (37%, 2034/5498), and frequent painful urination (34%, 1868/5498). Almost one-third of the total mobile FSWs continued to have sex while experiencing STI symptoms. Experience of STI symptoms predisposes FSWs to a higher risk of acquiring HIV and continuation of sex while experiencing these symptoms is likely to heightens their risk for HIV.

Table 2 presents the results of the association between indicators of mobility and socio-economic vulnerabilities. The results show that FSWs with higher degree of mobility in comparison to those with lower degree of mobility are significantly more likely to experience physical violence (25.8 vs. 35.1%; AOR = 1.4; 95% CI: 1.2–1.6; $P < 0.001$), and consume alcohol prior to sex (54 vs. 60.5%; AOR = 1.2; 95% CI: 1.0–1.3; $P < 0.05$). Similarly, the odds of experiencing violence by FSWs who visit jatra areas is 2 times (95% CI: 1.8–2.4; $P < 0.001$) higher than by those FSWs who did not visit

Table 2 Current socio-economic vulnerabilities by different indicators of mobility

Indicators of mobility	*N*	%	Experienced either physical or sexual violence[a]		Used alcohol before sex		Currently in debt	
			%	AOR[c] (95% CI)	%	AOR[c] (95% CI)	%	AOR[c] (95% CI)
Number of moves								
2–3 moves	1687	30.7	25.8	1.00	54.0	1.00	41.6	1.00
4 or more	3811	69.3	35.1	1.4 (1.2–1.6)**	60.5	1.2 (1.0–1.3)*	47.0	0.9 (0.8–1.1)
Average duration of stay in previous two places								
More than 1 month	1401	25.5	26.3	1.00	48.5	1.00	35.2	1.00
One month or less	4097	74.5	34.2	1.4 (1.2–1.6)**	61.9	1.6 (1.4–1.8)**	48.8	1.7 (1.5–2.0)**
Visited *Jatra*[b] places								
No	3825	69.6	26.0	1.00	57.4	1.00	40.4	1.00
Yes	1673	30.4	46.5	2.1 (1.8–2.4)**	61.1	0.9 (0.8–1.1)	56.8	1.6 (1.4–1.8)**
Visited place of seasonal male migrants								
No	5063	92.1	31.2	1.00	57.6	1.00	43.5	1.00
Yes	435	7.9	44.4	1.3 (1.0–1.6)*	69.0	1.5 (1.2–1.9)**	67.6	2.2 (1.8–2.7)**
Total	5498	100.0	32.2		58.5		45.4	

[a] In 6 months prior to the survey

[b] Jatra implies 'the pilgrimage sites in groups for religious festivities and celebrations. There are designated places and times in a year when people conduct these religious jatras

[c] Controlled for current age, education, marital status, caste, duration into sex work, reason for entry into sex work, program exposure and state

** $P < 0.001$, * $P < 0.05$

jatra places. FSWs with visits to jatra places (or) places of seasonal male migrants are significantly more likely to have financial debt.

The data were further analysed to understand the relationships between mobility, socio-economic vulnerabilities and HIV risk behaviors. The proportion of FSWs who reported inconsistent condom use with clients differs significantly between those with high and low degree of mobility (Table 3). FSWs with high degree of mobility reported higher inconsistent condom use than those with low degree of mobility (46.2 vs. 22.6%; AOR: 2.4; 95% CI: 2.1–2.8; $P < 0.001$). The odds of inconsistent condom use is high among those who spends lesser duration than those who spends more time while visiting places (43.7 vs. 25.1%; AOR: 1.7; 95% CI: 1.5–1.8; $P < 0.001$). More importantly, the odds of reporting inconsistent condom use with clients for FSWs with experiences of recent violence is 2.6 times (95% CI: 2.3–3.0; $P < 0.001$) more as compared to those who did not experience violence. The odds of continuing sex while experiencing STI symptoms among those who visited *jatra* places or places frequented by male migrant workers is higher than among those who did not visit these places. The presence of socioeconomic vulnerabilities also increases the odds of continuing sex while experiencing STI symptoms. Program exposure included in the present study of being in contact with outreach workers from NGOs did not show any association with both inconsistent condom use and STI risk.

Discussion

This cross-sectional investigation of HIV risk among mobile FSWs in four states of India indicates that higher degree of mobility, short duration visits and visit to jatra places are significantly associated with higher inconsistent condom use in sex with clients. This effect in part reflect the fact that a higher proportion of mobile FSWs come from disadvantaged strata of the society and continue to face higher socio-economic vulnerabilities such as experiencing violence, use of alcohol [5] and have relatively little economic independence than less mobile FSWs. The observed effect of different indicators of mobility on HIV risk behaviours, however, is independent of the current socio-economic vulnerabilities, and program exposure. Importantly, the findings from the current study, which is among the first to examine the relation between different indicators of mobility and HIV risk behaviours among mobile FSWs, provide empirical evidence to assertions made in the literature [23, 27] that mobility and the conditions under which FSWs move increases their HIV risk. A higher degree of mobility with lesser durations of stay, therefore, may be considered as a risk marker for sex worker's HIV risk.

The findings of this study provide empirical evidence to improve our understanding about the elements of mobility that are associated with elevated HIV risk. The high level of inconsistent condom use among mobile FSWs suggests

Table 3 Impact of mobility and current socio-economic vulnerabilities on HIV risk behaviours

Indicators of mobility	Inconsistent condom use in sex with clients[a]			Continued sex while experiencing STI symptoms		
	%	OR (95% CI)	AOR (95% CI)	%	OR (95% CI)	AOR (95% CI)
Number of moves						
2–3 moves	22.6	1.00	1.00	22.5	1.00	1.00
4 or more	46.2	2.9 (2.6–3.4)**	2.4 (2.1–2.8)**	20.8	0.9 (0.8–1.1)	0.9 (0.8–1.1)
Average duration of stay in previous two places						
More than 1 month	25.1	1.00	1.00	29.8	1.00	1.00
One month or less	43.7	2.3 (2.0–2.6)**	1.7 (1.5–1.8)**	18.5	0.5 (0.4–0.6)**	1.1 (0.9–1.2)
Visited *Jatra*[b] places						
No	36.1	1.00	1.00	17.2	1.00	1.00
Yes	45.4	1.5 (1.3–1.7)**	1.2 (1.0–1.4)*	31.0	2.2 (1.9–2.5)**	1.6 (1.4–1.9)**
Visited place of seasonal male migrants						
No	39.2	1.00	1.00	19.7	1.00	1.00
Yes	35.9	0.9 (0.7–1.1)	0.8 (0.6–1.0)	41.1	2.9 (2.3–3.5)**	2.1 (1.7–2.6)**
Experienced physical violence						
No	31.1	1.00	1.00	16.9	1.00	1.00
Yes	55.5	2.8 (2.5–3.1)**	2.6 (2.3–3.0)**	30.6	2.2 (1.9–2.5)**	1.8 (1.6–2.1)**
Use alcohol before sex						
No	34.3	1.00	1.00	16.4	1.00	1.7 (1.5–2.0)**
Yes	42.2	1.4 (1.2–1.6)**	1.3 (1.1–1.5)**	24.9	1.7 (1.5–1.9)**	
Currently in debt						
No	41.1	1.00	1.00	17.5	1.00	1.00
Yes	36.4	0.8 (0.7–0.9)**	0.6 (0.5–0.7)**	26.0	1.7 (1.5–1.9)**	1.5 (1.3–1.7)**
Program exposure						
No	40.2	1.00	1.00	19.7	1.00	1.00
Yes	38.4	0.9 (0.7–1.04)	0.9 (0.7–1.1)	18.1	0.9 (0.8–1.05)	0.8 (0.7–1.0)*

AOR Adjusted odds ratio (controlled for current age, education, marital status, caste, state, duration into sex work, reason for entry into sex work, program exposure in addition to the variables in the above table), *OR* Unadjusted odds ratio

[a] Inconsistent condom use in sex with occasional or regular clients in 1 week prior to the survey (*0* no; *1* yes)

[b] Jatra implies 'the pilgrimage sites in groups for religious festivities and celebrations. There are designated places and times in a year when people conduct these religious jatras

** $P < 0.001$, * $P < 0.05$

their contribution in continuing transmission of HIV along the mobility routes, including urban and rural areas across different districts. Higher HIV prevalence among young FSWs in India [32] and their strategic mobility at later ages through the facilitation of agents, brothel owners, pimps or madams could have an impact on the transmission of HIV into different populations. Additionally, the previously published research indicated that a high proportion of FSWs and the clients in India use alcohol prior to or during sex [5]. Alcohol may be used by FSWs to cope with the stress and violence associated with commercial sex work [22, 33]. Thus, strategic planning is required to develop and implement campaigns promoting '100% condom use' [34] so that FSWs continue to use condoms even if they are on the move. Although India based successful interventions using collectivization [18] have addressed some of the contextual factors associated with increased HIV risk, they were largely focused on FSWs who stayed in one place for sex work for longer period. It cannot be ascertained whether similar interventions would be feasible or successful for the group of mobile FSWs [5, 27]. The association between mobility and inconsistent condom use is significant in almost all the study states except for Tamil Nadu, where more than 90% of the FSWs reported consistent condom use in sex with clients [19–22].

The current results on association between higher degree of mobility and increased risk for HIV suggest a need for an increased attention in designing programmatic interventions to address structural and contextual factors to reduce the degree of mobility and to increase the consistent condom use not only at the place of destination but also along the routes of mobility. The intervention programs should develop mechanisms to identify FSWs who move frequently from one place to another and understand the

contexts under which they move or the local conditions that led FSWs to move. Perhaps the most crucial means through which mobility impacts the risk to HIV is her lack of power to negotiate and use condoms. This may be especially true with the regular paying but, more importantly non-paying clients. The newer environment, competition to acquire more and regular clients, lack of social support or protective structures, and high economic need are some of the contextual factors that appear to drive inconsistent condom use by mobile FSWs with these clients. Programs should strategically develop mobile FSWs community networks so as to provide protective environments along the routes of mobility.

Although the findings of this analysis indicate important programmatic implications based on empirical evidence on linkages between indicators of mobility and HIV risk, they must be interpreted cautiously in light of several study limitations. Firstly, the study population included mobile FSWs and did not include non-mobile FSWs. The findings of this study therefore refer to the linkages between different indicators of mobility and HIV risk, and not to mobility *per se*, i.e., not to those who move in comparison to those who do not. Secondly, this study indicates that each of the factors included in the analysis—socio-demographic characteristics and related vulnerabilities—independently increase the risk of acquiring HIV among the mobile FSWs. These factors may also increase the risk of acquiring HIV among the non-mobile FSWs; but we cannot validate these effects from the current analysis because our sample did not include non-mobile sex workers. Thirdly, the items used for analyses rely on self-reported responses and are subjected to social desirability and memory bias. Moreover, the independent effect of mobility on HIV risk could also question the sufficiency of the factors included in the analysis or deficiencies in their measurements or unmeasured factors not included in the analysis. For example, program exposure could be measured by the intensity and contents of contacts between FSWs and outreach workers. While the future research could address some of these study limitations, this large scale study documents for the first time empirical evidence on the effect of mobility indicators on HIV risks among major population affected by HIV within the country.

The two variables of HIV risk used in this paper considered responses from multiple questions. The first indicator about inconsistent condom use combines responses to four questions about inconsistent condom use with occasional and regular clients in the last 1 week, and condom use at last time sex with occasional and regular clients. Similarly the second indicator on continued sex while experiencing STI symptom in the past 6 months combines answers to five questions; four regarding STI symptoms and one regarding continuation of sex. Although, the recall bias is inherent in these types of behavioural research; the results however, indicate the minimum number of FSWs who are at risk for HIV due to their possible exposure to STIs.

While we recognize the bias inherent in the self reports of consistent condom use and experience of STI symptoms, the degree of this bias is minimized by considering multiple questions and most recent period. Despite several careful considerations in the survey, the bias cannot be fully eliminated [35] in self-reported responses and hence the results must be interpreted cautiously recognizing that they are only indicative of exposure to HIV and do not reflect the presence of HIV.

Finally, the higher degree of mobility with short durations of stay can become an important marker of HIV risk for implementing prevention interventions among FSWs. Additionally, the disadvantaged conditions of mobile FSWs and their continued negative life situations such as existing socio-economic vulnerabilities along the routes of mobility raise the need for developing newer strategies in HIV prevention programs in India and elsewhere. Some of the strategies for HIV prevention initiatives among mobile FSWs could include screening for higher degree of mobility among FSWs, tracking their HIV risk behaviors along the routes of mobility, providing preventive messages and information on availability of program services through mobile phones or other communication mechanisms, and mobilization of mobile FSW community networks.

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Relationship between reported prior condom use and current self-perceived risk of acquiring HIV among mobile female sex workers in southern India

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Abstract

Background: With the evolution of Health Belief Model, risk perception has been identified as one of several core components of public health interventions. While female sex workers (FSWs) in India continue to be at most risk of acquiring and transmitting HIV, little is known about their perception towards risk of acquiring HIV and how this perception depends upon their history of consistent condom use behavior with different type of partners. The objective of this study is to fill this gap in the literature by examining this relationship among mobile FSWs in southern India.

Methods: We analyzed data for 5,413 mobile FSWs from a cross-sectional behavioral survey conducted in 22 districts from four states in southern India. This survey assessed participants' demographics, condom use in sex with different types of partners, continuation of sex while experiencing STI symptoms, alcohol use before having sex, and self-perceived risk of acquiring HIV. Descriptive analyses and multilevel logistic regression models were used to examine the associations between risky sexual behaviors and self-perceived risk of acquiring HIV; and to understand the geographical differences in HIV risk perception.

Results: Of the total mobile FSWs, only two-fifths (40%) perceived themselves to be at high risk of acquiring HIV; more so in the state of Andhra Pradesh (56%) and less in Maharashtra (17%). FSWs seem to assess their current risk of acquiring HIV primarily on the basis of their past condom use behavior with occasional clients and less on the basis of their past condom use behaviors with regular clients and non-paying partners. Prior inconsistent condom use with occasional clients was independently associated with current perception of high HIV risk (adjusted odds ratio [aOR)] = 2.1, 95% confidence interval [CI]: 1.7-2.6). In contrast, prior inconsistent condom use with non-paying partners was associated with current perception of low HIV risk (aOR= 0.7, 95% CI: 0.5-0.9). The congruence between HIV risk perception and condom use with occasional clients was high: only 12% of FSWs reported inconsistent condom use with occasional clients but perceived themselves to be at low risk of acquiring HIV.

Conclusion: The association between high risk perception of acquiring HIV and inconsistent condom use, especially with regular clients and non-paying partners, has not been completely internalized by this high risk group of mobile FSWs in India. Motivational efforts to prevent HIV should emphasize the importance of accurately assessing an individual's risk of acquiring HIV based on condom use behavior with all types of partners: occasional and regular clients as well as non-paying partners; and encourage behavior change based on an accurate self-assessment of HIV risk.

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Background

With the evolution of Health Belief Model (HBM) in 1950, risk perception has been identified as one of the several core components of public health interventions, but it is an important marker to promote safe sex behavior in the context of HIV prevention programs [1]. According to this model, individuals must first feel personally threatened by a disease with serious consequences; and then they must believe that the benefits of taking preventive action outweigh the perceived barriers to and/or the cost of preventive action [2,3]. Individuals' knowledge of the modes of HIV transmission and accurate assessment of their own risk seem to be among the key factors in the adoption of safer sexual practices [4].

The relationship between risk perception and sexual behavior is complex and poorly understood in the Indian context. Studies conducted in different cultures and among different populations suggest that HIV risk perception is associated with a wide range of variables: lack of knowledge of the modes of HIV transmission [5-7], young age at first sex [8,9], multiple sexual partners [8,10,11], no or low condom use [8,12,13], not knowing someone with AIDS, and no discussions on AIDS at home [14].

Given the nature of female sex workers' (FSWs) occupation, reduction in the number of concurrent partners is unlikely to be a practical option to reduce their risk of acquiring HIV. In India, HIV prevention interventions include a strong component of behavioural change communication that attempts to build awareness of HIV risk associated with unprotected sex and the need for consistent condom use to prevent the transmission and acquisition of HIV [1]. In order to support the adoption of safe sex practices, interventions have ensured the availability of condoms [15-18], communicated with sex workers using peers [19-23], made attempts to empower sex workers [18,24-28], provided care for sexually transmitted infections (STIs) and HIV [29,30], and developed collectives and community groups [18,23,27,31,32]. These factors either independently or together have increased the self esteem of sex workers to insist on condom use with their clients [22,24,28,32]. The long-term success of such interventions, however, will depend on the extent to which they bring about sustained change in risky sexual behavior [33,34].

There is little empirical evidence on the role of risky sexual behaviors in predicting the perception of HIV risk among FSWs. While, more than two-thirds of FSWs move from one place to another for sex work and such mobility has been a challenge for HIV prevention programs [35]. The research also shows that FSWs with a higher degree of mobility and short duration of stay in any given place are significantly associated with higher inconsistent condom use with different clients than others [35]. It is not known whether this effect reflects the fact that FSWs who are on the move are less likely to perceive HIV risks in general or are likely to perceive low risk with new clients in new places.

In India, as in many other countries, FSWs are identified as a group at highest risk of acquiring and transmitting HIV, yet little is known about how they, particularly mobile FSWs, themselves perceive their own HIV risk and how their perception depends upon their condom use behaviors with different sexual partners among other factors. The objective of this paper is to assess the HIV risk perceptions of a group of mobile FSWs practicing sex work in four states of India, and to examine the association between reported inconsistent condom use with occasional and regular clients and with non-paying partners, and the high HIV risk perceptions after controlling for several background characteristics and the history/current experience of STI symptoms, and alcohol use before sex. The findings of this assessment will guide the design and modification of communication materials that aim to build an accurate assessment of HIV risk among target populations within extensive HIV prevention programs that are currently underway in India and elsewhere.

Methods

Data

This study is based on data from a cross-sectional survey conducted among FSWs from September 2007 to July 2008 in 22 districts from four states in southern (Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu) India, identified as high epidemic states by the National AIDS Control Organization (NACO) prior to start of the study in the year 2005. These districts were identified using unpublished mapping and enumeration data on FSWs collected independently by the State AIDS Control Societies and Avahan (the India AIDS Initiative of the Bill & Melinda Gates Foundation). A two-stage sampling procedure was used to select FSWs from both brothel and non-brothel sites. First, small and large sex worker solicitation sites, including brothel areas and open solicitation points such as roads, highways, bus stands, railway stations, and market areas, were mapped. These lists of solicitation sites were used to define and select site clusters, which were formed by combining small areas or by segmenting the large areas such that each cluster included approximately 500 FSWs. Three such clusters from each district were randomly selected, and FSWs were systematically sampled from the brothel areas and from open solicitation points to obtain a minimum of 1,500 eligible participants per state. Eligibility criteria included those aged 18 years or older who had moved to at least two places, one of which included a move across districts, in the past 2

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years for sex work. The sample size was determined using an estimated proportion of 30% non-condom use, an assumed difference of 3% increase in the proportion with every unit increase in degree of mobility, a confidence level of 95% and power of 80%.

Across the entire study 9,475 FSWs (out of 10,075 contacted) agreed to be interviewed initially, based on a screening questionnaire. Of these, 59% (n = 5,611) were found eligible according to the eligibility criteria described above. Of the total eligible FSWs (5,611), 198 were excluded: 15 could not be interviewed because they were below age 18 years, 21 refused to participate, 51 withdrew midway without completing the interview, the data on socio-economic variables were missing for 26 FSWs, and 85 FSWs did not answer the question on perceived risk of acquiring HIV. This resulted into a total analytical sample of 5,413 FSWs.

Ethical procedures

Ethical approval for the study was obtained from the institutional review boards (IRBs) of the Population Council and the University of Manitoba, Canada. Verbal consent was obtained from all respondents prior to participation at each stage. For ethical considerations, only those FSWs who were at least 18 years of age were interviewed.

Measures

The dependent variable—HIV risk perception—was created from responses to a direct question asked: "What do you think is the risk of your getting HIV?" The response categories included: high, moderate, and low. This information was used to measure whether FSWs perceived themselves to be at high or low risk of acquiring HIV; those who responded as high or moderate risk were coded as 1; and those who responded as low risk were coded as zero. A similar measure of risk perception has also been used in other studies [8,36-38].

Inconsistent condom use was measured for each of the following three types of sex partners: occasional (or new) clients, regular (or repeat) clients, and non-paying partners. For each type of partners, FSWs were asked the number of partners with whom they had sex; the frequency of condom use with these partners (indicated by 1=always, 2=sometimes, 3=never) in the week prior to the survey; and whether or not they had used a condom at last sex. This information was used to create three variables indicating consistent condom use with each type of client: FSWs who reported they had always used condoms in the last week as well as those who had used a condom at last sex were coded as zero (consistent); those who reported they did not have a client of that type in the past week were coded as 2 (no partner); and the rest were coded as 1(inconsistent condom use). The last category included FSWs who reported that they had always used condoms in the last week but had not used a condom at last sex, and those who had sometimes or never used condoms in the last week irrespective of whether or not they had used a condom at last sex.

To determine STI risk, participants were asked whether they had experienced any of the seven symptoms of STIs/reproductive tract infections (RTIs) in the six months prior to the survey and whether they had continued sex while experiencing STI/RTI symptoms. This information was used to create a variable on STI risk: those reported experiencing at least one of the four symptoms (ulcers/sores in genital area, swelling in groin area, pain during intercourse, and frequent painful urination) that are indicative of STI and continued sex were coded as 2; those who experienced STI symptoms but did not have sex were coded as 1; and those who did not experience any STI symptoms in the past six months were coded as zero. Similarly, to determine alcohol use, FSWs who reported "always" consuming alcohol before sex were coded as 1 while the others were coded as zero. Other background characteristics such as age, education, marital status, degree of mobility, living arrangements, currently in debt, experience of sexual violence– all collected using single questions in the questionnaire were also transformed into binary variables to be used as covariates in the multiple regression analysis.

Methodological considerations

Two important study variables—condom use behavior and HIV risk perception—are related with each other. This reciprocal (or two way) relationship between the two variables can be viewed as: inconsistent condom use at time 0 —> high HIV risk perception at time 1 —> consistent condom use between time 1 and time 2. These relationships reflect two related questions: (1) does past or recent risky behavior at time 0 explain current high HIV risk perception at time 1, and (2) will current high HIV risk perception at time 1 reduce subsequent risky behavior between time 1 and time 2? While causal inference can adequately be drawn from longitudinal studies [45-47], in the absence of such studies among FSWs in India, we have used cross-sectional data which is more appropriate to address the first question and not the second question [46]. In terms of temporal sequence, explanatory variable should precede the dependent or the outcome variable. We have incorporated the presumed temporal sequence between the two events by considering risky behavior for the period (i.e. condom use in one week prior to survey) preceding the reported self-perceived HIV risk referring to the risk perception at the time of survey.

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Statistical analysis

Bivariate, analysis of variance, and multilevel logistic regression analysis were conducted to study the relationship between reported condom use behavior and self-perceived risk of acquiring HIV. The sample of FSWs in this study is nested within a district which, in turn, is nested within a state. Analysis of variance was conducted to estimate the percent of variance explained by these two cluster variables. Further, to assess the variation existing across these states in terms of number of high risk populations, HIV prevalence and program implementation [30,40-42]; we used a multilevel logistic model for analysis, which also accounted for the design effect. In the multilevel model, the state with four categories was included as the fixed effect and the district with 22 categories as the random effect. Various covariates known to be associated with either condom use behavior or the individual's perception of HIV risk were included in the multilevel logistic models to eliminate their common effects on the observed relationship between condom use and perceived HIV risk. Adjusted odds ratios were estimated to test these relationships.

Four models were estimated: Model I included the two cluster variables: the district as a random component and the state as the fixed component. These two cluster variables were included in all models. Model II included variables indicating condom use behaviors only; Model III included all the covariates only; and Model IV included condom use variables and other covariates. A comparison of Models II and IV indicates the magnitude of relationship between condom use and perceived HIV risk that is explained by all the covariates included in Model IV. The adjusted odds ratios in Model IV indicate the independent effect of condom use behavior on self-perceived risk of acquiring HIV. All statistical analyses were conducted using STATA version 11.1.

Results

Of the sample of 5,413 mobile FSWs who were included in this study, 40% currently perceived themselves to be at high risk of HIV. Close to three-fourths (71%) reported consistent condom use in sex with occasional clients in one week prior to the survey; and 60% reported consistent use of condoms in sex with regular clients. About 31% of mobile FSWs reported sex with non-paying partners in the last one week; of these about 57% (or 18% of all FSWs) reported consistent condom use in sex with non-paying partners.

Association between prior condom use behavior and current perceived high HIV risk

Results presented in Table 1 indicate that the large majority of FSWs who engaged in risky sexual behaviors in last one week also currently perceived themselves to be at a higher risk of acquiring HIV, and that FSWs assessed their HIV risk mainly based on consistency of condom use with occasional clients rather than on consistency of condom use with regular clients or non-paying partners. The effect of reported consistent condom use with regular clients on the degree of perceived risk of acquiring HIV disappears once we control for consistency of condom use with occasional clients. This can be seen by considering FSWs who reported consistent condom use with occasional clients: among these FSWs, the percentage who perceived themselves to be at high HIV risk does not vary by condom use pattern with regular clients (35% among those who reported consistent condom use vs. 39% of those who reported inconsistent condom use with regular clients; panel 1, Table 1). Similarly, among those who reported inconsistent condom use with occasional clients, 56% perceived themselves to be at a high HIV risk among both groups—those reported consistent condom use as well those who reported inconsistent condom use with regular clients. Likewise, the weak relationship between consistency of condom use with non-paying partners and the degree of perceived HIV risk is explained by its relationship with reported consistency of condom use with occasional clients (panel 2, Table 1).

These relationships could also be restated in terms of the degree of congruence between prior condom use and self-perceived HIV risk at interview. A high degree of congruence was observed between the degree of self-perceived HIV risk and prior risky behavior with respect to condom use with occasional clients. It appears that about 63% of FSWs were able to assess their HIV risk correctly—47% used condoms consistently and correctly considered themselves to be at low HIV risk, and about 16% of FSWs used condoms inconsistently during past one week and correctly perceived themselves to be at high HIV risk at the time of survey (Table 2). About 36% of FSWs assessed their HIV risk incorrectly: 24% used condoms consistently but perceived themselves to be at high HIV risk, and 12% used condoms inconsistently and perceived themselves to be at low HIV risk.

State-level differences

Significant differences in HIV risk perception were noted among the four states included in this analysis; the percentage of FSWs who currently perceived themselves to be at a high HIV risk varied from about 17% in Maharashtra to 56% in Andhra Pradesh (Table 3). While the percentage of FSWs who reported consistent condom use with occasional clients in past one week was similar in Andhra Pradesh, Maharashtra, and Tamil Nadu (about 83% to 91%), a higher percent of FSWs in Andhra Pradesh perceived themselves to be at high HIV

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Table 1 Percentage of mobile FSWs in Southern India who perceived themselves to be at high risk of acquiring HIV at interview by prior condom use with different type of clients/partners

Condom use in last one week with occasional clients	Condom use in last one week with regular clients				
	Consistent	Inconsistent	No client	Total	N
Consistent	34.8	38.9	10.7	33.9	3853
Inconsistent	55.6	55.9	57.0	55.9	1514
No client	28.6	(27.3)	–	28.3	46
Total	35.3	50.9	22.7	40.0	
N	3225	1884	304		5413
Condom use in last one week with occasional clients	**Condom use in last one week with non-paying partners**				
	Consistent	Inconsistent	No partner	Total	N
Consistent	50.5	53.7	25.2	33.9	3853
Inconsistent	77.4	64.2	52.9	55.9	1514
No client	(83.3)	(33.3)	18.9	28.3	44
Total	51.6	58.7	33.5	40.0	
N	954	714	3745		5413

( ) based on less than 25 FSWs; — no FSW

risk than those in Maharashtra (54% vs. 14%). Only 25% of FSWs in Karnataka reported consistent condom use with occasional clients and 17% with regular clients, which was lowest among all states.

Multilevel logistic regression analysis

The difference in self-perceived risk of HIV among the states is greater than the difference among districts; clustering by states explains about 9% and by districts explains an additional 4% of the variance in the perceived risk of HIV, i.e., the remaining 87% of the variance in perceived HIV risk is not due to clustering but it is due to individual characteristics. The district effect (the standard deviation for the random effect of districts) reduces from 0.99 to 0.54 once the state is included in the fixed part of the model, and does not change much after individual variables are included. However, the district effect remains significantly greater than zero in all models, which indicates that the difference among districts in the degree of self-perceived HIV risk is not explained by the individual characteristics included in these models. Moreover, district effects within each state indicate that districts in Andhra Pradesh and Karnataka are more homogeneous than those in Tamil Nadu and Maharashtra (data not shown).

Multilevel logistic regression results presented in Table 4 confirm the associations observed in the descriptive analysis, even after controlling for several background characteristics. Inconsistent condom use in past one week with occasional clients was independently associated with currently perceived higher risk of acquiring HIV (adjusted odds ratios [aOR] =2.1, 95% CI: 1.7-2.6). However, inconsistent condom use with regular clients was not independently associated with the level of perceived risk of acquiring HIV (aOR=1.0, 95% CI: 0.8-1.2). Inconsistent condom use, in comparison to consistent condom use, with non-paying partners was associated with lower self-perceived risk of acquiring HIV (aOR=0.7, 95% CI: 0.5 - 0.9). These observed associations between prior consistent condom use behaviors

Table 2 Percentage of mobile FSWs according to the degree of congruence between HIV risk perception at interview and prior condom use behavior with occasional clients by states

Congruence between current HIV risk perception and prior condom use with occasional clients	Total	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu
I. Congruent	**62.6**	**49.9**	**62.3**	**81.1**	**61.3**
a. Consistent condom use and at low HIV risk	47.0	38.4	19.8	77.0	59.8
b. Inconsistent condom use and at high HIV risk	15.7	11.5	42.5	4.1	1.5
II. Not congruent	**36.4**	**49.3**	**37.6**	**18.4**	**36.6**
a. Consistent condom use and at high HIV risk	24.1	44.5	5.7	12.3	31.3
b. Inconsistent condom use and at low HIV risk	12.3	4.7	32.0	6.1	5.3
No client	0.8	0.8	0.1	0.4	2.0
Total : %	100	100	100	100	100
N	5413	1533	1420	1188	1272

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Table 3 Percentage of mobile FSWs in India who currently perceived themselves to be at high risk of acquiring HIV by consistent condom use in last one week and states in India

Condom use in last one week	% distribution of FSWs				% currently perceived high HIV risk			
	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu
Occasional clients								
Consistent	83.0	25.4	89.3	91.1	53.7	22.2	13.8	34.3
Inconsistent	16.2	74.4	10.3	6.8	71.0	57.0	40.2	21.8
No client	0.8	0.1	0.4	2.0	38.5	50.0	20.0	23.1
Regular clients								
Consistent	70.8	17.0	68.6	85.1	53.4	24.0	12.8	36.7
Inconsistent	28.0	78.0	20.2	8.4	64.3	52.9	32.5	17.8
No client	1.2	4.9	11.2	6.5	44.4	57.1	10.5	8.4
Non-paying partners								
Consistent	20.9	5.6	5.5	38.5	74.4	15.2	24.6	46.1
Inconsistent	25.1	10.7	11.6	3.1	66.4	54.6	46.4	42.5
No partner	54.1	83.7	82.9	58.3	44.8	49.5	11.8	24.3
Total:%	100.0	100.0	100.0	100.0	56.4	48.2	16.5	33.2
N	1533	1420	1188	1272				

with different types of clients and self-perceived HIV risk at the time of survey are not explained by their common relationships with other covariates: the magnitude of adjusted odds ratios for condom use changed only slightly after controlling for these covariates (Model II vs. Model IV).

Compared to FSWs who did not experience any STI symptom in last six months, the perception of HIV risk was higher among those who continued to have sex while experiencing STI symptoms (aOR=5.7; 95%CI: 4.7 – 7.0) as well as among those who did not have sex while experiencing STI symptoms (aOR=2.4; 95%CI: 2.0 -2.7). Incorporation of STI symptoms improves the degree of congruence between consistent condom use with occasional clients and self-perceived HIV risk from 63% to 80%. Only 7% of FSWs incorrectly perceived themselves to be at high HIV risk despite of the fact that they used condoms consistently and also did not have any STI symptoms.

Other conditions that may hinder consistent condom use— alcohol use before sex, entered sex work because of economic hardship or force, and engaging in sex work on a part-time basis—were also independently associated with higher perceived risk of acquiring HIV than others. In comparison, such covariates as living alone or with other family members, being in debt at the time of interview, and being relatively more mobile which may hinder the consistent condom use were not independently associated with degree of self-perceived risk of acquiring HIV.

State-level aORs indicate that there is no significant difference among FSWs from Tamil Nadu and Karnataka in terms of the degree of self- perceived HIV risk. However, FSWs from Andhra Pradesh perceive themselves to be at a higher risk than those from Tamil Nadu (aOR = 2.2; 95% CI: 1.0-4.6), and those from Maharashtra perceive themselves to be at a lower HIV risk than those from Tamil Nadu (aOR = 0.5; 95% CI: 0.2-0.9). These state-level effects are independent of the differences due to condom use behaviors and other covariates included in these models.

Discussion

The current study, based on a cross-sectional behavioral survey of mobile FSWs in four states, documents the high degree of congruence between the reported recent (prior) condom use behavior with occasional clients and self-perceived HIV risk at the time of survey. The association between reported condom use behavior with regular clients or non-paying partners and self-perceived HIV risk is either weak or not significant. These findings indicate that FSWs perceive their risk of acquiring HIV mainly on the basis of whether or not they used condoms consistently with occasional clients rather than condom use behavior with regular clients and non-paying partners. In fact, FSWs who either did not have sex with non-paying partners in one week prior to the survey or used condoms inconsistently with non-paying partners perceived themselves to be at a lower risk of acquiring HIV at the time of survey.

The study findings also show that several other risky behaviors are related to high self-perceived risk of HIV, e.g., experience of STI symptoms in the last six months, continuing sex while experiencing STI symptoms, and

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	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu	Andhra Pradesh	Karnataka	Maharashtra	Tamil Nadu
Occasional clients								
Consistent	83.0	25.4	89.3	91.1	53.7	22.2	13.8	34.3
Inconsistent	16.2	74.4	10.3	6.8	71.0	57.0	40.2	21.8
No client	0.8	0.1	0.4	2.0	38.5	50.0	20.0	23.1
Regular clients								
Consistent	70.8	17.0	68.6	85.1	53.4	24.0	12.8	36.7
Inconsistent	28.0	78.0	20.2	8.4	64.3	52.9	32.5	17.8
No client	1.2	4.9	11.2	6.5	44.4	57.1	10.5	8.4
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Consistent	20.9	5.6	5.5	38.5	74.4	15.2	24.6	46.1
Inconsistent	25.1	10.7	11.6	3.1	66.4	54.6	46.4	42.5
No partner	54.1	83.7	82.9	58.3	44.8	49.5	11.8	24.3
Total:%	100.0	100.0	100.0	100.0	56.4	48.2	16.5	33.2
N	1533	1420	1188	1272				

with different types of clients and self-perceived HIV risk at the time of survey are not explained by their common relationships with other covariates: the magnitude of adjusted odds ratios for condom use changed only slightly after controlling for these covariates (Model II vs. Model IV).

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Other conditions that may hinder consistent condom use— alcohol use before sex, entered sex work because of economic hardship or force, and engaging in sex work on a part-time basis—were also independently associated with higher perceived risk of acquiring HIV than others. In comparison, such covariates as living alone or with other family members, being in debt at the time of interview, and being relatively more mobile which may hinder the consistent condom use were not independently associated with degree of self-perceived risk of acquiring HIV.

State-level aORs indicate that there is no significant difference among FSWs from Tamil Nadu and Karnataka in terms of the degree of self- perceived HIV risk. However, FSWs from Andhra Pradesh perceive themselves to be at a higher risk than those from Tamil Nadu (aOR = 2.2; 95% CI: 1.0-4.6), and those from Maharashtra perceive themselves to be at a lower HIV risk than those from Tamil Nadu (aOR = 0.5; 95% CI: 0.2-0.9). These state-level effects are independent of the differences due to condom use behaviors and other covariates included in these models.

Discussion

The current study, based on a cross-sectional behavioral survey of mobile FSWs in four states, documents the high degree of congruence between the reported recent (prior) condom use behavior with occasional clients and self-perceived HIV risk at the time of survey. The association between reported condom use behavior with regular clients or non-paying partners and self-perceived HIV risk is either weak or not significant. These findings indicate that FSWs perceive their risk of acquiring HIV mainly on the basis of whether or not they used condoms consistently with occasional clients rather than condom use behavior with regular clients and non-paying partners. In fact, FSWs who either did not have sex with non-paying partners in one week prior to the survey or used condoms inconsistently with non-paying partners perceived themselves to be at a lower risk of acquiring HIV at the time of survey.

The study findings also show that several other risky behaviors are related to high self-perceived risk of HIV, e.g., experience of STI symptoms in the last six months, continuing sex while experiencing STI symptoms, and

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Table 4 Adjusted odds ratios for current perception of high risk of acquiring HIV among mobile FSWs in Southern India

Characteristics	Model I	Model II	Model III	Model IV
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Condom use in past one week with occasional clients				
Consistent		1		1
Inconsistent		2.85 (2.31 -3.51)		2.07 (1.65 -2.60)
No client		0.84 (0.41 -1.71)		0.95 (0.45 -1.97)
Condom use in past one week with regular clients				
Consistent		1		1
Inconsistent		1.16 (0.95 -1.42)		0.99 (0.79 -1.22)
No client		0.92 (0.66 - 1.27)		0.91 (0.64 -1.29)
Condom use in past one week with non paying partners				
Consistent		1		1
Inconsistent		0.56 (0.43 -0.72)		0.65 (0.49 -0.86)
No partner		0.32 (0.26 -0.38)		0.52 (0.42 -0.64)
STI symptoms in last six months & use of condom				
No STI symptom			1	1
No sex during STI symptom			2.68 (2.31 -3.11)	2.36 (2.02 -2.75)
Continued sex during STI symptom			6.76 (5.56 - 8.23)	5.70 (4.66 - 6.98)
Used alcohol prior to sex				
No			1	1
Yes			2.36 (2.04 – 2.71)	2.20 (1.90 – 2.54)
Reason for entering in to sex work				
Choice/tradition			1	1
Economic/force			1.39 (1.12 -1.72)	1.39 (1.12 -1.72)
Sex work				
Full time			1	1
Part time			1.51 (1.31 -1.75)	1.37 (1.18 -1.59)
State				
Tamil Nadu	1	1	1	1
Andhra Pradesh	2.84 (1.43 - 5.66)	2.97 (1.50 -5.89)	1.91 (0.89 - 4.10)	2.16 (1.02 - 4.60)
Karnataka	1.98 (0.99 - 3.93)	1.30 (0.65 - 2.60)	1.59 (0.73 - 3.44)	1.28 (0.59 - 2.78)
Maharashtra	0.37 (0.19 - 0.71)	0.48 (0.25 - 0.93)	0.38 (0.18 - 0.79)	0.45 (0.22 - 0.93)
Random component				
District (SD)	0.54 (0.38 - 0.75)	0.54 (0.38 - 0.74)	0.59 (0.42 - 0.83)	0.58 (0.42 - 0.81)
Regression statistics				
Log likelihood	-3288.778	-3128.85	-2896.539	-2854.597
Districts	22	22	22	22
N	5413	5413	5413	5413

Note:

1. The estimated standard deviation (SD) of the district variable without the state variable was 0.99.

2. Experience of sexual violence, living arrangements, currently in debt, degree of mobility, age, education, and marital status were also included as covariates in Models II and IV. Adjusted odds ratios for these covariates (except age) were not significant at 5% level of significance.

the use of alcohol before sex. The observed association between inconsistent condom use with occasional clients and perceived high HIV risk is not explained by their joint relationships with the experience of STI symptoms, alcohol use, and other covariates. Incorporating experience of STI symptoms increases the accuracy of personal HIV risk assessment from 63% to 80%. While STI symptoms have poor specificity among women in general, their experience of such symptoms may indicate the outcome of prior inconsistent condom use. In turn the appearance of STI symptoms among FSWs can be used as a marker for diagnosing and

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treating STIs as well as reinforcing the message of consistent condom use in all sexual encounters.

Furthermore, the apparent inaccurate perception of high HIV risk among about 7% of FSWs who reported using condoms consistently with occasional clients could simply be a reflection of their perception of high HIV risk associated with their profession. It is possible that this perception has not been modified to low risk with the adoption of consistent condom use. Alternatively, some of these FSWs may not have understood the behavioural communication messages and internalized the links between inconsistent condom use and high HIV risk or may be over-reporting both consistent condom use as well as their HIV risk perception. Nevertheless, the inaccurate perception of high HIV risk by those who reported consistent condom use is not important for controlling the spread of HIV, particularly if they actually used condoms consistently. The critical group of FSWs which should be the focus for controlling the spread of HIV is the 12% who perceived themselves to be at low risk of acquiring HIV even though they reported inconsistent condom use with occasional clients.

However, the finding regarding the congruence between inconsistent condom use during sex with occasional clients and high perceived HIV risk perhaps indicates the success of HIV prevention programs in communicating the HIV risk associated with unprotected sex with occasional clients. This finding is supported by the fact that consistent condom use in sex with occasional clients is high. However, the findings of this study also suggest that education programs may not have adequately emphasized the importance of using condoms consistently in all sexual encounters, especially in sex with regular clients and non-paying partners.

The finding that the variance in the degree of self-perceived HIV risk across districts is not explained by the factors included in the study suggests that there are some important unmeasured individual and district-level contextual factors that have not been included in this study. These may, for example, include the prevalence of STI/HIV and the availability of condoms and STI/HIV treatment in the district, and an individual's knowledge of peers with STIs, and especially HIV, and knowledge of the probability of HIV transmission during any single unprotected sexual encounter. Differences in these individual and contextual factors would also contribute to the important differences observed among states in the degree of self-perceived risk of HIV. In addition, these state-level differences may reflect differences in the type and nature of sex work and the differential effects of HIV prevention programs, particularly behavioral change communication using IEC materials or peer educators. However, the omission of unmeasured contextual factors at the district and state levels may not be important because these two clustering variables accounted for only 13% of the variance in the self-perceived risk of HIV.

The finding that differences across states are greater than differences across districts may indicate the effect of large variations in HIV prevalence across states. Recent data show that HIV prevalence among FSWs in the southern states of India has begun to decline or stabilize in places where effective interventions have been in place for several years [43]. However, due to differences in intensity and geographic coverage of these interventions, changes in the behaviors of high risk population groups, inconsistent condom use, and HIV prevalence continues to be high in selected districts of some of these states.

The finding that perceived level of HIV risk among FSWs differ by states suggest that the peer education programs in these states have been successful to different degrees, which may itself reflect the differences in the nature of sex work across these states. Therefore, these programs need to modify their message and the content of interaction between peer educators and FSWs. The FSWs from Maharashtra perceive themselves to be at the lowest HIV risk; those from Andhra Pradesh perceive to be at the highest HIV risk; and those from Karnataka and Tamil Nadu are in between the other two states. These differences suggest that the peer education programs in Maharashtra may have been more successful than other states. The emphasis in Karnataka could be on finding ways to enable FSWs to shift from inconsistent to consistent condom use with occasional clients. In Andhra Pradesh and Tamil Nadu, there is a need to reinforce the link between consistent condom use with occasional clients and low HIV risk.

In all the states, there is a need for messages to focus on the importance of using condoms consistently with regular and non-paying partners to reduce the risk of acquiring HIV. The design and success of these interventions in changing risky behavior with regular clients, especially with non-paying partners, would require a better understanding of why FSWs do not use condoms consistently with these partners and why those who do use condoms consistently still perceive themselves to be at a high HIV risk, and why FSWs who do not have non-paying partners perceive themselves to be at lower HIV risk than those who do. It is possible that FSWs do not use condoms with non-paying partners because of unequal power relationships. The current study suggests that FSWs may have emotional and perhaps security stakes in their relationships with non-paying partners, and may perhaps be in denial mode about the risk associated with inconsistent condom use. In-depth studies are needed on how self-assessment of HIV risk could

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Consistent		1		1
Inconsistent		1.16 (0.95 -1.42)		0.99 (0.79 -1.22)
No client		0.92 (0.66 - 1.27)		0.91 (0.64 -1.29)
Condom use in past one week with non paying partners				
Consistent		1		1
Inconsistent		0.56 (0.43 -0.72)		0.65 (0.49 -0.86)
No partner		0.32 (0.26 -0.38)		0.52 (0.42 -0.64)
STI symptoms in last six months & use of condom				
No STI symptom			1	1
No sex during STI symptom			2.68 (2.31 -3.11)	2.36 (2.02 -2.75)
Continued sex during STI symptom			6.76 (5.56 - 8.23)	5.70 (4.66 - 6.98)
Used alcohol prior to sex				
No			1	1
Yes			2.36 (2.04 – 2.71)	2.20 (1.90 – 2.54)
Reason for entering in to sex work				
Choice/tradition			1	1
Economic/force			1.39 (1.12 -1.72)	1.39 (1.12 -1.72)
Sex work				
Full time			1	1
Part time			1.51 (1.31 -1.75)	1.37 (1.18 -1.59)
State				
Tamil Nadu	1	1	1	1
Andhra Pradesh	2.84 (1.43 - 5.66)	2.97 (1.50 -5.89)	1.91 (0.89 - 4.10)	2.16 (1.02 - 4.60)
Karnataka	1.98 (0.99 - 3.93)	1.30 (0.65 - 2.60)	1.59 (0.73 - 3.44)	1.28 (0.59 - 2.78)
Maharashtra	0.37 (0.19 - 0.71)	0.48 (0.25 - 0.93)	0.38 (0.18 - 0.79)	0.45 (0.22 - 0.93)
Random component				
District (SD)	0.54 (0.38 - 0.75)	0.54 (0.38 - 0.74)	0.59 (0.42 - 0.83)	0.58 (0.42 - 0.81)
Regression statistics				
Log likelihood	-3288.778	-3128.85	-2896.539	-2854.597
Districts	22	22	22	22
N	5413	5413	5413	5413

Note:

1. The estimated standard deviation (SD) of the district variable without the state variable was 0.99.

2. Experience of sexual violence, living arrangements, currently in debt, degree of mobility, age, education, and marital status were also included as covariates in Models II and IV. Adjusted odds ratios for these covariates (except age) were not significant at 5% level of significance.

the use of alcohol before sex. The observed association between inconsistent condom use with occasional clients and perceived high HIV risk is not explained by their joint relationships with the experience of STI symptoms, alcohol use, and other covariates. Incorporating experience of STI symptoms increases the accuracy of personal HIV risk assessment from 63% to 80%. While STI symptoms have poor specificity among women in general, their experience of such symptoms may indicate the outcome of prior inconsistent condom use. In turn the appearance of STI symptoms among FSWs can be used as a marker for diagnosing and

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treating STIs as well as reinforcing the message of consistent condom use in all sexual encounters.

Furthermore, the apparent inaccurate perception of high HIV risk among about 7% of FSWs who reported using condoms consistently with occasional clients could simply be a reflection of their perception of high HIV risk associated with their profession. It is possible that this perception has not been modified to low risk with the adoption of consistent condom use. Alternatively, some of these FSWs may not have understood the behavioural communication messages and internalized the links between inconsistent condom use and high HIV risk or may be over-reporting both consistent condom use as well as their HIV risk perception. Nevertheless, the inaccurate perception of high HIV risk by those who reported consistent condom use is not important for controlling the spread of HIV, particularly if they actually used condoms consistently. The critical group of FSWs which should be the focus for controlling the spread of HIV is the 12% who perceived themselves to be at low risk of acquiring HIV even though they reported inconsistent condom use with occasional clients.

However, the finding regarding the congruence between inconsistent condom use during sex with occasional clients and high perceived HIV risk perhaps indicates the success of HIV prevention programs in communicating the HIV risk associated with unprotected sex with occasional clients. This finding is supported by the fact that consistent condom use in sex with occasional clients is high. However, the findings of this study also suggest that education programs may not have adequately emphasized the importance of using condoms consistently in all sexual encounters, especially in sex with regular clients and non-paying partners.

The finding that the variance in the degree of self-perceived HIV risk across districts is not explained by the factors included in the study suggests that there are some important unmeasured individual and district-level contextual factors that have not been included in this study. These may, for example, include the prevalence of STI/HIV and the availability of condoms and STI/HIV treatment in the district, and an individual's knowledge of peers with STIs, and especially HIV, and knowledge of the probability of HIV transmission during any single unprotected sexual encounter. Differences in these individual and contextual factors would also contribute to the important differences observed among states in the degree of self-perceived risk of HIV. In addition, these state-level differences may reflect differences in the type and nature of sex work and the differential effects of HIV prevention programs, particularly behavioral change communication using IEC materials or peer educators. However, the omission of unmeasured contextual factors at the district and state levels may not be important because these two clustering variables accounted for only 13% of the variance in the self-perceived risk of HIV.

The finding that differences across states are greater than differences across districts may indicate the effect of large variations in HIV prevalence across states. Recent data show that HIV prevalence among FSWs in the southern states of India has begun to decline or stabilize in places where effective interventions have been in place for several years [43]. However, due to differences in intensity and geographic coverage of these interventions, changes in the behaviors of high risk population groups, inconsistent condom use, and HIV prevalence continues to be high in selected districts of some of these states.

The finding that perceived level of HIV risk among FSWs differ by states suggest that the peer education programs in these states have been successful to different degrees, which may itself reflect the differences in the nature of sex work across these states. Therefore, these programs need to modify their message and the content of interaction between peer educators and FSWs. The FSWs from Maharashtra perceive themselves to be at the lowest HIV risk; those from Andhra Pradesh perceive to be at the highest HIV risk; and those from Karnataka and Tamil Nadu are in between the other two states. These differences suggest that the peer education programs in Maharashtra may have been more successful than other states. The emphasis in Karnataka could be on finding ways to enable FSWs to shift from inconsistent to consistent condom use with occasional clients. In Andhra Pradesh and Tamil Nadu, there is a need to reinforce the link between consistent condom use with occasional clients and low HIV risk.

In all the states, there is a need for messages to focus on the importance of using condoms consistently with regular and non-paying partners to reduce the risk of acquiring HIV. The design and success of these interventions in changing risky behavior with regular clients, especially with non-paying partners, would require a better understanding of why FSWs do not use condoms consistently with these partners and why those who do use condoms consistently still perceive themselves to be at a high HIV risk, and why FSWs who do not have non-paying partners perceive themselves to be at lower HIV risk than those who do. It is possible that FSWs do not use condoms with non-paying partners because of unequal power relationships. The current study suggests that FSWs may have emotional and perhaps security stakes in their relationships with non-paying partners, and may perhaps be in denial mode about the risk associated with inconsistent condom use. In-depth studies are needed on how self-assessment of HIV risk could

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relate to risky behavior with each type of client/partner and how this relationship could vary across different contexts.

While the current cross-sectional study of mobile FSWs has important implications for further research as well as HIV prevention programs, these results should be interpreted with caution because of a few limitations and methodological issues. First, the results of this study cannot be generalized to the non-mobile FSWs without repeating it for a representative sample of all FSWs. Second, answers to questions about consistent condom use may reflect some normative responses and could over-estimate the extent of consistent condom use. However, reported consistent condom use in last one week in this sample of mobile FSWs was lower than those who reported condom use at last sex with each type of client. Furthermore, the extent of this over-estimation of reported consistent condom use with occasional clients may be much lower than that associated with reported consistent condom use with regular clients and non-paying partners.

Third, obtaining accurate information about self-perceived risk is quite challenging. To begin with, risk is a probabilistic concept and it generally indicates the potential or the probability that an action or activity would lead to an undesirable outcome. Risk assessment or an individual's perception of risk involves an assessment, based on current knowledge and belief. While the life-time consequences of HIV are quite severe, the probability of acquiring HIV with a single unprotected sexual encounter is quite low. However, no attempt was made in this study to explain to the respondents the concept of risk in terms of its probabilistic nature; the data on the reported self-perceived risk of acquiring HIV is based on only one question asked directly. It did not include references to any time period, e.g., the question did not specify whether the risk referred to the present period or to the future, an obvious recommendation from other studies based on review of literature [44,45]. Further, the terms low, moderate, and high risk were not explained to the respondents. Thus, the response "moderate" to the question may reflect some ambivalence in risk perception. Future research of this type should explain the concept of risk to participants and include some time reference for assessed risk as well as a follow-up question to ascertain the respondents' understanding of the term "moderate" risk. Moreover, questions could also be asked about the source of high or low perceived HIV risk [45], and the perception of risk associated with specific types of risky behavior, e.g., inconsistent condom use with occasional clients, inconsistent condom use with regular clients, and inconsistent condom use with non-paying partners.

Fourth, due to the reciprocal (two way) nature of the relationship between reported risky behavior and perceived HIV risk, these results based on a cross-sectional design do not necessarily imply causation [39,44,46]. While causal inference can adequately be drawn from longitudinal studies, the cross-sectional studies are appropriate to explore the relationship between past risky behavior and current risk perception. The cross-sectional studies are not appropriate to explore the effect of risk perception on subsequent changes in risky behavior [46]. In terms of temporal sequence, explanatory variable should precede the outcome variable and we incorporated the presumed temporal sequence between the two events by considering risky behavior for the period (i.e. condom use in the week prior to the survey) preceding the reported perceived HIV risk at interview. Using this approach for a group of FSWs, we demonstrated the expected positive association between reported recent inconsistent condom use with occasional clients and higher self-perceived current HIV risk [39]. Longitudinal studies are especially important to establish causation between self-perceived high HIV risk at time 1 and reduction in subsequent risky behaviors between time 1 and time 2 [45-47]. Moreover, operations research studies are required to assess the impact of interventions on improvements in the accuracy of perceived HIV risk and its affect on the reduction in subsequent risky behavior.

It should be noted that the relationship between risk perception and the adoption of preventive behaviors is fairly complex. Moreover, sustained preventive behavior requires repeated condom use during each sexual encounter and perception of high risk associated with not using a condom during any sexual encounter. Perceived high risk of acquiring HIV associated with unprotected sex may be necessary but it is not a sufficient condition for the adoption of preventive behavior. For example, many FSWs may charge a higher fee for having unprotected sex even though they may be aware of the risk involved [48]. Many other individual and especially contextual factors may be responsible for hindering or facilitating an individual's decision to use condoms consistently with a client or a partner. Moreover, overall reduction in risky behavior may also happen with changes in societal norms about safe sex and with the implementation of programs focused on changing these norms and sexual practices at the group level, e.g. 100% condom use in Thailand. Nevertheless, motivational messages to reduce risky behavior should incorporate HIV risk associated with inconsistent condom use with all types of clients and partners.

Conclusions

This cross-sectional behavioral study of mobile FSWs demonstrates a high degree of accuracy in FSWs' self-perceived high HIV risk at the time of survey based on

their prior condom use behavior with occasional clients. However, the link between condom use behavior with regular clients and non-paying partners and perceived HIV risk is not as clearly understood. Findings of this study have important implications for designing the content of IEC materials and the issues to be discussed by peer educators with FSWs. Specifically, these messages and interactions need to emphasize the importance of using condoms in all sexual encounters not only with occasional clients, but also with regular clients as well as with non-paying partners. Peer educators should also enable FSWs to accurately assess their own risk of acquiring HIV based on such markers as frequency of inconsistent condom use with occasional and regular clients as well as with non-paying partners, experience of STI symptoms, and continuing sex while experiencing STI symptoms.

List of abbreviations used

AIDS: Acquired immune deficiency syndrome; aOR: Adjusted Odds Ratio; CI: Confidence Interval; FSW: Female Sex Worker; HBM: Health Belief Model; HIV: Human Immunodeficiency Virus; IEC: Information, Education and Communication; IRB: Institutional Review Board; NACO: National AIDS Control Organisation; STI: Sexually Transmitted Infections.

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Authors' contributions

AKJ led conceptualization, conducted all analyses, and led manuscript development. NS assisted with conceptualization, analytic approach, and manuscript development. BM assisted in manuscript development and literature review. MPS assisted with data analysis. HRM lead fieldwork in two states and helped with interpretation of results. SSH assisted with conceptualization and the interpretation of study findings. RKV assisted with conceptualization of analytic approach, manuscript development, and interpretation of study findings. All authors participated as described above and all read and approved this final submitted manuscript.

Competing interests

The authors have no financial benefits or competing interests related to this submitted work.

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Relationship between mobility, violence and HIV/STI among female sex workers in Andhra Pradesh, India

Sowmya Ramesh[1*†], Deepika Ganju[1†], Bidhubhusan Mahapatra[1†], Ram Manohar Mishra[1†] and Niranjan Saggurti[1†]

Abstract

Background: Violence and mobility have been identified as critical factors contributing to the spread of HIV worldwide. This study aimed to assess the independent and combined associations of mobility and violence with sexual risk behaviors and HIV, STI prevalence among female sex workers (FSWs) in India.

Methods: Data were drawn from a cross-sectional, bio-behavioral survey conducted among 2042 FSWs across five districts of southern India in 2005–06. Regression models were used to estimate odds ratios and 95% confidence intervals (CIs) for sexual risk behaviors and HIV infection based on experience of violence and mobility after adjusting for socio-demographic and sex work related characteristics.

Results: One-fifth of FSWs (19%) reported experiencing violence; 68% reported travelling outside their current place of residence at least once in the past year and practicing sex work during their visit. Mobile FSWs were more likely to report violence compared to their counterparts (23% vs. 10%, $p < 0.001$). Approximately 1 in 5 tested positive for HIV. In adjusted models, FSWs reporting both mobility and violence as compared to their counterparts were more likely to be infected with HIV (Adjusted odds ratio (adjusted OR): 2.07, 95% CI: 1.42–3.03) and to report unprotected sex with occasional (adjusted OR: 2.86, 95% CI: 1.76–4.65) and regular clients (adjusted OR: 2.07, 95% CI: 1.40–3.06).

Conclusions: The findings indicate that mobility and violence were independently associated with HIV infection. Notably, the combined effect of mobility and violence posed greater HIV risk than their independent effect. These results point to the need for the provision of an enabling environment and safe spaces for FSWs who are mobile, to augment existing efforts to reduce the spread of HIV/AIDS.

Keywords: HIV, Mobility, Violence, Sex work, Risky behaviour

Background

Violence and mobility are increasingly being recognized as important risk factors contributing to the spread of HIV and sexually transmitted infection (STI) worldwide [1-11]. High rates of violence perpetrated against female sex workers (FSWs) have been consistently documented in developing countries [12-14]. In a study of mobile FSWs (those who travelled to two or more places for sex work over a two-year period) in India, approximately one-third reported experiencing violence [14]. Both in India and elsewhere, published literature indicates that FSWs exposed to violence were more likely to be infected with HIV and other STI than those who did not report such experiences [15,16]. Forced unprotected sexual encounters were described as the most likely cause for their heightened vulnerability to HIV [12,14,17]. Further, research indicates that forced sex was a barrier to condom negotiation [12] and increased the likelihood of condom failure [13,18].

In addition to violence, recent research has identified employment-related mobility (intra-district, inter-district, or inter-state) as another major risk factor associated with HIV [4,8-10,19-23]. In India, as is the case globally, FSWs are highly mobile for sex work [5] due to police harassment [24]; to escape stigma and discrimination [4,25]; and to attract a different or wider client base [11]. Research suggests that FSWs who were mobile for sex work had higher rates of HIV as compared to non-mobile

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FSWs [5,10], possible reasons being their experience of violence [11,14,17], sexual risk behaviors such as unprotected sex [4,5,25], lack of access to condoms [25], inability to negotiate safe sexual practices [26], and limited access to health care services [11,27] and HIV prevention programs [11,26] in new locations.

While studies have demonstrated the independent effect of mobility and experience of violence on FSWs' sexual risk behaviors and STI, there is a paucity of literature on the combined relationship of mobility and violence on HIV risk behaviors, STI and HIV. This paper seeks to address this gap in the literature by examining: (a) the independent association between mobility for sex work and violence; and (b) the independent as well as the combined association of mobility for sex work and violence on risky sexual behaviors and STI, including HIV.

Methods

Design, setting and sample

Data were drawn from the Integrated Behavioral and Biological Assessment (IBBA), a cross-sectional survey conducted in 2005–06 among FSWs in eight high HIV prevalence districts of Andhra Pradesh state, India (Chitoor, Guntur, East Godavari, Prakasam, Hyderabad, Karim Nagar, Warangal and Visakhapatnam) [28]. A probability sampling method was adopted using two different approaches: (1) conventional cluster sampling for brothel-based and home-based sex workers, and (2) conventional time-location cluster sampling for street-based FSWs. The overall survey design including district selection, sample size calculation and participant recruitment has been described in detail elsewhere [29].

Overall, 3271 FSWs completed the behavioral interview and provided biological (blood and urine) samples in Andhra Pradesh. Of the eight districts surveyed, data from three districts, namely Hyderabad, Karim Nagar and Warangal, were not included in the current analysis, as a different questionnaire was used in these districts, which did not include mobility-related questions; this resulted in an analytical sample of 2042 FSWs.

Face-to-face interviews were conducted by trained field workers in the local language, Telugu, using a structured questionnaire that included questions on socio-demographic characteristics, sexual behavior, mobility and experience of violence. Interviews were conducted in locations previously hired for data collection purposes; respondents were escorted by members of the field team from solicitation sites to the interview location. In addition, biological samples were tested for HIV and other STI, including *Chlamydia trachomatis* (chlamydia), *Neisseria gonorrhea* (gonorrhea), syphilis and Herpes Simplex Virus-type 2 (HSV–2). The testing procedures adopted in the survey have been described in detail elsewhere [29].

Ethical considerations

Ethical clearances were obtained prior to the survey. Statutory approval for conducting the IBBA and its protocols was obtained from the Government of India's Health Ministry Screening Committee. A comprehensive consent process was adopted: respondents were first informed in detail about all aspects of the survey, following which oral consent was separately obtained for the behavioral and biological components.

Measures

Socio-demographic and sex work characteristics

The socio-demographic characteristics of FSWs considered in this paper were based on single items in the questionnaire, which included age (<30, 30+), literacy (illiterate, literate), marital status (never, currently or previously married), alcohol consumption (ever, never), primary place where clients were entertained (home including rented room; brothel including *dhaba*, bar/night club and lodge; and public place including park, street, cinema hall, bus stand, railway station and vehicle), having a regular non-paying partner and client volume per week (<10, 10+). Duration of sex work was computed by subtracting the respondent's age at initiation of commercial sex from her age at the time of interview. Both socio-demographic and sex work related characteristics were used as covariates in the multivariate analyses.

Violence and mobility for sex work

Experience of violence and mobility for sex work were the two key independent measures used in this paper. Respondents were classified as having experienced violence based on responses to the following question: whether they had been beaten or physically forced by any individual to have sexual intercourse against their will in the past one year. Similarly, respondents were classified as mobile for sex work if they had travelled outside their current place of residence in the past one year and practiced sex work during their visit. These two variables were combined to create four categories in order to examine the combined associations of violence and mobility for sex work: (i) no violence and not mobile; (ii) no violence but mobile; (iii) violence but not mobile; and (iv) both violence and mobility.

Sexual risk behaviors, HIV and STI

The dependent measures used in this paper were: sexual risk behaviors, STI and HIV infection. Sexual risk behaviors were measured using two key variables that determined FSWs' unsafe sex behavior: (1) no condom use at most recent sex with occasional clients; and (2) no condom use at most recent sex with regular clients.

Information on STI and HIV was based on the laboratory test results of biological samples. Participants were

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considered HIV-positive if their blood samples tested positive on the Microelisa test, and were confirmed by the Genedia HIV ½ ELISA 3.0 test. Participants were considered positive for chlamydia and gonorrhea if the infection was detected in their urine samples by the nucleic acid amplification test (NAAT). In this study, participants were considered to be infected with an STI if they were diagnosed with chlamydia or gonorrhea. The syphilis and HSV–2 test results were not included in the analysis as the syphilis test results may not reflect current infection and the HSV–2 test was conducted among only 10% of those who provided biological samples.

Statistical analyses

Sample characteristics were assessed to identify the factors that differed by mobility status and experience of violence, using chi-square contingency tables. Logistic regression models were used to estimate odds ratios (OR) and corresponding 95% confidence intervals (CI) to analyze the relationship between reported violence, mobility for sex work, and sexual risk behaviors and STI including HIV. A series of multivariate logistic regression models were constructed to measure: (i) the association between mobility for sex work and violence and vice versa; (ii) the association between mobility for sex work and sexual risk behaviors, HIV and STI status; (iii) the association between violence and sexual risk behaviors, HIV and STI status; and (iv) the combined association of mobility for sex work and the experience of violence on sexual risk behaviors, HIV and STI status. Adjusted OR and CI are presented. Sampling weights were used to account for the differential recruitment of FSWs by typology within districts, differential probabilities of selection across districts and differential non-response rates. The weighting methodology has been described elsewhere [29]. Statistical analyses were performed using STATA version 11.1.

Results

Socio-demographic and sex work characteristics

Of the 2042 FSWs included in the analyses, one-fifth (19%) had experienced violence and two-thirds (68%) had travelled outside their current place of residence at least once in the past year and practiced sex work during their visit (Table 1). Experience of violence was high among FSWs who were previously married, had ever consumed alcohol, had entertained clients in a public place, were mobile for sex work and had been engaged in sex work for more than four years. Similarly, mobility for sex work was high among FSWs who were previously married, had ever consumed alcohol, experienced violence, practiced sex work for more than four years, had a higher client volume per week and had a regular non-paying partner.

Association between violence, mobility for sex work and sexual risk behaviors

Sexual risk behaviors were significantly associated with experience of violence (Table 2). FSWs experiencing violence were more likely to report no condom use in their most recent sexual encounter with occasional clients (adjusted OR: 2.23, 95% CI: 1.57–3.18) and regular clients (adjusted OR: 1.64, 95% CI: 1.22–2.20) than those who did not report such experiences.

Further, the odds of no condom use in their most recent sex with occasional clients were three times higher among FSWs who reported both mobility and violence than those who were neither mobile nor reported violence (adjusted OR: 2.86, 95% CI: 1.76–4.65). Similarly, mobile FSWs who experienced violence were significantly more likely to report no condom use in their most recent sexual encounter with regular clients than non-mobile FSWs who did not experience violence (adjusted OR: 2.07, 95% CI: 1.40–3.06).

Association between violence, mobility for sex work and HIV/STI

Results indicate that the experience of violence and mobility for sex work were independently associated with HIV infection (Table 3). The odds of being infected with HIV were higher among FSWs who reported being beaten or raped by any individual at least once in the past year than others (adjusted OR: 1.58, 95% CI: 1.20–2.09). Similarly, compared to non-mobile FSWs, those who reported mobility for sex work were 32% more likely to be infected with HIV (adjusted OR: 1.32, 95% CI: 1.01–1.74). Further, compared to FSWs who were not mobile and did not experience violence, those who were both mobile and reported violence were two times more likely to be diagnosed as HIV-positive (adjusted OR: 2.07, 95% CI: 1.42–3.03).

Discussion

Our findings indicate that a large percentage of FSWs travelled outside their current place of residence and practiced sex work during these visits, and nearly one-fifth experienced violence in this high HIV prevalence state of southern India; these results are similar to prior findings in India [5,14,17]. Additionally, the present study documents that mobile FSWs who experienced violence were two times more likely to have been diagnosed with HIV compared to those who reported neither mobility nor violence. A possible reason for the observed high prevalence of HIV among this subgroup of FSWs could be their risky sexual behaviors, as evidenced in the current study.

Table 1 Background characteristics of female sex workers by experience of violence and mobility status in Andhra Pradesh, India

Characteristics	Total sample (%)	Experienced violence in the past one year[a]			Mobility for sex work in the past one year[b]		
		No (%)	Yes (%)	p-value	No (%)	Yes (%)	p-value
Total sample	**2042**	**1690**	**352**		**714**	**1328**	
Age (in years)							
<30	45.1	81.0	19.0	0.718	31.1	68.9	0.344
30+	54.9	81.6	19.4		33.1	66.9	
Marital status							
Currently married	67.0	83.2	16.8	0.006	33.2	66.8	0.019
Never married	6.7	80.7	19.3		39.0	61.0	
Previously married	26.3	76.8	23.2		28.0	72.0	
Literacy							
Illiterate	60.2	82.3	17.7	0.177	33.7	66.3	0.068
Literate	39.8	79.9	20.1		29.9	70.1	
Alcohol consumption							
Never	30.2	90.0	10.0	<0.001	53.3	46.7	<0.001
Ever	69.8	78.0	22.0		22.9	77.1	
Experienced violence in the past one year [a]							
No	81.3	-	-	-	35.6	64.4	<0.001
Yes	18.7				17.6	82.5	
Mobility for sex work in the past one year[b]							
No	32.2	89.8	10.2	<0.001	-	-	-
Yes	67.8	77.3	22.7				
Duration of sex work (in years)							
< 5	45.7	84.2	15.8	0.003	35.2	64.8	0.01
5+	54.3	79.0	21.0		29.7	70.3	
Have a regular non-paying partner							
No	24.9	80.5	19.5	0.580	41.4	58.6	<0.001
Yes	75.1	81.6	18.4		29.2	70.8	
Primary place for entertaining clients[c]							
Home-based	51.8	84.3	15.7	<0.001	33.3	66.7	0.182
Brothel-based	32.2	81.0	19.0		29.5	70.5	
Public place	16.0	72.6	27.4		34.2	65.8	
Client volume per week							
<10	48.0	82.7	17.3	0.121	40.8	59.2	<0.001
10+	52.0	80.0	20.0		23.8	76.2	

[a] Physically beaten or forced to have sexual intercourse by any individual against their will in past one year.
[b] Travelled outside their current place of residence and practiced sex work during their visit in past one year.
[c] Home-based includes home and rented room; brothel-based includes brothel, *dhaba*, bar/night club and lodge; public place includes park, street, cinema hall, bus stand, railway station and vehicle.

Consistent with previous research, our study shows that mobile FSWs were more likely to be infected with HIV than those who were not mobile [5,10,30]. While mobility for sex work per se may not be directly associated with HIV, as seen in prior research, mobility may increase FSWs' vulnerability to exploitation and abuse as a result of operating in new environments with unknown clients and the lack of community ties for social support [11]. Empirical research suggests that mobility for sex work among FSWs is common in India and around the world [4,5,10,11,23,31], and our study further suggests that some sub-groups of FSWs were more likely to be mobile than others. For example, mobility was higher among FSWs who were currently or previously married or who had a regular non-paying partner than others; reasons for higher mobility among this sub-group could be to work in an environment of anonymity and to keep their sex worker identity separate from their private life

Table 2 Association between violence, mobility for sex work and sexual risk behaviors among female sex workers in Andhra Pradesh, India

	No condom use at most recent sex with occasional clients			No condom use at most recent sex with regular clients		
	% (N)	adjusted OR[a] (95%CI)	adjusted OR[b] (95%CI)	% (N)	adjusted OR[a] (95%CI)	adjusted OR[b] (95%CI)
Experience of violence[c]						
No	7.4 (1635)	Referent	-	14.8 (1643)	Referent	-
Yes	16.0 (345)	2.23 (1.57, 3.18)***	-	22.1 (345)	1.64 (1.22, 2.20)*	-
Mobility for sex work[d]						
No	6.8 (677)	Referent	-	13.2 (687)	Referent	-
Yes	10.0 (1303)	1.29 (0.88, 1.91)	-	17.5 (1301)	1.26 (0.94, 1.69)	-
Experience of violence and mobility[e]						
No violence and not mobile	6.4 (610)	-	Referent	12.8(618)	-	Referent
No violence but mobile	7.9 (1025)	-	1.21 (0.80, 1.87)	15.9 (1025)	-	1.24 (0.90, 1.71)
Violence but not mobile	11.3 (68)	-	1.73 (0.72, 4.12)	17.1 (69)	-	1.52 (0.75, 3.11)
Both violence and mobility	16.9 (277)	-	2.86 (1.76, 4.65)***	23.1(276)	-	2.07 (1.40, 3.06)***

OR: Odds ratio; CI: Confidence interval.
[a] Model adjusted for age, marital status, literacy, alcohol consumption, duration of sex work, primary place of entertaining clients, client volume per week, having a regular male partner and experience of sexual violence in past year/mobility for sex work in past year.
[b] Model adjusted for age, marital status, literacy, alcohol consumption, duration of sex work, primary place of entertaining clients, client volume per week and having a regular male partner.
[c] Physically beaten or forced to have sexual intercourse by any individual against their will in past one year.
[d] Travelled outside their current place of residence and practiced sex work during their visit in past one year.
[e] No violence and not mobile: was not physically beaten or forced to have sexual intercourse against the will and did not travel and practice sex work during their visit outside their current place of residence in past one year; no violence but mobile: was not physically beaten or forced to have sexual intercourse against their will but travelled and practiced sex work during their visit outside their current place of residence in past one year; violence but not mobile: was physically beaten or forced to have sexual intercourse against the will but did not travel and practice sex work during their visit outside their current place of residence in past one year; both violence and mobility: was physically beaten or forced to have sexual intercourse against the will and travelled and practiced sex work during their visit outside their current place of residence in past one year.
*p < 0.05, ** p < 0.01, *** p < 0.001.

[25]. Following their relocation to new areas, FSWs face several kinds of vulnerabilities including physical and sexual violence [11,14], a finding also observed in our study, which indicates that a greater proportion of mobile FSWs were abused as compared to those who were not mobile.

The current research also indicates that one-fifth of FSWs had experienced violence in the past year, and the experience of violence was higher in selected groups; for example, those who were previously married. Further, a higher proportion of FSWs who had experienced violence were infected with HIV than their counterparts; a finding that is consistent with previous research [15,16]. As described earlier, the underlying reasons for these FSWs' heightened vulnerability to HIV could be multiple, such as the experience of forced sex, which may pose barriers to adopting safe sex behaviours [32]. Indeed, consistent with findings from prior research [13,14,17], we found that FSWs who experienced violence were less likely to report condom use with clients as compared to those who did not experience violence.

While there is growing recognition of the effect of mobility and violence individually on the health of FSWs, including their vulnerability to HIV [1-4,7,33,34], this study, to our knowledge, is amongst the first to assess the combined effect of mobility and violence on sexual risk behaviors and STI, including HIV, among FSWs. The prevalence of HIV increased twofold among respondents who reported both mobility for sex work and violence, compared to those who reported neither. Although not statistically significant, a higher proportion of mobile FSWs who experienced violence were infected with STI as compared to those who were neither mobile nor reported violence. This lack of significant association could be because of the low prevalence of STI diagnosed among this group of FSWs. Additionally, infections that occurred as a result of violence may have been treated as there is indiscriminate use of antimicrobials in India due to the easy availability of drugs over-the-counter without a medical prescription [35].

While this study underlines the strong association between violence, mobility and the prevalence of HIV among FSWs, the results should be interpreted with caution in light of certain limitations. First, the key independent variables considered in this study were based on self-reported responses, and the limitations of self-reported data are widely recognized [36]. Moreover, violence may have been underreported perhaps due to the stigma attached with reporting of violence or the sex workers' perception of reporting based on only severity

Table 3 Association between violence, mobility for sex work and HIV/STI among female sex workers in Andhra Pradesh, India

	Currently infected with STI[a]			Infected with HIV		
	%	adjusted OR[b] (95%CI)	adjusted OR[c] (95%CI)	%	adjusted OR[b] (95%CI)	adjusted OR[c] (95%CI)
Experience of violence[d]						
No (N = 1690)	3.9	Referent	-	16.6	Referent	-
Yes (N = 352)	4.8	1.31 (0.78,2.29)	-	25.6	1.58 (1.20, 2.09)**	-
Mobility for sex work[e]						
No (N = 714)	4.10	Referent	-	14.8	Referent	-
Yes (N = 1328)	4.17	1.10 (0.66, 1.83)	-	20.0	1.32 (1.01, 1.74)*	-
Experience of violence and mobility[f]						
No violence and not mobile (N = 643)	4.0	-	Referent	13.4	-	Referent
No violence but mobile (N = 1047)	4.3	-	1.03 (0.60, 1.77)	18.4	-	1.43 (1.06, 1.94)*
Violence but not mobile (N = 71)	4.0	-	1.00 (0.17, 3.04)	27.6	-	2.27 (1.34, 4.16)**
Both violence and mobility (N = 281)	5.1	-	1.45 (0.72, 2.92)	25.2	-	2.07 (1.42, 3.03)***

OR: Odds ratio; CI: Confidence interval.
[a] STI includes: chlamydia and/or gonorrhea.
[b] Model adjusted for age, marital status, literacy, alcohol consumption, duration of sex work, primary place of entertaining clients, client volume per week, having a regular male partner and experience of sexual violence in past year/mobility for sex work in past year.
[c] Model adjusted for age, marital status, literacy, alcohol consumption, duration of sex work, primary place of entertaining clients, client volume per week and having a regular male partner.
[d] Physically beaten or forced to have sexual intercourse by any individual against their will in past one year.
[e] Travelled outside their current place of residence and practiced sex work during their visit in past one year.
[f] No violence and not mobile: was not physically beaten or forced to have sexual intercourse against the will and did not travel and practice sex work during their visit outside their current place of residence in past one year; no violence but mobile: was not physically beaten or forced to have sexual intercourse against their will but travelled and practiced sex work during their visit outside their current place of residence in past one year; violence but not mobile: was physically beaten or forced to have sexual intercourse against the will but did not travel and practice sex work during their visit outside their current place of residence in past one year; both violence and mobility: was physically beaten or forced to have sexual intercourse against the will and travelled and practiced sex work during their visit outside their current place of residence in past one year.
*p < 0.05, ** p < 0.01, *** p < 0.001.

of violence [36]. However, the use of trained and experienced research staff while conducting the IBBA may have increased respondents' comfort level at the time of interview and reduced underreporting. Second, in the multivariate analyses we have only accounted for factors that were measured in the survey; therefore, the associations of key independent and dependent measures could have been affected by omission variable bias. Third, while our study analyzes recent mobility status and experience of violence, the HIV seropositivity data reflect only prevalence. Therefore we cannot determine whether there is any temporal relationship between violence, mobility and HIV infection. However, this study is based on the assumption that FSWs who reported experience of violence and mobility in the recent past may have also experienced similar vulnerabilities since their entry into the sex work. Finally, the findings of this study cannot be generalized to all FSWs across India as sex work in India is complex in nature and characterized by inter- and intra-regional differences. For example, in the north Indian states, the sex work industry is relatively visible, and is largely brothel-based, whereas in the southern states a significant proportion of sex work is home-based or street-based [37-39]. However, the study results can be generalized to other geographical areas with similar sex work settings, volume of mobility and HIV prevalence. Nonetheless, these limitations do not compromise the internal validity of the data: our findings are consistent with the results of previous studies that have assessed the association between violence, mobility and sexual risk behaviors/HIV and advance the knowledge on the inter-linkages between these risk factors and sexual risk behaviors/HIV. However, future research could provide critical information on several key issues that would have implications for HIV programming. For example, studies that include temporal data could provide insights on the causal relation between mobility and violence; that is, whether mobility among FSWs leads to the experience of violence or vice versa, so that programmatically FSWs most vulnerable could be addressed through appropriate structural interventions. Additionally, studies could explore the extent to which FSWs' degree of mobility (less mobile versus more mobile) and exposure to violence are associated with sexual risk taking behaviour and HIV.

Our finding that mobile FSWs who have experienced violence are particularly vulnerable to HIV has significant implications for the design of HIV prevention programs. To reach FSWs with different vulnerabilities, interventions would need to implement strategies that

recognize and address both issues of violence and mobility among FSWs. Moreover, intervention programs need to recognize that as mobile FSWs have recently moved to new places for sex work, they may be poorly informed about HIV prevention support and service programs in the new area, and additional efforts would be required to connect them to suitable local services, such as the availability of crisis response systems that provide appropriate information and timely services to address violence.

Conclusions

In the context of the study finding that mobile FSWs who also experience violence are at greater risk of acquiring HIV than others, special efforts are needed to address the vulnerabilities of this subgroup of sex workers. Ongoing and future programs need to explore the ways in which they can improve accessibility to support structures and services for sex workers on the move. Additionally, the ongoing efforts of community mobilization [40,41] need to be expanded to create an enabling environment and safe spaces for FSWs from perpetrators of violence. Further, it would be important to identify all FSWs who move to different places for sex work and orient them to prevention and crisis response services in the new location, which would help augment existing efforts to reduce the spread of HIV in India and elsewhere.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

SR led conceptualization, conducted all analyses, and wrote the manuscript. DG assisted with writing and editing of the paper. BM and RMM assisted with the analyses. NS assisted with conceptualization of analytic approach and interpretation of study findings. All authors have read and approved this final submitted manuscript.

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Anal sex and associated HIV-related sexual risk factors among female sex workers in Andhra Pradesh, India

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Abstract. ***Background*:** This study aims to understand the correlates of anal sex practices among female sex workers (FSWs) and examine the association of anal sex with HIV-related sexual risk factors in Andhra Pradesh, India. ***Methods*:** A cross-sectional behavioural survey was conducted in 2011 among 795 FSWs aged 18 years or older. Probability-based cluster sampling was used to select respondents from sex work hotspots. ***Results*:** One-quarter (23%) of FSWs had practiced anal sex in the last year. The odds of practicing anal sex were higher among FSWs aged 35 years or more than in those aged less than 25 years (adjusted odds ratio (AOR): 2.05, $P < 0.05$), in those formerly married compared to those currently married (AOR: 1.88, $P < 0.01$), in those having an income only from sex work compared to those having additional sources of income (AOR: 1.54, $P < 0.05$), those reporting heavy alcohol consumption compared to those who did not (AOR: 2.80, $P < 0.01$) and those who experienced violence compared to those who had not (AOR: 2.80, $P < 0.01$). FSWs practicing anal sex were more likely to experience sexually transmissible infection (STI) related symptoms than those practicing only vaginal sex. There was no association between anal sex practice and condom use. ***Conclusions*:** Anal sex is associated with STI symptoms, a factor for HIV risk. HIV intervention programmes need to educate FSWs about the risks associated with anal sex.

Additional keywords: prostitution, sexual practices, sexually transmissible infections.

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Introduction

Studies across the globe examining HIV risk transmission dynamics among female sex workers (FSWs) have primarily focussed on risk from peno–vaginal intercourse in the past, paying limited attention to the significance of penile–anal intercourse.[1,2] Since the early 1990s, researchers have suggested that anal sex can also increase the risk of HIV and other sexually transmissible infections (STI).[1,3–9] Empirical researches have subsequently demonstrated that anal intercourse carries a higher risk burden than vaginal intercourse even when practiced with a condom.[5,10–13] Since condoms are generally manufactured for use in vaginal intercourse, the chances of condom breakage are higher if used in anal sex, thus resulting in an increased risk of exposure to HIV and other STIs.[13,14] Furthermore, a growing body of research also suggests that the high rates of anal cancer could be attributable to the practice of anal intercourse.[15–17] However, researchers often neglect the importance of anal sex as a determinant of STIs or as one of the outcomes in HIV prevention interventions.[18]

Surveys have documented widely varying estimates of anal sex prevalence among sex workers. One study conducted in Rwanda and Kenya showed that ~5% of FSWs reported ever practicing anal sex,[2] but many other studies in Kenya indicate higher prevalence levels of anal sex among FSWs ranging between 14% and 40%.[19–23] A study conducted in South Africa suggests that more than 40% of the FSWs soliciting at truck stops had engaged in anal sex.[24] Other research in South Africa suggests that FSWs, on average, engage in five anal sex acts per week.[25] These wide variations in the prevalence estimates of anal sex may be due to differences in study inclusion criteria, the recruitment strategy or the reference period for occurrence of the event.

Parallel to global estimates, varying estimates of anal sex prevalence have been reported in studies conducted among FSWs in India. One study conducted in Karnataka, India, estimated that 13% of the FSWs had engaged in anal sex,[26] and another small-scale study in a similar setting estimated it to be at 27%.[27] In contrast, focus group discussions conducted among 50 sex workers in Andhra Pradesh, India, suggests that ~80% of the FSWs practiced anal sex regularly.[28] Empirical research suggests that the practice of anal sex among FSWs is independently associated with age, duration of sex work, number of sexual partners and alcohol use.[2]

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Extensive research on predictors of heterosexual anal sex in the general population is available outside India in other cultural and geographical settings, but it is limited in the context of sex work. In India, although substantial research has focussed on understanding how vaginal sex practices relate to HIV risk, the relationship between anal sex and HIV-related sexual risk factors has not been researched extensively. Also, the Indian studies examining anal sex practices among FSWs are constrained by several limitations,[27,28] including the failure to identify subgroups of sex workers who were more likely to practice anal sex. The study by Mondal and colleagues[27] was limited to examining the prevalence of anal sex among sex workers in Karnataka and lacked advanced analyses to draw statistical inferences on the predictors of anal intercourse. The limitation in analysis could be due to the data collection approach used (the Polling Booth Survey method was used, where responses are collected from a group of individuals and hence cannot be analysed at an individual level). The second study, conducted in Andhra Pradesh by Matheou,[28] used the focus group discussion approach with a small sample size of 50 FSWs, which limited the scope for any scientific analysis. As anal sex has been recognised as a marker to vulnerability towards HIV and associated risk factors, it is important to examine the subgroups of sex workers engaging in anal sex and determine whether such practices influence their HIV-related sexual risk behaviours. Therefore, this study has two objectives: (i) to examine the correlates of anal sex practice among FSWs in India and (ii) examine the relationship between practice of anal sex and HIV-related sexual risk factors.

Methods

Study context

This study was based in Krishna and Vizianagaram, two coastal districts of Andhra Pradesh, which is identified as one of the high HIV epidemic states in India[29] and where previous studies have reported a high prevalence of anal sex among sex workers.[28] The study districts were intentionally selected to include areas where the HIV prevention programmes funded by Avahan, the India AIDS initiative,[30] were implemented.

According to census of India, in 2011, Krishna District had a population of 4 529 009, 68% of which is rural.[31] The population density is 519 individuals per square kilometre and the literacy rate is 74%.[31] Developmental indicators suggest that 95% of the households in the district have access to electricity, 93% have access to drinking water, 60% have toilet facilities, 46% live in a pucca (concrete) house, 21% of girls wed before the age of 18 years and 77% households have a below poverty line (BPL) card.[32] Mapping estimates suggest that in 2009, the district had ~8000 FSWs accounting for 7% of the total sex worker population in the state.[33] The HIV sentinel survey in 2008 estimated an HIV prevalence of 0.7% among women attending antenatal care clinics.[33]

The district of Vizianagaram had a population of 2 342 868, 82% of which is rural.[34] It has a population density of 358 individuals per square kilometre and literacy rate of 59%.[34] Developmental indicators suggest that 79% households have access to electricity, 84% have access to drinking water, 19% have toilet facilities, 34% live in a pucca (concrete) house, 29% of girls wed before the age of 18 years and 87% had a BPL card at the time of the survey.[32] In 2009, 1038 sex workers were mapped in the district, comprising nearly 1% of the state's FSW population.[35] In 2008, the HIV prevalence among antenatal clinic attendees was 0.9% and ~12% among walk-in females at Integrated Counselling and Testing Centres. [35]

Study design

This study utilises data from the Behavioural Tracking Survey (BTS), a cross-sectional behavioural survey conducted among FSWs in 2011 to monitor the key components of the HIV prevention programme: safer sex behaviour, STI treatment-seeking behaviours and community mobilisation. In the BTS, FSWs were defined as females aged 18 years or more who had engaged in sex in exchange for cash in the month before the survey. A sample size of 400 FSWs was estimated for each district, allowing for detection of an absolute difference of 15% or more from the assumed value of 50% for consistent condom use with all clients, with 95% confidence, 90% power and a design effect of 1.7.

Hotspots where FSWs congregate to solicit clients such as brothels, streets, parks, cinema halls and homes were designated to be the primary sampling units (PSUs) in the BTS. A list of hotspots that served as a sampling frame of PSUs was produced by a rapid mapping exercise conducted using key informant interviews with community members and key local stakeholders such as the police and social workers. Each hotspot was mapped to validate the existing list of hotspots developed by nongovernmental organisations (NGOs) for implementing the programme, which helped in validating FSW size estimates and identifying active hotspots with the data provided by NGOs implementing the programme. For each hotspot, data were gathered on the number of FSWs present, segregated by the time slot when sex work was undertaken (e.g. 0900–1500 hours, 1500–19 000 hours, etc.) and by type of sex work. The data collected in the mapping exercise were consolidated and finalised after discussions with the NGOs, thus ensuring all the sex work sites in the districts were covered by the mapping team.

Hotspots located in the area covered by an NGO outreach worker for programme implementation were grouped to form a stratum of 200–250 FSWs. The number of interviews to be conducted in each stratum was allocated proportionately according to its size and was further disaggregated within each stratum by type of sex work. In each stratum, FSWs were recruited through a two-stage sampling procedure. In the first stage, a fixed number of PSUs were selected within each stratum using the proportion to population size procedure. The number of interviews to be conducted in each PSU was allocated proportionally. For FSWs based in nonpublic places (brothels, hotels, lodges, roadside eating establishments and homes), the conventional cluster sampling approach was used by selecting hotspots. For FSWs based in public places (streets, market areas, highways and cinema halls), time–location cluster sampling was used, where a hotspot was replicated multiple times to form a cluster for each time slot when FSWs congregate at the hotspot.[36] In the second stage, respondents were selected within each selected hotspot.

A total of 1062 FSWs were approached, of which 267 refused participation, resulting in a total analytical sample of 795 FSWs with a response rate of 75%. Sample weights were calculated to account for the unequal selection probability of respondents and nonresponse rates within each PSU. The survey instrument was developed in English and translated into Telugu, the local language of Andhra Pradesh. The translated forms were reviewed by study investigators fluent in both English and Telugu. Trained investigators with verbal and written skills in Telugu conducted interviews.

Ethical considerations

The BTS procedures was reviewed and approved by the institutional review boards of Family Health International and Karnataka Health Promotion Trust. A comprehensive informed consent process was followed, and no names or identifying information were recorded. Interviews took place in locations where women were comfortable and their privacy was assured.

Measures

Sociodemographic and sex work related variables

Single item questions were used to collect sociodemographic and sex work related information. They included age (grouped into three categories: <25 years, 25–34 years and 35+ years), education (recoded into two categories: no formal education and formal education), marital status (recoded into three categories: currently married, formerly married and never married), place where sex work is practiced (rural or urban), source of income being primarily from sex work (recoded into two categories: no and yes), number of working days in a month (recoded into two groups: <15 days and 15+ days), client volume per week (grouped into two categories: <10 *v.* 10+); place of entertaining clients (grouped into public place-based, home-based and brothel-based); travel outside for sex work (no or yes), heavy alcohol use (consumption of four or more drinks on a single occasion at least once) in past 30 days (no or yes) and experience of physical violence from someone including clients, regular partners and *goondas* (abusive men) in past 12 months (no or yes) were considered. These variables were used as independent variables when examining the associations with anal sex practices.

Anal sex in the last 12 months

All respondents were asked a single item question on whether they had practiced anal sex with any sexual partner in last 12 months, with response categories of 'no' and 'yes'. This variable was used as a dependent variable in the first multivariate model where we explored the correlates of anal sex practice, and as a key independent variable in the series of multivariate models when examining its association with HIV-related sexual risk factors.

HIV risk behaviours

HIV risk was assessed in terms of inconsistent condom use in vaginal sex. Inconsistent condom use in vaginal sex was measured for each of the following three types of sex partners: occasional clients, regular clients, and nonpaying partners. FSWs were asked about the frequency of condom use for each type of partners with response options of 'always', 'sometimes' or 'never'. FSWs who reported having always used a condom were considered as consistent condom users; others were categorised as inconsistent condom users.

Self-reported STI

Participants were asked if they experienced any genital ulcers or sores or vaginal discharge during the year before the survey. Those who answered affirmatively to any of these symptoms were considered to have suffered from some STI in the year preceding the survey.

Statistical analyses

Univariate, bivariate and multivariate analyses were performed. Multivariate logistic regression analyses were done in two stages: the first was to identify the correlates of anal sex, with the practice of anal sex in last 12 months as the dependent variable; the second was to examine the association of anal sex with HIV-related sexual risk factors, where anal sex has been considered as the key independent variable. We fitted independent logistic regression models for different measures of HIV-related sexual risk factors to predict the effect of anal sex on these risk behaviours. Each multivariate model was controlled for age, education, marital status, source of income being primarily from sex work, number of working days in a month, client volume per week, place of entertaining clients, heavy alcohol use in the past 30 days, experience of physical violence in the past 12 months and travel outside for sex work. The results from logistic regression were presented in the form of odds ratios and their corresponding 95% confidence intervals (CI). All the analyses were performed using STATA ver. 11.1 (StataCorp., College Station, TX, USA).

Results

Sample characteristics

The majority of the survey participants were young women, with a mean age of 29 years (s.d. = 6.2) and had been practicing sex work for 4.5 years on average (s.d. = 3.3). About one-fifth (21%) of FSWs were 35 years or older, and more than half (51%) were currently married. Two-thirds (67%) reported sex work as the only source of income and three-quarters (74%) had been practicing sex work for more than 15 days a month. Three-fifths (60%) were engaged in sex work in urban areas. About 23% of FSWs had travelled outside the district for sex work and 60% reported sex with clients in home-based settings (Table 1).

Anal sex practices

Nearly four-fifths (79%) of FSWs reported that their clients had demanded anal sex, with the average number of clients being 3 of their last 10 clients. One-quarter (23%) of FSWs reported that they had anal sex in the last year. Only 4% of FSWs who had anal sex in last 12 months reported not having used a condom at the last instance of anal sex. The majority of FSWs reported the reason for engaging in anal sex to be for more money (94%), followed by risk of losing clients (22%) and the perception that men finish more quickly (19%) (Table 2).

Bivariate analysis suggests that anal sex in the last 12 months was higher among older FSWs (35+ years) than in younger

Table 1. Correlates of anal sex among female sex workers (FSWs) in the last 12 months in two coastal districts of Andhra Pradesh, 2011
All other variables in the multivariate models were adjusted. District (Krishna or Vizianagaram) was included as a fixed effect in the logistic model. OR, odds ratio; CI, confidence interval

Characteristics	Number of FSWs ($n = 795$)	% of those who had anal sex	Crude ORs (95% CI)	Adjusted ORs (95% CI)
Current age (years)				
<25	200	12.0	Referent	Referent
25–34	421	24.7	2.40 (1.49–3.88)	1.94 (1.05–3.58)
35+	174	31.4	3.36 (1.97–5.72)	2.05 (1.01–4.16)
Education				
No formal education	470	26.7	Referent	Referent
Formal education	325	17.7	0.59 (0.42–0.84)	0.73 (0.48–1.11)
Marital status				
Currently married	408	15.5	Referent	Referent
Formerly married	331	33.2	2.71 (1.91–3.86)	1.88 (1.25–2.82)
Never married	56	17.7	1.18 (0.56–2.46)	2.49 (1.00–6.16)
Source of income being primarily from sex work				
No	265	20.0	Referent	Referent
Yes	530	29.0	1.64 (1.16–2.30)	1.54 (1.04–2.30)
Number of working days a month				
<15	210	16.7	Referent	Referent
15+	585	25.3	1.68 (1.12–2.53)	1.62 (0.95–2.78)
Client volume per week				
<10	416	19.6	Referent	Referent
10+	379	26.7	1.49 (1.07–2.08)	1.36 (0.93–2.01)
Place where sex work is practiced				
Rural	318	18.9	Referent	Referent
Urban	477	25.8	1.49 (1.05–2.11)	0.80 (0.42–1.52)
Travel outside for sex work				
No	609	21.9	Referent	Referent
Yes	186	26.6	1.29 (0.89–1.89)	0.86 (0.55–1.33)
Place of entertaining clients				
Public places	189	20.8	Referent	Referent
Home	473	22.1	1.08 (0.71–1.63)	1.13 (0.72–1.77)
Brothel	132	29.4	1.59 (0.95–2.65)	1.39 (0.78–2.47)
Heavy alcohol use in past 30 days				
No	588	15.9	Referent	Referent
Yes	207	43.1	3.99 (2.8–5.67)	2.80 (1.87–4.20)
Experienced physical violence in past 12 months				
No	700	19.8	Referent	Referent
Yes	95	46.8	3.56 (2.29–5.56)	2.80 (1.71–4.58)

Table 2. Anal sex and related behaviours among female sex workers in two coastal districts of Andhra Pradesh, 2011

Characteristics	% or mean (s.d.)	*N*
% clients asking for anal sex	79.2	795
Average number of clients asking for anal sex (of the last 10 clients)	3.1 (2.4)	795
% who had anal sex in last 12 months	23.0	795
% who did not use a condom at last anal sex[A]	4.3	183
% who did not use any lubricant in anal sex[A]	61.4	183
Reasons for practicing anal sex[A]		
More money	94.5	183
Risk of losing clients	22.1	183
Less risk of infection	5.5	183
Men finish more quickly	18.8	183
Enjoy it	2.4	183

[A]Among those who had anal sex in the last 12 months.

FSWs (<25 years) (31% *v.* 12%, $P < 0.001$), in those with no formal education than in those with some education (27% *v.* 18%, $P = 0.003$), in those formerly married FSWs than in those currently married ones (33% *v.* 16%, $P < 0.001$) and in those with sex work as only source of income than in those who had other sources of income (29% *v.* 20%, $P = 0.004$). The practice

of anal sex also varied considerably by sex work related characteristics. Anal sex in the last 12 months was higher among FSWs working for 15 days or more in a month than among those working for fewer days (25% *v.* 17%, $P = 0.012$), those with 10 or more clients a week than among those with fewer clients (27% *v.* 20%, $P = 0.018$), those had sex in brothels than among those who had sex in public places (29% *v.* 21%, $P = 0.077$) and in those practicing sex work in urban areas compared to rural areas (26% *v.* 19%, $P = 0.023$). Anal sex was also higher in those FSWs who reported heavy consumption of alcohol in the past 30 days compared to those who did not (43% *v.* 16%, $P < 0.001$) and among those who had experienced violence compared with those who had not (47% *v.* 20%, $P < 0.001$).

The multivariate analysis confirms the findings of the bivariate analysis and suggests that older FSWs were more likely than younger ones to have practiced anal sex (adjusted odds ratio (AOR): 2.05; 95% CI: 1.01–4.16), and formerly married FSWs were more likely to practice anal sex than currently married FSWs (AOR: 1.88; 95% CI: 1.25–2.82). The odds of anal sex practice were also higher among FSWs whose primary source of income was sex work (AOR: 1.54; 95% CI: 1.04–2.30), those who reported heavy alcohol consumption (AOR: 2.80; 95% CI: 1.87–4.20) and those who had experienced violence (AOR: 2.80; 95% CI: 1.71–4.58) than their counterparts.

Association between anal sex and HIV risk behaviours

After adjusting for different demographics and sex work related factors, the data showed that FSWs practicing anal sex were more likely to report experiencing STI-related symptoms in the last 12 months before the survey than those who did not engage in anal sex (27% *v.* 16%; AOR: 1.85, 95% CI: 1.18–2.88). However, anal sex was not associated with the rate of condom use with different types of sexual partners (Table 3).

Discussion

This cross-sectional study of FSWs in two coastal districts of Andhra Pradesh is one of the first to document the correlates of anal sex practice among sex workers in India and found that a substantial proportion of FSWs practicing anal sex with their clients. The study found that anal sex was more likely to be practiced among FSWs who were more than 25 years old, had been formerly married, gained their income primarily from sex work, had experienced physical violence in last 12 months and reported heavy alcohol use in last 12 months compared with their counterparts. The research also documented positive associations between anal sex and experiencing STI-related symptoms; however, no statistical association was noted between anal sex practice and inconsistent condom use in vaginal sex.

The study findings on the association between age and anal sex practices corroborates the findings of other studies linking older age to increased anal sex practice.[1,37] This positive association may be due to fact that old sex workers get fewer clients to entertain than younger sex workers and may fear for their survival in the situation of a reducing number of clients. Hence, such FSWs tend to agree to the demands made by clients, which can range from the type of sex – particularly anal sex – the place of sex or alcohol consumption. This explanation is supported by the findings of the current research with 40% of older sex workers reporting that they had practiced anal sex for fear of losing their clients and that ~75% of the older sex workers reported sex work to be the only source of income. In addition, FSWs who gained income only from sex work were twice as likely to practice anal sex as who had income from other sources as well.

This study's findings of the higher likelihood of anal sex among formerly married FSWs are supported by similar findings from the study by Leynaert *et al.*[10] Though it is not possible to determine whether such FSWs transitioned from currently married to formerly married in last 12 months, it is highly likely that most of these FSWs would have gone through this transition much earlier than 12 months preceding the survey. *Post hoc* analysis suggests that 79% of the formerly married FSWs were either living alone or staying with their children, indicating greater dependence of family members on their income. In such situation, sex workers need to earn more money to contribute to the family income[38] either by entertaining more clients or charging more money per client while surrendering to clients' demands. As a large proportion of the formerly married FSWs tend to be in their late 30s, their ability to attract clients may not be that encouraging compared with younger sex workers and hence, these sex workers may agree to clients' demands for anal sex. Further in-depth studies are needed to confirm these assumptions.

The importance of alcohol consumption in the practice of risky sexual behaviour has been well documented by many research studies among sex workers as well as in the general population.[2,39,40] This study also noted a strong association between heavy consumption of alcohol and anal sex.

Table 3. Associations between practicing anal sex in the last 12 months and HIV risk or vulnerability among female sex workers in two coastal districts of Andhra Pradesh, 2011

Adjusted for respondent's current age, education, marital status, source of income being primarily from sex work, client volume per week, place of entertaining clients, number of working days, travel outside for sex work, heavy alcohol use in past 30 days and experience of physical violence. District (Krishna or Vizianagaram) was included in the model as a fixed effect. OR, odds ratio; CI, confidence interval; STI, sexually transmissible infections

HIV risk or vulnerability	Vaginal sex only	Vaginal sex + anal sex	Crude OR (95% CI)	Adjusted OR (95% CI)
Inconsistent condom use in vaginal sex with occasional clients	24.3	23.6	0.96 (0.65–1.42)	1.09 (0.66–1.78)
Inconsistent condom use in vaginal sex with regular clients	30.2	40.2	1.55 (1.10–2.19)	1.43 (0.94–2.18)
Inconsistent condom use in vaginal sex with nonpaying partner	90.8	91.3	1.06 (0.53–2.13)	0.87 (0.38–1.99)
Experience of STI in the last year	15.8	26.7	1.94 (1.31–2.87)	1.85 (1.18–2.88)

Although information on whether FSWs consumed alcohol before having anal sex was not collected, there is evidence to suggest that they may consume alcohol before sex in general to numb themselves from the pain of anal sex.[41] The research also noted that experience of physical violence was one of the strongest correlates of anal sex, which corroborates the findings of other studies in India and Moscow.[26,42] Though it is difficult to establish a one-to-one relationship between experiencing violence and anal sex based on a cross-sectional survey, future research should examine the context of this relationship. However, it is clear from the study findings that experiencing violence can create an unsafe environment for a FSW, which can hamper her negotiation power for safer sex; engagement in anal sex may be one of the outcomes of that weak negotiation.

The research findings documented a similar rate of inconsistent condom use among FSWs who reported anal sex versus who did not report anal sex in last 12 months, which is contrary to the other research among sex workers in Rwanda and Kenya.[2] Furthermore, our study findings suggests that a significantly higher proportion of FSWs engaging in anal sex were more likely to report experiencing STI-related symptoms in the last 12 months. Given no difference in condom use levels, the high rates of STIs may be occurring due to practice of anal sex. Interestingly, majority of FSWs who practiced anal sex reported using a condom at last anal sex. *Post hoc* analysis suggests that ~80% of FSWs practicing anal sex either reported no use of lubricant or used oil-based lubricants like coconut oil or Vaseline in anal sex, which would have increased the likelihood of condom breakage. This is supported by empirical research showing higher chances of condom breakage when a condom is used in anal sex.[13,14,43] Hence, even though many FSWs used condoms, the protection from STIs may be very minimal and resulting in STIs.

Although the study findings offer important evidences for programme intervention, certain limitations need to be kept in mind while interpreting the results. First, data were collected in a cross-sectional survey and although associations between some of the behavioural measures and anal sex are evident, the cause–effect relationship between them is difficult to establish. Second, previous research suggests that the prevalence of anal sex may be under-reported, as the information was self-reported and the stigma associated with reporting such sensitive experiences is recognised.[3,44] Third, biological samples were not collected in the survey; instead, self-reported STI symptoms were used as marker for HIV risk. Future research should collect biological samples and attempt to establish the association of anal sex with HIV and other STIs. Next, information on inconsistent condom use in anal sex was not collected in this study; however, it is recommended that future research studies among sex workers in India collect such information to examine the correlates of unprotected anal sex. Further, we suggest that information on risk perception specific to anal sex and anal sex practices by type of partners should be collected to better understand the context of anal sex practices and help programme planners in strategising interventions that are more effective.

The findings of this study have important policy implications. The high rates of STI-related symptoms, particularly anal sores and ulcers, reported by FSWs engaging in anal sex highlight the need for inclusion of communication messages related to the need for a safer sex environment even during anal sex. The finding that a substantial proportion of FSWs are practicing anal sex in a setting where HIV prevention programmes have been implemented for some time suggests that such interventions have not provided adequate information on the risks of anal sex and the need to abstain from such practices. HIV prevention programmes should educate FSWs on risks associated with anal sex practices in their routine visits to the STI clinics as well as during one-to-one counselling sessions. Special attention is needed in such interventions at clinics to build the skills of FSWs on safer sex negotiation with clients demanding anal sex. From the data, it is evident that FSWs who are in disadvantaged life situations, such as FSWs who are older, formerly married and working in brothels reported anal sex more than their counterparts. In order to make anal sex safer, the peer educators or community collectives needs to work together to educate these disadvantaged sex workers on the HIV risks associated with anal sex and the need for safer sex practices. Furthermore, FSWs who reported anal sex were also the ones reporting heavy alcohol consumption and who had experienced violence, vulnerability factors that need special attention from the programme using structural interventions. Structural interventions such as community collectivisation initiatives need to undertake education campaigns within sex work settings to educate both clients and FSWs on the need for safer sex practice even in anal sex. Further, STI clinics treating both FSWs and their clients could be the place for focussed communication on anal sex and its associated STI risk. In summary, anal sex is practiced by specific subgroups of FSWs, who may be in disadvantaged life situations in India and elsewhere, and may need increased attention from HIV prevention interventions.

Conflicts of interest

None declared.

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Vulnerabilities of men who have sex with men and injecting drug users

Vulnerabilities of men who have sex with men and injecting drug users

RESEARCH HIGHLIGHTS

- It is important to include anti-violence components in HIV prevention programs for men who have sex with men, as have been adopted in some programs for female sex workers in India because men who have sex with men, particularly those who engage in sex work, experience a high degree of sexual violence (Shaw et al., 2012).
- Typically, injecting drug user (IDU) programs in India focus primarily on needle and syringe distribution; however, recent research indicates that IDUs who share needles and syringes also report multiple sexual partners and unprotected sex (Souhu et al., 2012). Therefore, IDU programs should include sexual risk reduction interventions.
- More research is needed in this area.

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Factors Associated with Sexual Violence against Men Who Have Sex with Men and Transgendered Individuals in Karnataka, India

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Abstract

Objectives: There is a lack of information on sexual violence (SV) among men who have sex with men and transgendered individuals (MSM-T) in southern India. As SV has been associated with HIV vulnerability, this study examined health related behaviours and practices associated with SV among MSM-T.

Design: Data were from cross-sectional surveys from four districts in Karnataka, India.

Methods: Multivariable logistic regression models were constructed to examine factors related to SV. Multivariable negative binomial regression models examined the association between physician visits and SV.

Results: A total of 543 MSM-T were included in the study. Prevalence of SV was 18% in the past year. HIV prevalence among those reporting SV was 20%, compared to 12% among those not reporting SV (p = .104). In multivariable models, and among sex workers, those reporting SV were more likely to report anal sex with 5+ casual sex partners in the past week (AOR: 4.1; 95%CI: 1.2–14.3, p = .029). Increased physician visits among those reporting SV was reported only for those involved in sex work (ARR: 1.7; 95%CI: 1.1–2.7, p = .012).

Conclusions: These results demonstrate high levels of SV among MSM-T populations, highlighting the importance of integrating interventions to reduce violence as part of HIV prevention programs and health services.

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Introduction

Internationally, sexual violence has been recognized as a human rights priority, with significant implications for public health policy [1]. Sexual violence, according to the World Health Organization (WHO) is defined as "…any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion, by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work."(p.149) [1] The potential negative health implications of experiencing sexual violence have been demonstrated; short- and long-term impacts of experiencing sexual violence include increased susceptibility to HIV and other sexually transmitted infections (STIs), physical and mental disability (e.g. depression and post-traumatic stress disorder), and mortality [2,3,4].

As most research has focused on women, sexual violence in other populations, such as men who have sex with men and transgendered individuals (MSM-T) has been largely overlooked, despite the demonstrated vulnerability of MSM-T to violence [1,5]. MSM-T in developing countries, such as India, may be at heightened vulnerability, given strongly entrenched societal and structural sanctions against same-sex relationships [6,7]. Correspondingly, a few studies have demonstrated that MSM-T in India have an elevated risk of experiencing violence [8,9]. Prevalence of sexual violence, however, is likely to be under-reported, due to the stigma attached to reporting of sexual violence by men, as well as the marginalization of MSM-T communities in India [8]. Although MSM-T identity is highly nuanced and diverse in India [10,11,12], to varying degrees, stigma and discrimination have contributed to social and structural vulnerability [8]. For example,

it was not until 2009 that 'homosexual intercourse' was decriminalised in a Delhi court [6,13], overturning a discriminatory law that had been part of the Indian Penal Code since 1860 [6,7]. Added to the ever-present stigma and discrimination against MSM-T, some MSM-T in India engage in commercial sex work [8,10], raising the potential for these particular MSM-T to be at especially high risk, given the known vulnerabilities associated with sex work [14,15,16].

The social and structural vulnerability of MSM-T may be particularly problematic in the Indian context. Although the heterosexual spread of HIV, thought to be in large part through relationships between female sex workers (FSWs) and clients of FSWs, was an important factor in earlier phases of the HIV epidemic in southern India [17,18,19,20,21], heterogeneity in HIV transmission dynamics has increasingly been recognized [20,22,23,24,25,26,27,28,29,30]. In particular, elevated rates of HIV among MSM-T have been reported in India [21,31,32,33]. Despite this increasingly important role in HIV epidemiology, both in India and in other parts of South Asia [34,35,36], there has historically been a lack of information on MSM-T populations in India [8,37].

Although recent studies have increased our understanding of MSM-T [26,30,38,39], there is still little research examining sexual violence within MSM-T communities in South Asia. Using data from a cross-sectional study of four districts in Karnataka State, southern India, this study therefore sought to describe the prevalence of sexual violence among MSM-T, as well as examine factors related to experiencing violence. Given both the complexities related to violence against MSM-T in the Indian context, the demonstrated links between violence and HIV in other populations and the nuanced nature of MSM-T identities in India [40], the results can be used to inform future HIV prevention initiatives.

Methods

Study design and sampling

Institutional review boards at the University of Manitoba in Winnipeg, Canada and St. John's Medical College and Hospital in Bangalore, India approved the study and the verbal consent process. Interviews were conducted anonymously, with no names or personal identifiers recorded. Because of the high levels of marginalization and stigmatization of MSM-T populations in India, verbal consent was obtained for all respondents in lieu of written consent, as MSM-T are reluctant to sign their names to documents. An independent witness signed each consent form for the respondent, affirming that consent was correctly obtained. Data were from a cross-sectional behavioural and biological survey of MSM-T populations in four districts (sub-state administrative areas) in Karnataka State, southern India: Belgaum, Bellary, Mysore and Shimoga. Resources were only sufficient to conduct surveys in these four districts, plus an additional district, Bangalore Urban. Thus, the districts were chosen purposively, based on size of high risk populations and the socio-cultural regions of Karnataka [41]. MSM-T in Belgaum (n = 250), Bellary (n = 101), Mysore (n = 100) and Shimoga (n = 92) were recruited in 2008 through a multistage cluster sampling technique, as described in some depth by Saidel et al. [42], and in other previous published studies [38,40]. Briefly, as per the IBBA protocol, a sample size of 400 at the district level was thought adequate to detect an absolute difference of 15% or more from an assumed value of 50% in key behavioural characteristics between survey administrations, with 95% confidence and 90% power [42]. The four districts in this analysis were treated as a single study, and the target sample size was inflated to 550 in order to ensure adequate representation. Selection of solicitation sites occurred in the first stage of sampling, and selection of MSM-T in the second. Time-location cluster sampling was used to select specific clusters. Informed by previous mapping exercises, a total of 110 clusters with a minimum 5 interviews in each cluster were targeted across the four districts. Within each cluster, MSM-T were randomly approached by field staff and asked to participate. Free transportation was then arranged to a private venue for those MSM-T agreeing to participate. At the venue, MSM-T were explained IBBA procedures in detail, and given the opportunity to ask questions; the voluntary nature of the survey was stressed, especially the ability of the participant to withdraw participation at any point in the survey. Prior to field work and recruitment, a specific effort was made to inform community members of the scope, purpose and the risks and benefits of the IBBA by field workers through community-based organizations.

Surveys were conducted as part of a baseline assessment of HIV prevention programs located in these districts. Program and mapping activities were directed at the most at- risk MSM-T [38,40], and broadly focused on those frequenting cruising sites, and practicing receptive anal intercourse. The larger sample size of Belgaum reflects the larger MSM-T population in that district. Bangalore was omitted from the present analysis as MSM-T in Bangalore were surveyed over a different time frame than the other four districts. Participants were included in the study if they were 18 years or older, and reported having had sex with a man at least once in their lifetime.

Survey organization and methods

MSM-T were interviewed individually through a structured questionnaire administered face-to-face by trained peer workers in the local language (e.g. individuals from within the MSM-T community). As in previous studies [41], biological data were gathered using blood and urine samples. HIV serological testing was conducted using Microelisa (J. Mitra and Company, India), and positive tests were confirmed using Genedia HIV 1/2 ELISA 3.0 (Green Cross Life Science Corporation, South Korea). Where serum samples were not provided, a dried blood spot was performed on finger prick blood using the same serological tests. When neither serum nor finger prick samples were provided, urine samples were tested for HIV by Calypte (Biomedical Corporation, Berkeley, California, USA), and positives were confirmed by Western blot. When confirmed by Western blot, urine samples have been shown to have 99% sensitivity [43,44] and 100% specificity [43]. Chlamydia and gonorrhoea testing was done using the Gen-Probe Aptima assay (Gen-Probe Incorporated, San Diego, USA). Respondents could choose to answer the behavioural portion of the IBBA if they chose not to provide samples.

Measures

Respondents were asked if they had been physically forced to have sexual intercourse with someone in the past year; those answering 'yes' were classified as having experienced sexual violence. Two measures of physician utilization were used as outcome variables: one measuring the number of non-specific physician visits, while the other asked about STI-related visits. Similar to the sexual violence question, the timeframe for both physician utilization questions was over the past year. Respondents were compared on socio-demographic, sexual behaviour, health care access and biological variables. Age, literacy levels, marital status, district of residence, and sexual identity were included as socio-demographic variables.

In India, sexual identity among MSM-T is highly diverse and nuanced, thus it should be noted that any categorization of MSM-

T may not necessarily capture this complexity [12,40]. Similar to other studies [38], MSM-T could self-identify as *Kothis* (those who primarily practice receptive anal sex); *Hijras* (transgenders who often self-identify as female); *Panthis* (those who primarily practice insertive anal sex and are often clients of Kothis or Hijras); *Double-deckers* (those who practice both insertive/receptive anal sex), and *others* [40]. For the purposes of this study, and balancing the need to create meaningful categories, we grouped MSM-T into the following identities: *Kothi/Hijras* (due to the heightened vulnerability of "feminine" MSM-T [8,11,26]); *Double-deckers* (as over 50% of the sample was comprised of this identity); and all others. As indicated above, there were relatively few *Panthis* in the sample, as they are not a focus of programmatic efforts. Age at first vaginal and anal intercourse, use of condoms generally and at last anal intercourse, reasons for not using condoms, usual place of solicitation of other MSM-T, usual place for anal sex, frequency of anal sex in the last week, and condom use with both regular and non-regular male sex partners, were used to characterize sexual behaviour. In addition to general sexual behaviour questions, respondents were asked whether or not they had a "primary" male sex partner. In terms of sex work–related questions, a positive answer to the question "Have you ever received cash or a gift in return for anal sex" was interpreted as having been involved in sex work; those answering positively to this question were asked at what age their first paid sex occurred.

Statistical Analysis

For analyses examining the factors related to sexual violence, bivariate logistic regression models were used to test for significant associations between experiencing sexual violence and all variables of interest. Factors that were significantly associated with experiencing violence at the $p<.10$ level, using the adjusted Wald test, and that did not have more than 1% missing data, were included for multivariable analyses. For multivariable analyses, multiple logistic regression models were used to assess the impact of included variables on the odds of experiencing sexual violence. *A priori*, HIV status, district of residence and identity were thought to be important variables to adjust for, and thus these variables were forced into models. In addition to models using the entire sample, and because of the high levels of association between sex work, *kothi*-identity, and number of male sexual partners [8], multivariable models stratified by sex work were also fitted to the data.

As physician utilization was a count variable (i.e., the number of discrete physician visits), bivariate and multivariable negative binomial regression models were used for analyses examining the association between sexual violence and physician utilization [45]. Crude and adjusted relative risks (RR and ARR respectively) are reported for these analyses. For comparability purposes, the same set of variables used in examining the factors of sexual violence were adjusted for in the multivariable negative binomial models. Finally, models were stratified by sex work status. For all analyses, sampling weights were utilized in multiple regression models to account for the complex sampling design, using survey methods in Stata 11 [46]. Multicollinearity in multivariable models was assessed using the variance inflation factor (VIF) and tolerance statistics, corrected for the survey methods employed [47].

Results

A total of 543 MSM-T were included in the study. All percentages, means and p-values reported in tables are based on the results from weighted analyses, and sample sizes reported are unweighted. The mean age of respondents was 31.3 years, with slightly less than half of the sample reporting being currently married (Table S1). At 0.7% and 0.4%, respectively, chlamydial and gonorrheal infections were rare, while 13.5% of the sample tested positive for HIV. In total, 17.5% of the sample reported experiencing sexual violence in the last year. The most common sources of violence were clients (61%), police (18%), a regular partner (13%), a pimp (10%) and 'other' (21%). The mean age of respondents for the entire sample was 30.9 years (SD: 9.5), with an inter-quartile range of 23–37, with slightly less than half of the sample reporting being currently married. MSM-T reporting violence tended to be younger, with the mean age of those reporting violence 27.7 years, compared to 31.6 for those not reporting violence; similarly, MSM-T reporting violence were less likely to be married (30.5% vs. 56.2%), and to self-identify as Kothi/*Hijra* (45.8% vs. 22.6%). MSM-T from Belgaum represented the largest majority of respondents, at 46% ($n = 250$).

Bivariate Analyses

Prevalence of Sexual Violence by Socio-Demographic Characteristics. Table S2 examines the prevalence of violence by variables of interest. MSM-T who were currently married were less likely to have reported sexual violence (8.6% vs. 21.6%, $p<.001$), and those self-identifying as *Kothi/Hijra* reported the highest levels of sexual violence (25.9%, $p<.001$). The prevalence of sexual violence varied significantly by district ($p = .036$), with MSM-T from Mysore reporting the highest prevalence of sexual violence, at 31% compared to 12%, 13% and 22% in Shimoga, Belgaum, and Bellary, respectively. HIV prevalence was higher among MSM-T experiencing sexual violence (20.3% vs. 12.4%).

Prevalence of Sexual Violence by General Sexual Behaviour Characteristics. MSM-T who reported never having vaginal intercourse were more likely to report experiencing sexual violence (22.3% vs. 10.6%, $p = .002$); age at first vaginal intercourse was not significantly different among those reporting vaginal intercourse ($p = .290$). MSM-T experiencing sexual violence were younger at first anal intercourse (17.0 vs. 18.8 years, $p = .029$), and those reporting condom use in last anal intercourse were more likely to have experienced sexual violence (16.3% vs. 2.2%, $p<.001$). MSM-T experiencing violence reported having anal sex with a higher number of regular male sex partners ($p = .088$) and non-regular male sex partners ($p = .043$) in the past week.

Prevalence of Sexual Violence by Sex Work Characteristics & Health-Care Access Behaviours. Sexual violence prevalence was 27.2% for those reporting sex work, compared to 10.7% for those who did not ($p<.001$). On average, MSM-T experiencing sexual violence reported more general doctor visits in the past year (12.5 vs. 10.3 visits, $p = .017$). Although there were no statistically significant differences in ever having taken an HIV test ($p = .690$),

Multivariable Analyses

Table S3 shows the results from multivariable analyses of variables for the total sample that were significant at the $p<.10$ level in bivariate analyses. The variables measuring number of regular/non-regular partners were highly correlated ($r>.90$); thus, given the more substantive interest in non-regular partners, only the variable measuring number of non-regular partners was included in multivariable models. Sexual violence was associated with younger age (AOR: 0.9, 95%CI: 0.9,1.0; $p = .001$); and *Kothi/Hijra* identity (AOR: 3.5, 95%CI: 1.2,10.6; $p = .027$). Having anal sex with 5+ non-regular male sex partners was marginally non-significant at the $p<.05$ level (AOR: 1.8, 95%CI: 1.0,3.5;

p = .067). Upon stratification by sex work (Table 1), and for MSM-T reporting sex work, only having 5+ non-regular male partners in the last week was associated with sexual violence, adjusting for all other variables in the model (AOR: 4.1; 95%CI: 1.2,14.3; p = .029). For those not reporting sex work, *Kothi/Hijra* identity (AOR: 6.0; 95%CI: 1.3,28.8; p = .026) and age (AOR: 0.9; 95%CI: 0.9,1.0; p = .002) remained significantly associated with sexual violence (Table 1).

Table 2 shows the results from analyses examining physician utilization, including only those individuals who provided complete answers to the utilization questions. On average, MSM experiencing sexual violence reported more physician visits, both for general (12.5 vs. 10.3) and for STI-related (1.7 vs. 1.5) reasons. In adjusted analyses, experiencing sexual violence was significantly associated with a 40% increase in general physician visits when the entire sample was examined (ARR: 1.4; 95%CI: 1.1,1.7; p = .012)

Table 1. Crude (OR) and Adjusted odds ratios (AOR) and 95% confidence intervals (95%CI) from weighted logistic regression models examining correlates of sexual violence among men who have sex with men and transgenders (MSM-T), stratified by sex work status, Karnataka, South India (2008)*.

		Violence Prevalence (%)	OR	95% CI	AOR	95% CI	P**
Sex Work (N = 175)							
Age (mean)		26.9	0.99	(0.94,1.03)	0.97	(0.95,1.06)	.276
Identity***	Bisexual/Panthi/Other	39.0	*Ref*	–	*Ref*	–	–
	Double decker	19.9	0.39	(0.05,3.28)	1.15	(0.17,7.79)	.884
	Kothi/Hijra	31.7	0.72	(0.10,5.48)	1.23	(0.17,8.76)	.834
Currently Married	No	29.7	*Ref*	–	*Ref*	–	–
	Yes	20.4	0.61	(0.25,1.49)	0.92	(0.32,2.67)	.881
Has main male sex partner	No	17.5	*Ref*	–	*Ref*	–	–
	Yes	35.2	2.56	(1.12,5.89)	1.82	(0.77,4.32)	.166
District	Belgaum	22.9	*Ref*	–	*Ref*	–	–
	Bellary	36.4	1.92	(0.71,5.20)	1.50	(0.48,4.75)	.477
	Shimoga	25.0	1.12	(0.28,4.56)	1.52	(0.36,6.33)	.558
	Mysore	30.1	1.45	(0.58,3.63)	1.61	(0.47,5.45)	.434
Non-regular male sex partners, past week	0	18.3	*Ref*	–	*Ref*	–	–
	1–4	26.9	1.64	(0.57,4.74)	1.57	(0.47,5.27)	.452
	5+	52.4	4.90	(1.58,15.17)	4.08	(1.17,14.26)	.029
HIV status	Negative	24.0	*Ref*	–	*Ref*	–	–
	Positive	40.8	2.19	(0.75,6.34)	2.44	(0.63,9.48)	.192
No Sex Work (N = 368)							
Age (mean)		27.4	0.93	(0.88,0.97)	0.92	(0.87,0.97)	.002
Identity***	Bisexual/Panthi/Other	4.3	*Ref*	–	*Ref*	–	–
	Double decker	10.3	2.58	(0.81,8.22)	2.73	(0.76,9.85)	.121
	Kothi/Hijra	19.0	5.25	(1.43,19.23)	6.00	(1.25,28.81)	.026
Currently Married	No	16.6	*Ref*	–	*Ref*	–	–
	Yes	7.0	0.38	(0.18,0.79)	1.02	(0.42,2.50)	.958
Has main male sex partner	No	9.0	*Ref*	–	*Ref*	–	–
	Yes	13.9	1.63	(0.75,3.55)	1.17	(0.49,2.80)	.715
District	Belgaum	10.3	*Ref*	–	*Ref*	–	–
	Bellary	13.5	1.37	(0.45,4.15)	1.01	(0.30,3.46)	.986
	Shimoga	8.9	0.86	(0.27,2.74)	0.66	(0.18,2.43)	.525
	Mysore	33.3	4.38	(1.84,10.45)	2.00	(0.71,5.69)	.187
Non-regular male sex partners, past week	0	10.2	*Ref*	–	*Ref*	–	–
	1–4	11.9	1.18	(0.54,2.57)	1.36	(0.60,3.08)	.455
	5+	4.0	0.37	(0.07,2.08)	0.29	(0.04,1.79)	.179
HIV positive status	Negative	10.5	*Ref*	–	*Ref*	–	–
	Positive	12.7	1.24	(0.28,5.61)	1.49	(0.31,7.24)	.614

*All percentages are weighted percentages;
**P-value reported for adjusted analyses only.
***Kothis: those who primarily practice receptive anal sex; Hijras: transgenders who often self-identify as female; Panthis: those who primarily practice insertive anal sex; Double-deckers: those who practice both insertive/receptive anal sex.
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Table 2. Crude (RR) and adjusted relative risk ratios (ARR) and 95% confidence intervals (95%CI) from weighted negative binomial regression models examining association between general and sexually transmitted infections-related physician utilizations (past 1 year) and sexual violence among men who have sex with men and transgenders (MSM-T), by total sample and stratified by sex work status, Karnataka, South India (2008).

		Mean Utilization	RR	95% CI	ARR	95% CI	P value*
General Physician Visits	**Total Sample (N = 378)**						
	Did not experience violence	10.3	*Ref*	–	*Ref*	–	.012
	Experienced violence	12.5	1.30	(1.01,1.67)	1.35	(1.07,1.71)	
	Reported Sex Work (N = 140)						
	Did not experience violence	12.0	*Ref*	–	*Ref*	–	.012
	Experienced violence	16.6	1.39	(0.87,2.21)	1.74	(1.14,2.66)	
	Did Not Report Sex Work (N = 238)						
	Did not experience violence	9.8	*Ref*	–	*Ref*	–	.284
	Experienced violence	10.3	1.04	(0.74,1.49)	1.21	(0.85,1.73)	
STI-Related Physician Visits	**Total Sample (N = 376)**						
	Did not experience violence	1.5	*Ref*	–	*Ref*	–	.835
	Experienced violence	1.7	1.13	(0.63,2.03)	1.07	(0.55,2.09)	
	Reported Sex Work (N = 140)						
	Did not experience violence	2.5	*Ref*	–	*Ref*	–	.302
	Experienced violence	2.1	0.82	(0.33,2.02)	1.60	(0.64,3.99)	
	Did Not Report Sex Work (N = 236)						
	Did not experience violence	1.2	*Ref*	–	*Ref*	–	.160
	Experienced violence	1.4	1.14	(0.52,2.53)	0.58	(0.27,1.25)	

*P-value reported for adjusted analyses only; models adjusted for age, sexual identity, marital status, district, number of unknown partners, presence of a main sexual partner and HIV status.

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and 70% in those reporting sex work (ARR: 1.7; 95%CI: 1.1,2.7 p = .012).

Discussion

This study demonstrated a high level of sexual violence among MSM-T, with nearly one out of every five MSM-T experiencing sexual violence in the year prior to their interview. This prevalence is less than reported by Newman et al., who found an overall prevalence of past year sexual violence of 41% in a sample of MSM-T from Chennai [5]. However, similar to our results, paid sex work was associated with higher rates of sexual violence, highlighting the increased risk of sexual violence to MSM-T who engage in sex work, over and above the already elevated rates of violence and harassment experienced by Indian MSM-T in general [8,9]. Notably, the prevalence of sexual violence reported in our study is higher than the reported prevalence among FSWs in southern India, which has been estimated at 10–15% [48]. Our results suggest that an increased likelihood of sexual violence was associated with greater numbers of non-regular male sex partners, but only among those who reported an involvement in sex work. Among MSM-T who reported no involvement in sex work, older age was associated with decreasing risk, while the odds of having experienced sexual violence was over six-fold for those respondents identifying as *Kothis* or *Hijras*. Although in univariate analysis an association was found between condom use at last anal intercourse and increased sexual violence, it should be noted that this variable had 10% missing data; thus caution is warranted in interpretation of this result. As well, this association may be confounded by MSM-T who practice sex work generally having higher rates of condom use at last intercourse (96% vs. 90%, data not shown).

Feminine identities and the risk of sexual violence

The observation of heightened risk of sexual violence among *Kothis* and *Hijras* aligns with previously published work [8]. In the Indian context, Chakrapani et al. have noted that the complex interplay between macro-level environments interact to create "…interlocking subsystems supporting direct and indirect victimization…"(p.358) [8] of MSM-T, and in particular, those MSM-T that self-identified as *Kothis* [8]. At the community level, *Kothis* are often intimidated for sex and money, while acts of harassment, extortion, and physical and sexual assault perpetrated by police have been reported. Given systematic discrimination at the health care level, *Kothi*-identified MSM-T are left little recourse for protection [8]. Ultimately, and with respect to HIV infection, this complex dynamic results in increased risk for MSM-T from multiple fronts: protective measures, such as condom use are difficult to negotiate in the context of sexual violence, while the medical system offers minimal support for those experiencing violence.

Like *Kothis*, *Hijras* (i.e., transgendered) have few available economic choices [11,49]; however, as Reddy suggests, *Hijras*' highly visible nature, in combination with their particular lack of societal power, may lead to further stigma, marginalization and

vulnerability [49]. HIV prevalence of nearly 50% among *Hijras* has been noted by other published studies [50]. Indeed, in our sample, *Hijras*, at 26%, had the highest HIV prevalence, followed by *Kothis*, *Panthis/Bisexuals/Others*, and *Double-deckers* (11%). Combined, HIV prevalence among *Kothis/Hijras* was 20%.

Given the complex and multi-level factors responsible for the continued discrimination of MSM-T, our findings suggest the importance of structural and societal changes to help alleviate the vulnerabilities associated with MSM-T identity in India. Decriminalization of 'homosexual' activities is one important step towards reducing discrimination against MSM-T. However, without concurrent interventions aimed at other societal institutions, such as the policing and medical subsystems, the impact of state-level decriminalization on the safety and well-being of MSM-T may be lessened. Finally, and recognizing, as Boyce does, that ascribing the interpretation of *Kothi* identities with "self-evident meanings and behavioural patterns" (p.178) [12] is itself limiting for the purposes of understanding MSM-T in South Asia, it is imperative to explore the reasons why risk for sexual violence is seemingly elevated for those who take on this identity. Given the discordance in social meanings around *Kothi* identities, occurring between how the term is used in practice and how *Kothi*-identifying men perceive themselves [12,49], thoughtful examinations of whether the increased risk of sexual violence is due to how perpetrators perceive *Kothi*s (e.g. as being easier targets), how *Kothis* view themselves (e.g., powerless), or some combination of both, are much needed. Disentangling this fundamental association will be important for informing effective sexual violence prevention initiatives.

Sex work and the risk of sexual violence

Although evidence is limited in the Indian MSM-T context, engaging in sex work has been associated with vulnerability to violence [5,8]. As reported by Newman et al. in their study of MSM-T in Chennai, the proportion of MSM-T engaging in sex work was 68% among those experiencing sexual violence in the past year; in comparison, among those not experiencing sexual violence, this proportion was 54% [5]. In this same study, the authors found that MSM-T engaging in sex work were two-fold more likely to have experienced physical and verbal harassment in the past year. This aligns with our finding of a higher prevalence of sexual violence among MSM-T reporting sex work (28% vs. 10%). The situations contributing towards involvement of MSM-T in sex work, including environments of desperation and survival, can help to explain the elevated risk among those involved in sex work [51]. As Chakrapani et al. write, cruising in public sex environments for potential clients place MSM-T at higher risk of direct forms of violence from members of society (e.g., rowdies) and from those in authority (e.g., police). Moreover, the dual marginalization of MSM-T and sex work contribute to indirect forms of violence, as MSM-T are likely to be exploited because they cannot seek recourse against those who perpetrate direct forms of violence against them [8]. Although MSM-T often turn to sex work for survival reasons, heterogeneity in reasons behind becoming a sex worker, including those of desire and sexual expression should be recognized [10].

Irrespective of trajectories and reasons involved, it is clear that sex work places MSM-T at higher risk of sexual violence. An increased exposure to clients may be one reason why higher numbers of non-regular partners was associated with a greater risk for sexual violence in our study only among sex workers. Although representing a different marginalized population (and recognizing important limitations in their comparison), the experience of FSWs in India may be informative [52,53,54]. Because female sex work is quasi-criminalized, policing and enforcement policies can operate to increase risk for experiencing sexual or physical violence, particularly for sex workers in street-based or public settings. To avoid being arrested and/or having their clients arrested, research indicates that women in sex work in other settings are forced to work in more isolated settings where they are at higher risk for client violence and further away from health services [2,54,55,56]. Similarly, the dual social marginalization experienced by MSM-T who do sex work in southern India may exacerbate the risk for different types of violence.

Our results also highlight the importance of including anti-violence components in HIV prevention programs for highly vulnerable MSM-T, as has been undertaken in southern India recently for FSWs [54]. Indeed, the longer history of MSM programming in Mysore may have impacted both the recognition, and reporting of sexual violence, thus contributing to the higher prevalence observed there [57]. It should be noted that given MSM-T's still-precarious position within Indian society [6,13], and ours and others' demonstration of high levels of sexual violence, the urgency to develop and implement initiatives aimed at eliminating sexual violence cannot be overemphasized. At the same time, research is needed to better understand how best to address violence against MSM-T, particularly for MSM-T who do sex work, in prevention programs. Prospective studies examining HIV risk over time may help to inform the timing of prevention/intervention studies, and qualitative studies that delineate the specific intersecting vulnerabilities faced by MSM-T according to sexual identity and involvement in sex work are much needed.

Importantly, our observation of higher rates of general physician utilization among those experiencing sexual violence suggests those who experience sexual violence have a greater demand for health services. Therefore, developing clinical services integrated with sexual violence services could be stressed where sexual violence is common [58]. That interventions have been implemented in the four districts with a specific focus on health care access among high-risk MSM-T groups, such as *Kothis/Hijras* with high numbers of sex partners [59], suggests the importance of future studies evaluating the extent to which interventions have had an impact on utilization of health care. As the HIV epidemic across South Asia becomes further entrenched in MSM-T populations [21,31,32,33,60], the establishment of an effective interface between health care systems, and MSM-T and their subpopulations may impact the trajectory of the epidemic in this region. Studies characterising the unique risks and environments of MSM-T may be used to educate and inform practitioners and policy-makers, thus having wide-ranging implications in the policy response to HIV in this vulnerable population.

There were a number of limitations to the study; first and foremost, the study sample was relatively small, thus it was not possible to conduct district-specific analysis. The study may have been insufficiently powered to detect differences in HIV prevalence by sexual violence status. However, having data collected from four districts using a well-established sampling methodology ensured a wider spectrum of responses, with an approximation of representation of the wider population of MSM-T. At the same time, the substantial differences in socio-cultural and political environments across different states in India should not be underestimated; thus, inferences from our sample to other states/populations should be undertaken with caution. Second, IBBA sampling methodology primarily relied on sampling from cruising sites, therefore our findings may not be generalisable to those MSM-T who do not frequent cruising sites. This sampling strategy was employed however, on the rationale that MSM-T who frequented cruising sites were at the highest HIV risk. Third,

sexual identity of MSM-T was necessarily simplified and broad; future studies with a larger sample size may be able to better distinguish among sexual identities. Fourth, sexual violence was also measured fairly broadly; at the minimum, future studies should include more specific questions on violence by partner type. Fifth, the possibility of recall bias exists, as all behavioural questions were self-reported; this may be especially important considering some of the time frames involved in the behavioural questions (e.g., age at first sexual intercourse, ever use of condoms with partners, etc.). As well, the accuracy of one-year recall of physician visits may be called into question; having a six-month assessment of physician visits may help bolster the findings from the present study. However, there is no reason to suspect a systematic bias for providing incorrect answers, based on socio-demographic characteristics, and thus, the bias would tend to render associations towards the null. Finally, data were of a cross-sectional nature, and thus causality could not be inferred from our study.

In conclusion, the high rate of sexual violence in this sample of MSM-T further illustrates the importance of understanding vulnerabilities associated with MSM-T identity in India. As protection of marginalized populations from sexual violence is considered a fundamental human rights priority, these results may be used to help guide intervention activities among MSM-T, particularly in subpopulations shown to be at especially high risk.

ETHICS APPROVAL

Institutional review boards at the University of Manitoba in Winnipeg, Canada and St. John's Medical College and Hospital in Bangalore, India approved the study and the verbal consent process. Interviews were conducted anonymously, with no names or personal identifiers recorded. Because of the high levels of marginalization and stigmatization of MSM-T populations in India, verbal consent was obtained for all respondents in lieu of written consent, as MSM-T are reluctant to sign their names to documents. An independent witness signed each consent form for the respondent, affirming that consent was correctly obtained.

Supporting Information

Table S1 Comparison of socio-demographic, sexual behaviour and health care access characteristics among men who have sex with men and transgenders (MSM-T) experiencing sexual violence in the last year, Karnataka, South India (2008).
(DOC)

Table S2 Prevalence of violence by socio-demographic, sexual behaviour and health care access characteristics among men who have sex with men and transgenders (MSM-T) experiencing sexual violence in the last year, Karnataka, South India (2008).
(DOC)

Table S3 Crude (OR) and Adjusted odds ratios (AOR) and 95% confidence intervals (95%CI) from weighted logistic regression models examining correlates of sexual violence among men who have sex with men and transgenders (MSM-T), by total sample and stratified by sex work status, Karnataka, South India (2008).
(DOC)

Author Contributions

Analyzed the data: SYS KND. Wrote the paper: SYS RRL KND. Conceived and performed the analyses, drafted the first draft of the manuscript and provided important intellectual content: SYS. Played critical roles in analysis and interpretation of data, as well as provided help in drafting the manuscript and providing critical intellectual content: RRL KND. Helped in the interpretation of data, as well as provided important intellectual content: LA. Played critical roles in the conception, design and interpretation of the data, and revised the manuscript critically for important intellectual content: HLM PB SRP SI BMR RW. Had roles in the conception, design and interpretation of the data, and helped draft the manuscript as well as provide important feedback and intellectual content: SM JB. Approved the final submitted manuscript: SYS RRL KND LA HLM PB SRP SI BMR RW SM JB.

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Understanding the association between injecting and sexual risk behaviors of injecting drug users in Manipur and Nagaland, India

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Abstract

Background: In India, as in rest of the world, HIV prevention programs have focused on HIV transmission through unsafe injecting practices with less attention on sexual risk behaviors among injecting drug users (IDUs). This study examines the sexual risk taking behaviors of IDUs associated with their pattern of drug use in India.

Methods: Data were obtained from the behavioral tracking survey conducted in 2009 among 1712 IDUs in two districts each of Manipur and Nagaland states in Northeastern part of India. Sexual risk behaviors among IDUs were assessed in terms of multiple sex partners, sex with a paid female partner in the last 12 months and inconsistent condom use with any female partner.

Results: More than one-fourth (27%) in Manipur and almost one in two (47%) IDUs reported having had sex with two or more female partners in the past 12 months. In Manipur where heroin is commonly used, the odds of having multiple sex partners were higher among non-heroin users than heroin users (42% vs. 23%, Adjusted Odds Ratio (AOR): 1.7, 95% Confidence Interval (CI): 1.1-2.6) and who shared needles/syringes in the last one month than who did not share (46% vs. 26%, AOR: 2.2, CI: 1.2-4.0). In Nagaland, where Spasmoproxyvon (SP, a synthetic opioid analgesic that contains dextropropoxyphene, dicyclomine hydrochloride and paracetamol) is most common, regular injectors as compared to occasional injectors were more likely to report multiple sex partners (67% vs. 42%, AOR: 2.7, CI: 1.8-4.1) and sex with paid partners (13% vs. 3%, AOR: 6.0, CI: 3.0-12.1). Sharing of needles/syringes was positively associated with multiple sex partners (51% vs. 44%, AOR: 1.6, CI: 1.2-2.2), and inconsistent condom use (93% vs. 80%, AOR: 3.0, CI: 1.8-5.1).

Conclusions: IDUs with unsafe injecting practices also engage in risky sexual practices magnifying the risk of HIV infection. There is a need to focus on prevention of sexual transmission among high-risk IDUs, particularly in areas where Spasmoproxyvon is commonly used.

Keywords: Injecting drug users, Sexual behavior, Condom use, Northeastern India

Background

Approximately 10% of HIV infections worldwide are attributed to unsafe injecting of illicit drugs [1]. HIV infection, hepatitis C and hepatitis B, all infections linked with injecting drug use, are important public health concerns in India [2-7] and in many other countries worldwide [1,8-10]. The National AIDS Control Organization (NACO) in India has also identified injecting drug users (IDUs) as one of the high risk groups requiring special focus [11].

HIV epidemics among IDUs in the Northeast Indian states of Manipur and Nagaland have been a concern since the mid-1990s. Both states share porous borders with Myanmar, which is part of the Golden Triangle (Myanmar, Laos and Thailand), and is the second largest producer of opium in the world [12]. Approximately 2% of the population of Manipur and Nagaland inject drugs [13]. In Manipur, heroin is the most commonly injected

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drug whereas in Nagaland Spasmoproxyvon (SP, a synthetic opioid analgesic that contains dextropropoxyphene, dicyclomine hydrochloride and paracetamol) is used more widely. Heroin use became popular among the youth in 1980's, particularly in Manipur, and unsafe injecting of illicit drugs has remained a major route of HIV infection in Northeast India ever since. The states of Manipur and Nagaland consistently report among the highest HIV prevalence in the country, and in the case of Manipur, the highest. Adult HIV prevalence in 2009 was estimated to be 1.4% in Manipur and 0.78% in Nagaland (compared with 0.31% nationally) [14]. However, HIV prevalence among IDUs is much higher. A large cross-sectional behavioral and biological survey undertaken in two districts within each state in 2009 revealed that HIV prevalence among IDUs ranged between 16.2% - 39.9% in Manipur, and 1.0% - 2.1% in the Nagaland districts.

Avahan (Bill & Melinda Gates Foundation's HIV initiative in India) has been complementing the HIV prevention programs of the State AIDS Control Societies in these two states through Project ORCHID (Organized Response for Comprehensive HIV Interventions in selected high-prevalence Districts of Manipur and Nagaland), a joint initiative of the Emmanuel Hospital Association (EHA) and the Australian International Health Institute (AIHI) from the University of Melbourne since 2004 [15].

Most of the interventions in India that aim to reduce HIV infection among IDUs have largely focused on transmission of infection through unsafe injecting drug use [14-16]. However, there is also a need to understand and address sexual transmission of HIV infection among IDUs and their sexual partners. While a few studies from Indonesia and United States of America (USA) have demonstrated no association between injecting and sexual risk behaviors [17,18], other international studies conducted in South Africa and USA have established this association [19-23]. Although some Indian studies have investigated the sexual risk behaviors of IDUs [2,4,6,24,25], none have attempted to analyze the associations between injecting and sexual risk behaviors of IDUs in Northeast India, where injecting drugs remains an important route of HIV transmission [13,15]. Understanding this association will assist program planners and managers to sharpen the focus of their HIV prevention interventions. Therefore, this study examines the relationship between injecting and sexual risk behaviors of IDUs in the Indian states of Manipur and Nagaland. It also examines how this relationship is influenced by the type and pattern of drugs injected.

Methods

Study design

Data for this study were obtained from a Behavioral Tracking Survey (BTS) conducted in 2009 among IDUs in Ukhrul and Chandel districts of Manipur, and Kiphire and Zunheboto districts of Nagaland. The BTS is a cross-sectional survey that collects information on HIV risk behaviors, HIV knowledge, exposure to Project ORCHID's harm reduction interventions, and community mobilization. Ethics approval was obtained from the Institutional Review Board of the Emmanuel Hospital Association Ethics Committee, New Delhi.

Sampling

The Behavioral Tracking Survey used respondent driven sampling (RDS) to recruit participants. RDS is a validated probability sampling method used with hidden populations such as sex workers and IDUs [26]. RDS is based on conventional snowball sampling and is used to recruit participants in many HIV biological and behavioral surveillance studies [27]. RDS involves recruiting participants via an initial pool of accessible contacts (seeds) who are the starting point for a system of recruitment using coupons and financial incentives. A sample size of 400 was estimated based on the ability to detect changes in proportions of 15% at follow-up surveys from estimated baseline values of 50% (which yield the biggest sample size), an alpha level of 0.05 for a two-sided test, and a power of 90%. A design effect of 1.5 was applied to account for intra-class correlation [24]. A total of 1712 participants, 421 from Ukhrul, 415 from Chandel, 427 from Kiphire and 449 from Zunheboto, were recruited for this study.

Data collection

The eligibility criteria were being male, 18 years of age or older and having injected drugs for non-medical reasons at least once in the last 6 months. Peer educators who had good knowledge of the local injecting drug use context screened the participants for eligibility. Eligible participants were interviewed using a questionnaire that collected information on socio-demographic characteristics, drug use and injection practices, sexual behavior and condom use, knowledge of HIV and exposure to interventions. The questionnaire was adapted from one used previously for a large scale survey in India [28], and was piloted prior to formal data collection.

To start the RDS sampling chain, four seeds in each district were purposively selected to ensure diversity of demographic characteristics including age, geographic location, marital status, employment status, and drug use pattern. An individual coupon system was used to track the recruitment of participants. Seed participants were provided with three coupons each to distribute to fellow IDUs in their social network. Only people presenting the coupon were eligible to participate in the study. Each subsequent participant was also given three coupons and could recruit up to three other IDUs to

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participate in the study. A primary payment of INR 100 (approx.USD 2.00; 1 USD = INR 50) was provided to each participant at the conclusion of their interview and a secondary payment of INR 50 (approx. USD 1) was provided for each additional participant that they recruited through their three coupons. This process was continued until the desired sample size was attained.

Measures

The main outcome measures for this study were sex with multiple partners in the last 12 months, sex with a paid partner in last 12 months, and inconsistent condom use with any female partner. The number of sexual partners in the last 12 months was dichotomized into less than two partners and two or more partners. Participants were classified as inconsistent condom users if they reported not always using a condom with any of their female sexual partners (regular, paid, or non-paid casual).

The independent measures considered for this study were frequency and type of drug use, duration since injecting drugs, sharing needles/syringes in the last one month, and accessing services from nongovernmental organizations (NGOs) that had a needle and syringe exchange program (NSEP) in the last six months. Frequency of drug use was dichotomized with regular injectors defined as those IDUs who injected drugs at least daily, whereas occasional injectors were those who injected once or more per week, but not on a daily basis. The type of drug use was different for the two states. The majority of the participants from Manipur had most recently been injecting heroin, whereas the majority from Nagaland had most recently been injecting Spasmoproxyvon. Consequently, for the drug use variable, Manipur participants were coded as heroin users or non-heroin users, and Nagaland participants as Spasmoproxyvon users or non-users. Duration of drug use was dichotomized as less than three years since injecting drugs and three or more years. Sharing of needle/syringe was defined as passing on or receiving a used needle/syringe to or from another IDU.

Socio-demographic characteristics included age, literacy, marital status and employment status. Age was recorded as a continuous variable and categorized into three categories; less than 24 years, 25 to 29 years and 30 years or older. Literacy was assessed as whether the participant could read and write or not. Marital status was categorized as the participant being currently married or not currently married, and employment status was recorded as unemployed if the participant was a student or did not have any source of income.

Statistical analysis

RDS data are usually analyzed with RDSAT software that generates appropriately weighted estimated proportions with confidence intervals [26,29]. The weights are designed to account for patterns of recruitment. However, RDSAT software is not able to calculate bivariate or multivariate statistics, so we used STATA (Version 11.0) for bivariate and adjusted logistic regression analyses to estimate the association between injecting and sexual risk behaviors of IDUs. Logistic regression models were adjusted for age, literacy, marital status, employment status, and having received needles/syringes from NSEP. These adjusted odds ratios were derived from unweighted estimates. Separate models were developed for each state because of the major differences in the nature of the HIV epidemic, the profile of drug users, and the patterns of drug use in the two states.

Results

Socio-demographic characteristics, injecting practices, program exposure and sexual risk behaviors

In both Manipur and Nagaland, the majority of IDUs were literate, 90% and 73% respectively, and were not currently married, 65% and 69% respectively. While 61% of IDUs in Manipur were employed, only 42% in Nagaland were. Differences were observed in the injecting practices of IDUs in Manipur and Nagaland. In Manipur, 73% of IDUs were regular (at least daily) injectors and 79% generally injected heroin, whereas in Nagaland, only 18% of IDUs were regular injectors and 87% generally injected Spasmoproxyvon. About 62% of IDUs in Manipur and 54% in Nagaland had been injecting drugs for three or more years. While 93% of IDUs did not share needle/syringes in Manipur, only 62% did not share in Nagaland. Further, 90% of IDUs in Manipur and 70% in Nagaland had accessed NGO services. Only a small percentage of IDUs in both states reported sex with a paid partner in last 12 months, 7% in Manipur and 5% in Nagaland. Inconsistent condom use with any female partner was common both in Manipur and Nagaland, 86% and 85% respectively (Table 1).

Association between injecting and sexual risk behaviors by state

In Manipur, frequency of drug use and duration of injecting had no significant association with any of the sexual risk behavior indicators. However, heroin users were less likely to have had two or more partners in the last 12 months compared to non-heroin users (23% vs. 42%, Adjusted Odds Ratio (AOR) = 0.6, 95% Confidence Interval (CI) = 0.4-0.9). Further, those who shared needle/syringes in the last one month were more likely to have had two or more partners in the last 12 months compared to those who did not share (46% vs. 26%, AOR = 2.2, 95% CI = 1.2-4.0) (Table 2).

In Nagaland, regular injectors were more likely to have had two or more partners in the last 12 months (67% vs.

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Table 1 Socio-demographic characteristics, injecting practices, program exposure and sexual risk behaviors among injecting drug users in Northeastern India

	Manipur (N = 836)	Nagaland (N = 876)
Background characteristics	% (n)	% (n)
Socio-demographic characteristics		
Age		
<=24	28.7 (240)	48.4 (424)
25-29	25.2 (211)	30.4 (266)
30+	46.1 (385)	21.2 (186)
Literate		
No	10.3 (86)	26.6 (233)
Yes	89.7 (750)	73.4 (643)
Currently married		
No	64.7 (541)	68.6 (601)
Yes	35.3 (295)	31.4 (275)
Employed		
No	39.1 (327)	58.3 (511)
Yes	60.9 (509)	41.7 (365)
Injecting drug use practices		
Frequency of drug use		
Occasional	27.0 (226)	81.8 (717)
Regular	73.0 (610)	18.2 (159)
Heroin user		
No	21.5 (180)	
Yes	78.5 (656)	
Spasmoproxyvon user		
No		13.0 (114)
Yes		87.0 (762)
Duration since injecting drugs		
< 3 years	37.9 (317)	46.2 (404)
3+ years	62.1 (519)	53.8 (471)
Shared needle/syringe in last one month		
No	92.5 (773)	62.0 (543)
Yes	7.5 (63)	38.0 (333)
Program exposure		
Accessed NGO services in last 6 months		
No	10.2 (85)	25.0 (219)
Yes	89.8 (751)	75.0 (657)
Sexual risk behavior		
Number of female partners in last 12 months		
<2	72.7 (608)	53.1 (465)
2+	27.3 (228)	46.9 (411)
Sex with paid partner in last 12 months		
No	93.5 (782)	95.0 (832)
Yes	6.5 (54)	5.0 (44)
Inconsistent condom use with any female partners		
No	13.8 (85)	15.0 (118)
Yes	86.2 (531)	85.0 (670)

42%, AOR = 2.7, 95% CI = 1.8-4.1) and more likely to have had sex with a paid partner in the last 12 months (13% vs. 3%, AOR = 6.0, 95% CI = 3.0-12.1). Those IDUs who had been injecting for three or more years were more likely to report overall inconsistent condom use compared to those who had been injecting for less than three years (91% vs. 77%, AOR = 1.7, 95% CI = 1.1-2.9). The IDUs who reported sharing needle/syringes in the last month reported having two or more partners in the last 12 months (51% vs. 44%, AOR = 1.6, 95% CI = 1.2-2.2) and overall inconsistent condom use (93% vs. 80%, AOR = 3.0, 95% CI = 1.8-5.1) as compared to those who did not share in the last month. Although a higher proportion of IDUs who accessed services reported having two or more partners in the last 12 months as compared to those who did not access services (51% vs. 32%, AOR = 2.7, 95% CI = 1.7-4.2), a smaller proportion reported inconsistent condom use (82% vs. 95%, AOR = 0.4, 95% CI = 0.2-0.9).

Discussion

The results indicate that a significant proportion of injecting drug users in both the states of Manipur and Nagaland engage in high risk sexual behaviors. Further, IDUs who share needles were more likely to have multiple sexual partners. However, state level differences in the association between injecting and sexual risk behaviors were also evident, and the observed differences could be, at least in part, due to the different types of drugs used in each of the states. In Manipur, heroin users were less likely to have two or more partners in the last 12 months as compared to non heroin users. Further, sex with a paid partner in the last 12 months was not associated with any injecting behavior of IDUs. This is consistent with literature that documents a negative association between the use of heroin and sexual risk behavior [18] as heroin use tends to suppress sexual desire [23,30]. In Nagaland, Spasmoproxyvon was used more widely and our results demonstrate that riskier injecting behavior was associated with riskier sexual behavior in this state. Although regular injectors in Nagaland were more likely to have two or more partners in the last 12 months and have sex with paid partners, those who accessed NGO services were significantly less likely to be inconsistent condom users. Hence NGO services have been effective in increasing condom use among those IDUs who actually access them, as documented by a previous study conducted in these two states [24]. These findings persisted even after adjusting for socio-demographic characteristics known to be strong confounders of both injecting and sexual behaviors. Our finding that IDUs practicing high risk injecting behaviors are more likely to practice high risk sexual behaviors is

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Table 2 Associations between pattern and type of injecting drug use, exposure to program and sexual risk behaviors among injecting drug users in Northeastern India

Characteristics	2+ partner in last 12 months		Sex with paid partner in last 12 months		Inconsistent condom with any female partner	
	%	AOR[1] (95% CI)	%	AOR[1] (95% CI)	%	AOR[1] (95% CI)
Manipur (N = 836)						
Frequency of drug use						
Occasional	26.1 (226)	Referent	6.6 (226)	Referent	85.5 (173)	Referent
Regular	27.7 (610)	0.9 (0.6-1.4)	6.4 (610)	0.8 (0.4-1.6)	86.5 (443)	1.2 (0.7-2.1)
Heroin user						
No	41.7 (180)	Referent	3.3 (180)	Referent	84.5 (142)	Referent
Yes	23.3 (656)	**0.6 (0.4-0.9)**	7.3 (656)	2.2 (0.9-5.6)	86.7 (474)	1.0 (0.5-1.8)
Duration since injecting drugs						
< 3 years	31.2 (317)	Referent	8.5 (317)	Referent	81.0 (221)	Referent
3+ years	24.9 (519)	1.1 (0.8-1.6)	5.2 (519)	0.6 (0.3-1.0)	89.1 (395)	1.4 (0.9-2.4)
Shared needle/syringe in last one month						
No	25.7 (773)	Referent	6.3 (773)	Referent	85.7 (561)	Referent
Yes	46.0 (63)	**2.2 (1.2-4.0)**	7.9 (63)	1.7 (0.6-4.6)	90.9 (55)	1.8 (0.7-4.9)
Accessed NGO services in last 6 month						
No	20.0 (85)	Referent	3.5 (85)	Referent	92.8 (69)	Referent
Yes	28.1 (751)	1.5 (0.7-3.1)	6.8 (751)	1.2 (0.2-5.4)	85.4 (547)	1.0 (0.3-3.7)
Nagaland (N = 876)						
Frequency of drug use						
Occasional	42.4 (717)	Referent	3.2 (717)	Referent	85.8 (633)	Referent
Regular	67.3 (159)	**2.7 (1.8-4.1)**	13.2 (159)	**6.0 (3.0-12.1)**	81.9 (155)	0.8 (0.5-1.3)
Spasmoproxyvon user						
No	45.6 (114)	Referent	5.5 (762)	Referent	84.9 (680)	Referent
Yes	47.1 (762)	0.9 (0.6-1.4)	1.8 (114)	3.4 (0.8-14.8)	86.1 (108)	1.3 (0.7-2.5)
Duration since injecting drugs						
< 3 years	46.5 (404)	Referent	5.2 (404)	Referent	77.4 (337)	Referent
3+ years	47.3 (471)	1.4 (0.9-1.9)	4.9 (471)	1.2 (0.6-2.4)	90.7 (450)	**1.7 (1.1-2.9)**
Shared needle/syringe in last one month						
No	44.2 (543)	Referent	5.0 (543)	Referent	80.1 (477)	Referent
Yes	51.4 (333)	**1.6 (1.2-2.2)**	5.1 (333)	0.9 (0.5-1.7)	92.6 (311)	**3.0 (1.8-5.1)**
Accessed NGO services in last 6 months						
No	31.5 (219)	Referent	5.0 (219)	Referent	95.3 (193)	Referent
Yes	52.1 (657)	**2.7 (1.7-4.2)**	5.0 (657)	1.0 (0.2-2.5)	81.7 (595)	**0.4 (0.2-0.9)**

95% CI- 95% Confidence Interval.
AOR-Adjusted Odds Ratio.
[1]Adjusted for age, literacy, marital status, employment status and received needle/syringe from an NSEP.

consistent with findings from previous studies conducted in the USA and South Africa [19-21,23].

The present study findings should be considered in light of the following limitation. As the data for each district was collected independently and an unweighted analysis conducted at the state level by combining districts, we could not use RDSAT for our regression analysis. Further, since there is no consensus among statisticians as to whether data gathered through RDS can be appropriately weighted for multivariate analysis, it is important to interpret these regression findings with some caution [31].

Despite this limitation, the findings highlight the double jeopardy faced by high risk IDUs who engage in both risky injecting and risky sexual practices, amplifying not only their own risks of HIV infection but also the likelihood of HIV transmission to their injecting and sexual partners. This underscores the importance of interventions that focus on safer sexual practices, especially among high risk IDUs, in the ongoing HIV prevention programs in Northeast India.

This is especially the case in Nagaland where the link between unsafe injecting and unsafe sex was strongest.

The importance of preventing sexual transmission of HIV in Nagaland is being increasingly recognized. In 2008, the HIV prevalence among IDUs in Nagaland was only 3.2% (compared with 9.2% among IDUs nationally), while among FSWs it was 14.1% (compared with 4.9% among FSWs nationally) [32]. Based on prevention of parent to child transmission (PPTCT) testing data, Nagaland has the highest HIV prevalence among pregnant women in the country (0.89% compared with 0.19% nationally) [32]. These data point towards a shift away from an HIV epidemic driven by unsafe injecting, to one driven by unsafe sexual behaviors. The overlap between unsafe injecting and unsafe sexual behaviors among a high-risk sub-set of IDUs, as identified in this study, has the potential to amplify HIV transmission in this state.

Typically, programs targeted towards IDUs focus primarily on distribution of needles and syringes; however, as documented in previous literature [33], it is essential that these efforts are strongly complemented with sexual risk reduction programs. Also, given that condom use is more consistent among IDUs who access NGO services, extending the coverage of the targeted HIV prevention interventions so they reach a greater proportion of IDUs is recommended.

Abbreviations

AIHI: Australian international health institute; AOR: Adjusted odds ratio; BTS: Behavioral tracking survey; CI: Confidence interval; EHA: Emmanuel hospital association; HIV: Human immunodeficiency virus; IDU: Injecting drug user; NACO: National AIDS Control Organization; NGO: Nongovernmental organization; NSEP: Needle and syringe exchange program; ORCHID: Organized response for comprehensive HIV interventions in selected high-prevalence districts of Manipur and Nagaland; PPTCT: Prevention of parent to child transmission; RDS: Respondent driven sampling; USA: United States of America.

Competing interests

The authors declare that they have no competing interests.

Authors' contribution

KS was responsible for conceptualization and writing of the paper; CH led research implementation and assisted in interpretation of study findings; NS assisted in conceptualization and interpretation of study findings; SS conducted literature review and assisted in drafting of manuscript; BM performed the statistical analysis and assisted in writing of manuscript; MC provided overall guidance. All authors have read and approved this version of the manuscript.

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Male Out-Migration: A Factor for the Spread of HIV Infection among Married Men and Women in Rural India

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Abstract

Introduction: Thus far, the reasons for increasing HIV prevalence in northern and eastern Indian states are unknown. We investigated the role of male out-migration in the spread of human immunodeficiency virus (HIV) infection through a case-control study in rural India.

Methods: Currently married men and women were recruited from HIV testing and treatment centers across seven selected districts with high rates of male out-migration in eastern and northern India in 2010 using a case-control study design. Case subjects (men: 595, women: 609) were people who tested HIV seropositive and control subjects (men: 611, women: 600) were those tested HIV seronegative. For each gender, we obtained adjusted odds ratios (AORs) and population attributable risks (PARs) for migration, and behavioral factors.

Results: For men, the prevalence of HIV was significantly higher among those with a migration history (AOR, 4·4); for women, the prevalence of HIV was higher among those with migrant husbands (AOR, 2·3). For both genders, the returned male migration (men: AOR, 3·7; women: AOR, 2·8) was significantly associated with higher prevalence of HIV infection. The PAR associated with male migration was higher for men (54·5%–68·6%) than for women (32·7%–56·9%) across the study areas.

Discussion: Male out-migration is the most important risk factor influencing the spread of HIV infection in rural areas with high out-migration rates, thereby emphasizing the need for interventions, particularly, for returned migrants and spouses of those migrants.

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Introduction

Migration plays a significant role in the spread of HIV/AIDS [1,2]. Migration and mobility can increase vulnerability to HIV infection [3,4,5,6] for mobile people [1,7,8,9] and their partners residing at their hometown [10,11]. The relationship between population migration and the spread of HIV in selected countries outside Asia is well documented [1,4,12]. For example, a study in Uganda found that individuals who had migrated in three years prior to survey were three times more likely to be infected with HIV than those who had not migrated during the past ten years prior to the survey [1]. Although migrant men are believed to acquire HIV infection in destination areas and transmit the virus to their sexual partners upon returning to their hometowns [13,14], no epidemiological study has examined the relationship between spousal out-migration and the HIV serostatus of married women in rural India.

In India, barring a few micro-level studies conducted in urban destinations that have shown no differences in the sexual behaviors between migrants and non-migrants, [15,16] most studies have documented a positive and significant correlation between migration and increased sexual risk behaviors [10,17,18,19,20,21] and HIV [19]. A study of migrant and non-migrant youth in a district in rural Jharkhand, India indicates that migrants tend to have sexual relations with sex workers and casual female partners at their hometowns [20]. The likelihood of migrants engaging in sexual relations in their hometowns before their first migration and during regular home visits is higher than that of non-migrants [19,20]. Although studies indicate high sexual risk behaviors in migrants' hometowns in India [22], there are no specific interventions aimed at migrants or their sexual partners in these settings due to lack of appropriate epidemiological data on the role of out-migration in the transmission of HIV to sexual partners in these areas. Further, recent evidence from India suggests that 85% of newly diagnosed HIV infections are among currently married persons [23]. Therefore, the current study is designed to examine this issue by comparing HIV seropositive and seronegative individuals by male out-migration status using a case-control study design. This study aimed to investigate whether a higher proportion of migrant married men—returned or active migrants—are HIV infected than non-migrants married men, and whether a higher proportion of married women—with returned or

active migrant husbands—are identified with HIV infection than women with non-migrant husbands.

Methods

Study setting

The study was conducted in seven districts of India; three districts each in northern Bihar (Darbhanga, Muzaffarpur, and Sitamarhi) and eastern Uttar Pradesh (UP) (Azamgarh, Allahabad, and Deoria) and one district in Odisha (Ganjam). These seven districts are characterized by high male out-migration to other states because of lack of employment opportunities and urbanization (the rate of urbanization ranges from 6% in Sitamahri district to 25% in Allahabad district). Of a combined total population of 24.4 million in these seven districts, 5,11,286 people migrated to other states to seek employment by the year 2001 [24]. Of these, 4,83,027 were males who migrated to Delhi, Gujarat, Maharashtra, and West Bengal. The largest proportion of out-migrants from Ganjam migrated to Gujarat (mainly to Surat district) and Maharashtra (mainly to Mumbai/Thane districts), those from northern Bihar migrated to Delhi and West Bengal, and those from eastern UP migrated to Maharashtra. Coincidentally, HIV prevalence among female sex workers (FSWs) is high in metro cities that attract numerous rural male migrants from less developed states; HIV prevalence among female sex workers in Mumbai (Maharashtra), Surat (Gujarat), and Kolkata (West Bengal) are 37%, 8%, and 8%, respectively [25].

Results from a district level household survey conducted in 2007–08 suggest that these seven study districts are poorly developed as compared to national average: 20%–53% of households have electricity (all-India: 70%), 16%–27% have a toilet facility (all-India: 42%), and 66%–86% of households have low standard of living (all-India: 52%) [26]. In most districts, only a small percentage of women were aware that consistent condom use could reduce the risk of acquiring HIV/AIDS (21% in Ganjam to 45% in Allahabad), and a mere 1%–4% of the women had ever undergone HIV testing (all-India: 12%) [26]. Moreover, most households in these districts are socially disadvantaged; one-fourth of households belong to scheduled castes/tribes (a proxy for family's social status). The female illiteracy rate in these districts ranged between 36% to 67% (all-India: 35%) [27].

Research design

A case-control study was conducted in 2010 wherein the cases were currently married HIV seropositive persons who had tested seropositive in the six months prior to the survey and were utilizing services from integrated counseling and testing centers (ICTCs) and/or antiretroviral therapy (ART) centers. Controls were currently married HIV seronegative persons who had been tested for HIV in the six months prior to the survey and were recruited from the same location as the cases. Respondent recruited in this case-control study were matched for their recruitment location in order to minimize the differences in HIV risk behaviors between cases and controls.

The sample size necessary for estimating migration's role in the spread of HIV infection was assumed for obtaining a result within a given percentage point of the true value with a 95% confidence interval (CI). It was assumed that, at most, 75% of the HIV-infected population would be migrants and the desirable precision of the estimation would be 5%, yielding a sample size of at least 200 cases and controls [28]. To achieve the target sample size within three months of data collection, three, four, and seven ICTCs in Ganjam, northern Bihar, and eastern UP respectively, and one ART center in each of the study districts were selected.

Research assistants contacted individuals who came to collect their HIV test results and/or receive counseling at the ICTCs to enquire about their willingness to participate in a study on HIV and health. Similarly, individuals who visited the ART centers (diagnosed for HIV at the ICTCs selected in the study) either for treatment pre-registration or further clinical investigations were contacted for their willingness to participate in the study. Interested individuals were requested to visit the interview venues located within campus of ICTCs and ART centers, where a research assistant assessed their eligibility for their study. The individuals' HIV serostatus was recorded in the survey instrument from the medical report card that was available with each individual who agreed to participate in the interview. The HIV test result was based on rapid enzyme linked immunosorbent assay (ELISA), a test to detect the presence of HIV antibodies; and the testing center confirmed positivity after conducting a second and third ELISA test. Interviewers fluent in English and local language of the state conducted the interviews with eligible respondents who consented to participate in the study. All the researchers had at least five years of relevant experience and a Graduate/Masters degree in sociology, anthropology, or statistics. A 45-minute interviewer-administered survey assessing the demographics, migration history of the respondent and spouse, sexual and condom use behaviors, risk factors for HIV infection, and sexually transmitted disease-related symptoms was answered by respondents in the local language of the state. Questionnaires were based on prior literature documenting HIV risk factors, including sexual behavior and migration in India [29,30]. Instruments were developed in English, translated into local language of the state, and reviewed by investigators fluent in both languages. All interviews were conducted in private locations within the ICTCs and/or ART centers.

Overall, 1,300 women and 1,500 men from the seven districts were contacted. Of these, 1,250 women (HIV seropositive cases: 639; HIV seronegative controls: 611) and 1,230 men (HIV seropositive cases: 613; HIV seronegative controls: 617) met the study's eligibility criteria. Among those eligible, 41 women and 24 men refused to participate, or did not complete the interview and were thus excluded from the analyses, providing the final sample size of 1,209 women (HIV seropositive cases: 609; HIV seronegative controls: 600) and 1,206 men (HIV seropositive cases: 595; HIV seronegative controls: 611).

Procedures for this study were reviewed and approved by the institutional review boards of Population Council, and the ethics committee of the National AIDS Control Organization (NACO), Government of India. In accordance with the protocol, written informed consent was obtained from the participants prior to their participation.

Data quality control and questionnaire management involved immediate review by field staff after interviews to ensure accuracy and completion, same-day review by the field supervisor, and weekly transportation of survey forms to the data management team. To ensure consistency and accuracy, trained data entry officers entered and processed the survey data on a weekly and monthly basis respectively, through a customized data entry screen programmed using census and survey processing system (CSPro), a data entry software.

Measures

Demographic data were single-item measures including age (>30 years, 18–29 years), education (no formal education, formal education), occupation (unemployed/unskilled work, skilled work), referral source (self/NGOs/CBOs/friends/relatives, hospital/

Table 1. Socio-demographic and sexual characteristics of HIV seropositive and HIV seronegative men and women—East and North India, 2010.

	Married men			Married women		
	HIV seropositive Men (n = 595) Number (%)	HIV seronegative Men (n = 611) Number (%)	AOR*,[1] (95% CI)	HIV seropositive Women (n = 609) Number (%)	HIV seronegative Women (n = 600) Number (%)	AOR*,[1] (95% CI)
Age above 30 years	481 (80·8)	389 (63·7)	1·5 (1·1–2·1)	535 (87·9)	357 (59·5)	3·3 (2·3–4·6)
No formal education	199 (33·4)	147 (24·1)	1·2 (0·9–1·6)	341 (56·0)	239 (39·8)	1·5 (1·1–1·9)
Unemployed or unskilled occupation	519 (87·2)	481 (78·7)	2·0 (1·4–2·8)	596 (97·9)	589 (98·2)	0·9 (0·4–2·1)
Referral: self/friends/NGOs	222 (37·3)	226 (36·9)	1·0 (0·8–1·4)	290 (47·6)	166 (27·7)	2·9 (2·1–3·8)
Duration of marriage >10 years	368 (61·9)	236 (38·6)	1·9 (1·4–2·6)	352 (57·8)	193 (32·2)	1·6 (1·2–2·1)
Reported >=1 casual partners, lifetime	333 (55·9)	145 (23·7)	4·0 (3·1–5·2)	72 (11·8)	67 (11·2)	1·2 (0·8–1·8)
Reported sex with partner in exchange for money/gifts, lifetime	245 (41·2)	86 (14·1)	4·3 (3·2–58)	14 (2·3)	25 (4·2)	0·6 (0·3–1·1)

*AOR: adjusted odds ratio; model controlled for age, education, occupation, duration of marriage, type of referral, study district, and reported sex with partner in exchange of money/gifts at least once in their lifetime.
[1]Dependent variable: HIV seropositive (yes/no).
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health clinic), and residence (Ganjam, northern Bihar, or eastern UP).

Male and female out-migration status was assessed based on whether the respondents and/or their spouses had ever migrated for work. Further, respondents with a history of migration were asked whether they and/or their spouses were currently working in another state. Using these questions, two variables were constructed: Male/female out-migration, ever (yes, no) and Male/female out-migration status, current (never/returned/active migrant). As female out-migration was reportedly negligible, our analyses focused on two key independent variables: male out-migration ever and current status of male out-migration. For female respondents, spouse's out-migration was considered for analyses.

Men's sexual risk behaviors were assessed for the following types of sex partners: paid partners, unpaid casual partners, and male partners in case of the male survey. Respondents were asked to share their sexual experiences in destination and hometown areas, and were asked about their condom use behavior across sexual encounters. Coding details for these variables are provided as footnotes under each table.

The key outcome variable of interest in this study was the HIV serostatus of each respondent. Respondents were coded 1 and 0 if they were HIV seropositive and HIV seronegative, respectively.

Statistical Analyses

Univariate and stratified multivariate analyses were conducted. A series of logistic regression models were constructed for married men and women samples to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for associations between male out-migration and HIV outcome. Adjusted population attributable risks (PAR) were also calculated for these variables using a procedure *aflogit* in STATA (version 10.0). Separate logistic regression models were used to estimate the ORs and 95% CIs for association between sexual risk behaviors and HIV outcomes within sub-samples where male out-migration status was non-migrant/returned migrant/active migrant. For these, a series of crude models and those adjusting for major demographics (age, education, occupation, residence, and referral source) were created.

Results

Socio-demographic characteristics of married men and women

A higher proportion of HIV seropositive married men than HIV seronegative married men had no formal education (33% vs. 24%, $p<0·01$), were unemployed or employed in unskilled occupations (87% vs. 79%, $p<0·01$), aged over 30 years (81% vs. 64%, $p<0·01$), and married for over 10 years (62% vs. 39%, $p<0·01$) (Table 1). Similarly, a higher proportion of HIV seropositive married women than HIV seronegative married women had no formal education (56% vs. 40%, $p<0·01$), were aged over 30 years (88% vs. 59%, $p<0·01$), and married for over 10 years (58% vs. 32%, $p<0·01$).

Association between male out-migration and own HIV serostatus

Among men, 80% of HIV seropositive respondents versus only 44% of the HIV seronegative respondents had ever migrated (Table 2). The multiple logistic regression analyses adjusted for socio-demographic characteristics demonstrate a significant association between migration and men' HIV status. The odds of HIV seropositivity were four times higher among men with a migration history than those who had never migrated (adjusted odds ratio (AOR) = 4·4, 95% CI = 3·3–5·9, $p<0·01$). The proportion of HIV-infection among married men in the study area that could be attributed to male out-migration history was estimated at 62% (95% CI = 54·5–68·6), of which, active migrant men's contribution was higher than that of returned migrant men.

Association between spousal out-migration and women's HIV serostatus

Data from women survey revealed higher odds of HIV seropositivity among those whose husbands had a history of migration than those whose husbands had never migrated (82% vs. 65%, AOR = 2·3, 95% CI = 1·7–3·0, $p<0·01$) (Table 2). Compared to women whose husband had never migrated, the odds of HIV seropositivity were approximately three times higher for women whose husband was returned migrant (29% vs. 18%, AOR = 2·8, 95% CI = 1·9–4.3, $p<0·01$) and two times higher for

Table 2. Male out-migration and HIV in East and North India, 2010.

	Married Men				Married Women			
	HIV seropositive Men (n = 595) Number (%)	HIV seronegative Men (n = 611) Number (%)	AOR* (95% CI)	PAR† (95% CI)	HIV seropositive Women (n = 609) Number (%)	HIV seronegative Women (n = 600) Number (%)	AOR* (95% CI)	PAR† (95% CI)
Male out-migration history, ever	478 (80·3)	271 (44·4)	4·4 (3·3–5·9)	62·2 (54·5–68·6)	501 (82·3)	388 (64.7)	2·3 (1·7–3·0)	46·1 (32·7–56·9)
Male out-migration status, current#								
Non-migrants	117 (19·7)	340 (55·6)	Referent	—	108 (17·7)	212 (35.3)	Referent	—
Returned migrants	139 (23·4)	75 (12·3)	3·7(2·3–5·8)	17·0 (12·3–21·4)	180 (29·6)	111 (18.5)	2·8 (1·9–4·3)	23·6 (17·4–28·7)
Active migrants	339 (56·9)	196 (32·1)	4·8 (3·5–6·7)	45·1 (39·0–50·6)	321 (52·7)	277 (46.2)	2·1 (1·5–2·9)	22·5 (15·3–28·1)
Female out-migration for work, ever	9 (1·5)	12 (2·0)	0·6 (0·2–1·5)	NE	9 (1·5)	6 (1.0)	1·5 (0·5–4·5)	0·5 (0·0–2·9)

*AOR: adjusted odds ratio; model controlled for age, education, occupation, duration of marriage, type of referral, study district, and reported sex with partner in exchange of money/gifts, lifetime.
†PAR: Population-attributable risk; CI: Confidence interval; NE: Not estimable.
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females whose husband was active migrant (53% vs. 46%, AOR = 2·1, 95% CI = 1·5–2·9, p<0·01). Among married women, the proportion of HIV infection in the study areas that could be attributed to husband's out-migration history was estimated at 46% (95% CI = 32·7–56·9), of which, the contribution returned migrant men was similar to that of active migrant men.

Male out-migration, sexual risk behaviors, and their association with married men's HIV serostatus

An analysis of sex risk behaviors by male out-migration status was conducted based on the survey data for married men (Table 3). Among active migrants, the multivariate models demonstrate that the odds of HIV seropositivity were higher if they reported having sex with a partner in exchange for money/gifts at least once in their lifetime (45% vs. 19%; AOR = 3·6, 95% CI = 2·3–5·7), having sex in migrant destinations (40% vs. 18%; AOR = 3·8, 95% CI = 2·3–6·2), or inconsistent condom use in sexual encounters along migration routes (94% vs. 74%; AOR = 5·4, 95% CI = 2·1–13·9) compared to their counterparts in these categories. Similar results were noted among returned migrant men. Returned migrant men who reported having sex with male partners (30% vs. 4%; AOR = 7·8, 95% CI = 1·9–33·3) or having extramarital sex in their hometown (32% vs. 4%; AOR = 6·3, 95% CI = 1·6–23·9) had higher odds of HIV infection than their counterparts. The odds of HIV seropositivity among non-migrants were higher if they reported having sex with at least one casual partner in their lifetime (32% vs. 20%, AOR = 2·0, 95% CI = 1·2–3·3), having sex with a partner in exchange for money/gifts at least once in their life time (21% vs. 11%, AOR = 2·1, 95% CI = 1·2–3·7), and/or having sex with a male partner (12% vs. 4%, AOR = 3·6, 95% CI = 1·6–8·2).

Discussion

The increasing prevalence of HIV in districts with high male out-migration in India [31] has raised important questions regarding the role of migration in the spread of HIV. This study indicates that the proportion of migrant men among HIV seropositive individuals is higher than that among HIV seronegative individuals in rural India, suggesting a concentration of HIV among individuals with migration history. These findings are consistent with the findings of previous studies conducted among African and Asian populations [10,32,33].

For men, sexual risk behaviors are strongly associated with HIV seropositivity. The relationship between sexual risk behaviors and HIV seropositivity are much stronger among the group of migrant men than non-migrant men. The high odds of HIV seropositivity among active migrants reporting extramarital sex in destination areas suggest that they may have been infected with HIV in those areas. Additionally, a higher proportion of returned migrants reporting extramarital sexual relationships in hometowns suggest that they may be contributing significantly to the spread of HIV in their hometowns; these findings are consistent with the some of the study results from Nepal [33] and India [22]. The lesser odds of being HIV seropositive among non-migrant than migrant men reporting extramarital sexual relationships indicates the high concentration of the epidemic among migrant families and lower HIV prevalence among men from non-migrant families. These are important findings given the widespread prevalence of the HIV epidemic in western Indian states among various high risk population groups (such as female sex workers, men who have sex with men), which attract numerous migrants from other parts of the country. It is likely that migration plays an important role in

Table 3. Sexual/behavioral characteristics of HIV seropositive and HIV seronegative men by male out-migration status—East and North India, 2010.

	HIV seropositive Men (n = 595) Number (%)	HIV seronegative Men (n = 611) Number (%)	AOR* (95% CI)	PAR† (95% CI)
Male: Active Migrant (n = 535)	339	196		
Reported > = 1 casual partners, lifetime	203 (59·9)	62 (31·6)	3·0 (2·0–4·5)	40·1 (29·2–49·3)
Reported sex with partner with in exchange for money/gifts, lifetime	151 (44·5)	37 (18·9)	3·6 (2·3–5·7)	32·3 (24·1–39·6)
Reported sex with a male partner	34 (10·0)	10 (5·1)	1·8 (0·8–4·0)	4·6 (0·0–9·7)
Reported extramarital sex in city (destination)	137 (40·4)	35 (17·9)	3·8 (2·3–6·2)	29·7 (22·1–36·6)
Reported extramarital sex in native place either during migration or current visit (origin)	15 (4·4)	6 (3·0)	1·1 (0·4–3·2)	0·5 (0·0–5·0)
Inconsistent condom use in sexual encounters (N = 219)	153 (94·4)	42 (73·7)	5·4 (2·1–13·9)	76·9 (47·9–89·7)
Male: Returned Migrant (n = 214)	139	75		
Reported > = 1 casual partners, lifetime	93 (66·9)	14 (18·7)	5·4 (2·5–11·7)	54·5 (39·6–65·8)
Reported partner with exchange of money/gifts, lifetime	70 (50·4)	11 (14·7)	3·4 (1·5–7·8)	35·5 (18·3–49·0)
Reported sex with a male partner	42 (30·2)	3 (4·0)	7·8 (1·9–33·3)	26·4 (17·4–34·4)
Reported extramarital sex in city (destination)	93 (66·9)	15 (20·0)	7·4 (3·4–16·2)	57·9 (45·7–67·3)
Reported extramarital sex in native place either during migration or current visit (origin)	45 (32·4)	3 (4·0)	6·3 (1·6–23·9)	27·2 (16·9–36·3)
Inconsistent condom use along the migration route (N = 123)	91 (96·8)	23 (79·3)	7·0 (1·3–37·8)	82·9 (23·7–96·2)
Male: Non-migrant (n = 457)	117	340		
Reported > = 1 casual partners, lifetime	37 (31·6)	69 (20·3)	2·0 (1·2–3·3)	15·9 (3·5–26·6)
Reported sex with partner in exchange for money/gifts, lifetime	24 (20·5)	38 (11·2)	2·1 (1·2–3·7)	10·7 (1·0–19·4)
Reported sex with partner in exchange for money/gifts, 12 months	15 (12·8)	31 (9·1)	1·5 (0·7–2·9)	4·1 (0·0–11·7)
Reported sex with a male partner	14 (11·9)	14 (4·1)	3·6 (1·6–8·2)	8·7 (1·8–15·0)
Not used condom with male/female partner, last time (N = 116)	39 (90·7)	60 (82·2)	3·5 (0·9–12·9)	64·5 (0·0–88·3)

*AOR: adjusted odds ratio; model controlled for age, education, occupation, duration of marriage, type of referral, and study district.
†PAR: Population-attributable risk; CI: Confidence interval.
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the spread of HIV from high HIV prevalence states of India to migrants' hometowns.

Although the overall HIV seropositivity rates are lower among women than men, the results indicate the occurrence of HIV infection among married women from their HIV seropositive husbands in rural areas. Further, the results suggest that being a partner of either returned or active migrant presents significant level of risk than being a partner of non-migrant men. In addition to HIV risk from migrant husbands, one could argue that women may also be migrating for work and the environments around such migration may be putting them at risk too. The data in the current study indicates that less than 2% of the women reported a history of migration for work from these areas, making it difficult to examine the association between women's migration and HIV infection. Nevertheless, the weak association between female migration and HIV seropositive status raises important research questions regarding the extent to which HIV risk among women could be attributed to: their own extramarital sexual behaviors, lack of knowledge about modes of HIV transmission and prevention, and lack of condom use in marital sex. Further in-depth studies are needed to examine these issues.

One of the strength of this study is that almost all HIV seropositive married men and women (cases) were recruited from HIV testing and treatment centers in high out-migration areas and controls were randomly selected from the same centers; therefore, the findings should accurately reflect migration's role in the spread of HIV infection. More importantly, both cases and controls were newly diagnosed HIV seropositive and HIV seronegative individuals, indicating some causal relationship between history of migration and HIV. The non-response rates among cases and

controls were low, thereby reducing the likelihood of selection bias in the explanation of our key findings.

An unavoidable study limitation is that the relationship between active migrant men and HIV status may not be indicative of an actual relationship, as it included only a selective sample of men who were present in the hometown (study location) at the time of study. While under-representation of active migrant men should not compromise the internal validity of the study; rather it may have resulted in an underestimation of the population's risk of being infected with HIV that could be attributed to migrant men's behavior. Another limitation is related to study focus being assessing the role of male out-migration in the spread of HIV among women; other determinants of HIV transmission among women at the population level, such as their own extramarital sexual behavior, have not been captured. Further, most individuals who were tested for HIV at ICTCs are volunteers or referred by NGOs/friends whose levels of HIV risk behaviors may differ from those in the general population. Although this may limit the generalization of the study findings, one can argue that if individuals are recruited from general population using a case-control study design matched for HIV seropositive and HIV seonegative, the ratio of migrants to non-migrants among HIV seropositive and seronegative individuals may remain same as observed in this study. Although future population based research could address some of these limitations, this large-scale case-control study offers, for the first time, empirical evidence on the role of male out-migration in the spread of HIV in districts with high male out-migration.

Overall, this study shows that migrant men and their partners are at higher risk of HIV infection than their non-migrant counterparts, thereby confirming the concentration of the epidemic among migrants and their partners in destination and hometown areas and underscoring the importance of designing HIV prevention programs for these groups in both settings. The high volume of returned migrants and persistently high HIV prevalence among migrants and their spouses in their hometown reflect the urgent need to provide HIV prevention and treatment services in these areas. However, targeting only migrants and their spouses in rural areas can increase stigma and discrimination; therefore, integrating HIV prevention and treatment services with existing structural resources within rural settings, such as public health centers, village administrative (*panchayat*) offices, and HIV testing and treatment centers may be more effective. Appropriate operations research is required to test the feasibility and effectiveness of such structural interventions in India and elsewhere.

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Author Contributions

Conceived and designed the experiments: NS. Performed the experiments: NS BM. Analyzed the data: BM SS. Contributed reagents/materials/analysis tools: BM SS SG. Wrote the paper: NS SG. Provided overall guidance: AJ.

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HIV risk behaviours among contracted and non-contracted male migrant workers in India: potential role of labour contractors and contractual systems in HIV prevention

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Objective(s): To assess the HIV risk behaviours of male migrant contracted and non-contracted labourers in India and to understand the role of contract labour systems for use in HIV prevention efforts.

Methods: Cross-sectional surveys ($N = 11\,219$) were conducted with male migrant workers, aged 18–49 years from 21 districts in four high HIV prevalence states of India. Analyses involved data from the subsample of contracted labour ($n = 3880$; 35% of total sample) to assess the prevalence of HIV risk behaviours and sexually transmitted infection (STI) symptoms and further comparisons with non-contracted labourers.

Results: Contracted male labourers are largely young; 70% were between the ages of 18 and 29 years. Over half (55%) were married, and a third (34%) resided away from their wives because of migrant work. More than one in six contract labourers (17%) reported having sex with a sex worker, and two-fifths of these reported an inconsistent use of condoms. One in 10 reported sex with both sex workers and non-spousal unpaid female partners in the past year in the places they had migrated to, and 31% reported sex with either a sex worker or non-spousal unpaid female partner in their places of origin over the past 2 years. After adjustment for sociodemographic characteristics, the contracted labourers were significantly more likely to report alcohol use and HIV risk behaviours than non-contracted labourers.

Conclusion: The existence of a wide network of labour contractors and a structured infrastructure of the contract system provides opportunities for effective and sustained worksite HIV prevention programmes among contracted male migrant workers in India.

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Introduction

Globally, the epidemiology of HIV/AIDS is closely linked to the process of migration [1]. Research from Africa and Asia has demonstrated a link between migration and multipartner sexual networking as well as the prevalence of sexually transmitted infection (STI)/HIV infection [2–11]. Within these world regions, high

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rates of HIV among migrant men largely occur by sexual contact with HIV-infected women, often sex workers, while away from home; infected men then transmit the virus to wives and other sex partners en route and in their places of origin [12,13]. Consistent with this pattern, a number of studies have suggested that migrants and other mobile individuals are bridge populations who spread HIV infection from high to low-risk populations and regions and from urban to rural areas [14–17].

In India, an estimated 258 million adults are migrants, with a great majority being men migrating for employment [18]. The primary destination states for migrants within India are: Maharashtra, Andhra Pradesh, and Karnataka, which are also states with high HIV prevalence [19]. International migration, primarily from other parts of south Asia to India, is also on the increase, with Maharashtra being a major destination [20,21]. Recent research on Nepali migrants to India, a major international migrant population within the country [21], documents a high prevalence of HIV and syphilis among male returnees to Nepal; these infections are presumed to occur via male migrant contact with infected sex workers in India [22].

Within India, there has been little examination of male migrant workers' sexual behaviours and how these may facilitate risks of acquiring and transmitting HIV/STI in the country. The existing literature does suggest that premarital and extramarital sexual relationships are common among migrant men. A study conducted in 30 villages in the northern parts of Karnataka state revealed that 40% of single men and 35% of married migrant men had non-marital sexual relationships [23]. Evidence also suggests that migrant men living predominantly in male settings and groups [11] and those who drink alcohol are substantially more likely to engage in risky sexual behaviours such as unprotected sex [24]. Other contributing factors to HIV vulnerability include low knowledge of HIV transmission and prevention [25], availability of cheap sex, singlehood, low perceived vulnerability to HIV/STI [11], and existing cultures of risky sexual behaviours, for example among long-distance truckers [26,27].

Recent research indicates that male migrant workers in India are increasingly employed within contract labour systems; there are currently millions of migrant men who are contract labourers in the country [28]. A contract labourer, as per the 1970 Contract Labour Regulation and Abolition Act, India, is defined as one who is hired in connection with the work of an establishment by a principal employer through a contractor. Although a contractor recruits and oversees contract labourers for a business establishment (e.g. market or construction industry), the principal employer is the person responsible for the control of the establishment. Contract labour jobs provide a minimum wage, certain health and sanitation facilities in the work premise, provident fund benefits and other social and welfare benefits [29].

The contract labour system in India is hierarchical in structure, connecting individual agents based in smaller towns with the recruiting agencies and establishments/industries at state and national levels. Multinational and national industries or agencies operate at the national level with licensed contractors, who in turn have subcontractors at the state or district levels, and each of these subcontractors have several agents, recruiters or middlemen at the subdistrict level. Middlemen or agents are largely the recruiters and overseers for contracted labour. Anecdotal evidence suggests that a high proportion of migrant men work under the contract system. Despite evidence of disproportionate HIV risk among migrant male workers and increasing numbers of migrant male workers employed as contract labourers, there are very few empirical data on contracted migrant male workers in India, including their HIV risk behaviours and how the structures in which they work and live can be used to address these risks.

The objective of this paper is to examine if contract systems are a potential mechanism to reach higher risk male migrants in India, and to engage these systems for HIV prevention strategies tailored to male migrants. This paper describes the structure of the contract system, the extent to which migrant men work under a contract system, and contracted male labourers' sexual behaviours and risk of acquiring HIV. In addition, analyses examine the mobility of contract labourers and whether contracted labourers differ from non-contracted labour in terms of sociodemographic characteristics and HIV risks.

Methods

The study design involved a survey with migrant male workers to assess migration, labour systems/structures and associated HIV risks in India. All participants were recruited from 21 districts across four states in southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India, identified as high epidemic states by the Indian National AIDS Control Organisation (see Fig. 1). The districts with the highest rates of in-migration in each state, as per the 2001 Indian census [19,30], were chosen for inclusion into the study ($N = 21$; five districts each in the states of Andhra Pradesh, Karnataka and Maharashtra; six districts in Tamil Nadu).

Study participants were recruited through a two-stage systematic sampling procedure conducted in selected migrant worker residential colonies (either organized labour colonies or illegally occupied land with small houses without a proper roof) and worksites. Geographical maps drawn for each district were used to list all

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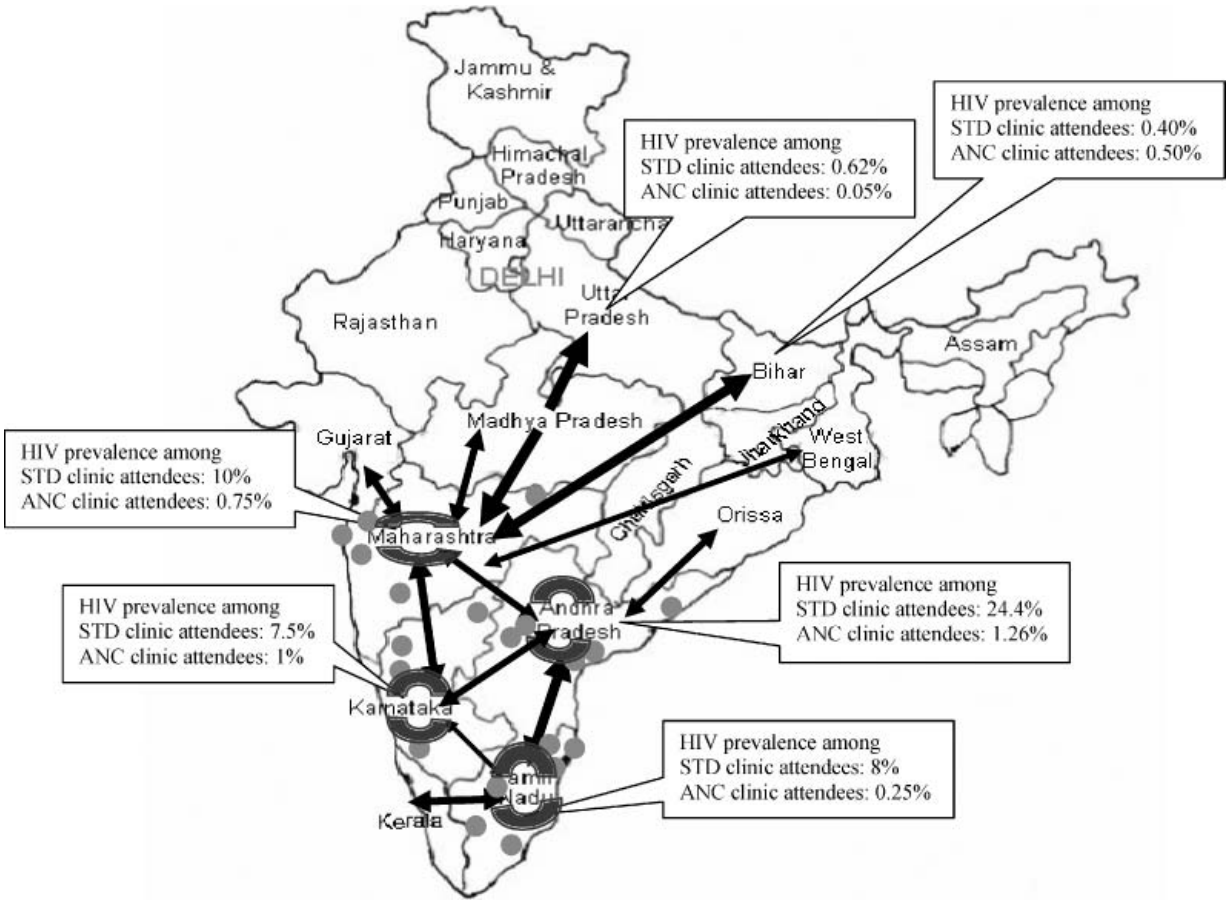

Fig. 1. Map showing the approximate geographical locations of study sites within each study state in India and the major routes of interstate connectivity in India with which they are linked through male workers mobility. ● Approximate location of study sites. ↔ Indicates the direction of interstate male workers mobility. The thickness of line indicates the volume of mobility and arrows indicate the direction of mobility. The results on mobility are presented from the analysis of Census data reports. ◘ Indicates the interdistrict mobility of male workers. The thickness of line indicates the volume of mobility. Data source for HIV prevalence data: NACO, 2008. HIV sentinel surveillance and HIV estimation. 2006. New Delhi: National AIDS Control Organisation (NACO).

migrant worker residential areas and worksites and to select cluster areas within these sites for recruitment. Clusters were created by combining smaller sites and dividing larger sites such that each cluster offered an area with approximately 5000 male migrant workers. Three clusters were then selected randomly from within each district, and migrant men within the chosen clusters were systematically sampled to obtain a minimum of 2500 participants per state. The sample size was determined using an estimated proportion of 15% of men having sex outside marriage, an assumed difference of 3% increase in the proportion with every unit increase in degree of mobility, a confidence level of 95% and power of 80%.

A total of 11 635 eligible male migrant workers satisfied the inclusion criteria: age 18 years or older, having migrated to at least two places in the past 2 years for work, and were selected for the cross-sectional survey. Of these, 145 (1.2%) men refused to be interviewed, and 271 (2.3%) men did not complete their interviews and were thus excluded from the analyses, providing our final sample size of 11 219.

Interviews were conducted by multilingual graduates or postgraduates in sociology, anthropology or statistics. Interviewers were trained and experienced in quantitative data collection techniques and field-based public health and HIV/AIDS research. Data were obtained through face-to-face interviews conducted in private locations close to the respondents' residence or workplace. Verbal consent was obtained from all respondents before being interviewed. Data quality and management involved immediate review by field staff after interviews to ensure accuracy and completion, same-day review by the field supervisor and weekly transport of surveys to the data management team. Trained data entry officers then entered the survey data weekly and processed it monthly to verify consistency and accuracy, using SPSS. Ethical

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approval for the study was obtained from the institutional review boards of the Population Council and the University of Manitoba, Canada.

Data collected included the sociodemographic characteristics of the migrants, including age, highest level of education completed, marital status, current residence with wife, income, and occupation (construction work, market place loading and unloading, daily wage work, industrial work, stone cutting, and fishing). Information was also collected on whether a labourer had worked within a contract system (either the first migratory move for the current work was under contract or because his current work was under contract).

Risky behaviour was measured by collecting information on men's sexual behaviour, frequency of condom use, and alcohol use with paid sex workers and unpaid, non-spousal sex partners in destination areas (past 12 months) and in their places of origin (past 24 months). These data were used to create variables such as alcohol use before non-marital sex, the number of sex worker partners, the number of non-spousal unpaid female sex partners, and the occurrence of sex with a sex worker or non-spousal unpaid female sex partner in place of origin. They were also used to create measures of consistent condom use. Consistent condom use is defined as the use of a condom every time that the respondent had sex. Consistent condom use with a range of partners, sex workers, non-spousal unpaid female sex partners, and in any non-marital sex encounter, was measured. An additional variable measured whether the participant had ever used condoms.

The survey also collected information on HIV risk perceptions and STI symptoms. Participant HIV risk perception was assessed by responses to a question on their perceived risk of getting HIV and if the risk was high, moderate and low. Participants were defined as having recent STI symptoms if they indicated any of the following in the past 12 months: genital ulcers; swelling in groin area; itching in genital area; or frequent painful urination. Alcohol use was assessed based on responses to alcohol consumed in the past 30 days and the type of alcohol (e.g. beer, whisky, country liquor).

Data analysis

Data analysis involved generating descriptive statistics on the prevalence of contracted labour and, for the subsample of contract labourers, sociodemographic and HIV risk profiles. Chi-square analyses were used to detect differences in HIV risk indicators by sociodemographics among contract labourers; the significance for all analyses was set at $P < 0.05$. Logistic regression models and models adjusted for sociodemographics (age, education, income, occupation and marital status) were also used to assess associations between contract systems and HIV risk indicators. Logistic regression results are presented for the key independent variable, being under contract, which is an easily identifiable characteristic of a migrant labourer and can be used for appropriate targeting of HIV prevention interventions. All statistical analyses were conducted using SPSS 11.0.

Results

Prevalence of contract labour and HIV risk among contract labourers

Sample characteristics

One-third of migrant male workers surveyed (35%, $n/N = 3880/11\,219$) were contracted labourers, and the proportion of men reporting contract labour varied by state: 47% in Andhra Pradesh; 42% in Tamil Nadu; 31% in Karnataka and 19% in Maharashtra (see Table 1). Among the contract labourers, 70% were under the age of 30 years. Over half (55%) were married; 34% resided away from their wife as a result of migrant work. Seventeen per cent (17%) were illiterate, having received no formal education; an additional 16% received only primary education. The median income of contract labourers was 3500 rupees (approximately US$90, at 1US$ = 39 rupees in the year 2008) per month, and were primarily occupied in the construction (29%), industrial (24%), daily wage (12%), and loading and unloading industries (7%).

Alcohol use and HIV risks among contract labourers

More than three-quarters of contract labourers (77%) reported drinking of any alcohol type in the past month, with 19% reporting the use of a variety of alcohol (i.e. beer, whisky, country liquor) in this same timeframe (see Table 1). Thirty-seven per cent of the contracted labourers reported that at the last sexual encounter with a non-marital sex partner they had imbibed alcoholic drinks before sex. More than one in six men (17%) reported sex with a sex worker in the past year; 12% reported sex with multiple sex workers in the past year. Almost one-quarter of men (24%) reported sex with a non-spousal, unpaid female partner in the past year; 9% reported sex with multiple non-spousal, unpaid female partners in the past year. The majority of contracted labourers (65%) had never used condoms with any partner. Among men reporting sex with a sex worker in the past year, however, 58% reporting consistent condom use. Among men reporting sex with a non-spousal unpaid female sex partner in the past year, only 19% of men reported consistent condom use. Almost two-thirds of men (64%) reported at least one of the four STI-associated symptoms in the 12 months before the survey. Despite such high sexual risk behaviours, only 3.2% of the contracted labour sample reported moderate or high HIV risk perceptions.

Associations between sociodemographic characteristics and HIV risks among contract labourers

The proportion of contracted labourers visiting sex workers was found to be high among men aged 20–34 years (19.0%)

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Table 1. Social economic and demographic profile of contract labourers in four high HIV prevalence states in India.

Demographic and economic characteristics	Andhra Pradesh ($N=1300$) %	Karnataka ($N=743$) %	Maharashtra ($N=569$) %	Tamil Nadu ($N=1268$) %	Total ($N=3880$) %
Sociodemographic characteristics					
Age group, years					
18–29	59.5	69.7	89.2	71.3	69.7
30+	40.5	30.3	10.8	28.7	30.3
Education (classes)					
Illiterate (0)	31.1	24.4	10.2	1.7	17.1
Primary school (1–4)	22.9	22.2	8.4	7.4	15.6
Secondary school (5–8)	36.6	35.9	54.8	51.5	44.0
High school+ (8+)	9.4	17.5	26.5	39.4	23.3
Current marital status					
Married and wife is at current place	50.3	41.9	17.6	21.0	34.3
Married but wife is away at place of origin	19.6	17.0	25.5	21.6	20.6
Not married	30.1	41.2	56.9	57.4	45.1
Occupation[a]					
Construction workers	20.5	21.1	51.5	30.6	28.5
Loading and unloading workers	19.7	0.1	0.2	–	6.6
Daily wage labourers	7.1	29.3	0.5	10.7	11.6
Industry workers	18.3	9.3	39.9	31.8	24.1
Stone cutters	10.2	1.9	0.2	5.8	5.7
Fishermen	15.9	0.9	–	1.6	6.0
Others	8.3	37.3	7.7	19.6	17.4
Monthly income, median (range)	3000 (500–50 000)	4000 (2000–45 000)	3000 (1500–7500)	4500 (1500–8000)	3500 (500–50 000)
Alcohol use					
Reported alcohol use in past one month	84.5	70.7	54.9	83.5	77.2
Reported taking all of the following types of alcohol in past one month: beer, country liquor and whisky	24.6	6.3	2.1	26.7	18.5
Reported consumption of alcohol before sex with sex worker or non-spousal, unpaid female partner in past one year[b]	39.6 [618]	22.2 [221]	31.0 [142]	47.4 [228]	36.9 [1209]
Sexual behaviours					
Had sex with at least one sex worker in past 12 months	30.3	7.8	17.2	8.6	17.0
Had sex with 2+ sex workers in past 12 months	19.6	6.3	14.9	5.8	11.9
Had sex with 3+ sex workers in last 12 months	10.4	4.0	10.4	3.2	6.8
Had sex with non-spousal, unpaid women during past 12 months	37.2	24.0	10.4	15.6	23.7
Had sex with 2+ non-spousal, unpaid female partners in past 12 months	14.3	5.9	2.5	7.4	8.7
Had sex with 3+ non-spousal, unpaid female partners	5.8	1.7	0.2	4.8	3.9
Had sex with both paid sex worker and unpaid female partners in past 12 months	19.9	2.0	2.6	6.2	9.5
Had sex with either sex worker or non-spousal, unpaid female partner in the place of origin in past 2 years	35.8	23.8	39.7	26.2	30.9
Condom use behaviour					
Reported of never using condom in life so far	50.4	77.8	60.6	73.4	64.7
Reported using condoms consistently in sex with all sex workers in past 12 months[c]	42.6 [394]	68.4 [58]	91.8 [98]	77.1 [109]	57.8 [659]
Reported using condoms consistently in sex with all non-spousal, unpaid female partners in past 12 months[d]	18.8 [483]	4.6 [178]	40.4 [59]	27.6 [198]	19.2 [918]
Reported using condoms consistently with all types of partners (sex workers, non-spousal, unpaid female partner) in past 12 months[b]	29.1 [618]	20.7 [221]	78.5 [142]	43.4 [228]	35.9 [1209]
STI-like symptoms and perceived vulnerability to HIV					
Reported having at least one STI-like symptoms in past 12 months	74.9	67.7	60.6	51.3	63.7
Perceived high/moderate risk for HIV	5.5	7.4	5.6	0.7	3.2

STI, Sexually transmitted infection.

[a]The construction workers are those labourers working for the construction of big building sites, bridges and roads. The loading and unloading workers are those who lift goods on their heads and are seen mostly in vegetable, fruit and grain market places. The daily wage labourers are the men available for all kinds of unorganized labour work, for example help in construction, help in road work, help in painting or repairs of buildings. The industrial workers in the study refers to those temporary workers who work in mining, factories, brick and sugar cane industries. The stone cutters are the men who work in quarries. Fishermen are those who work in deep sea fishing from port areas. Other workers involved those men working on small businesses in migrant workers sites, garment making, farm produce warehouse work, and also those engaged in unskilled jobs such as digging roads or cleaning sewage systems, etc.

[b]Among those who had sex with either sex workers or non-spousal, unpaid female partners.

[c]Among those who had sex with sex workers.

[d]Among those who had sex with non-spousal, unpaid female partners.

[] Figures in brackets indicate the total sample size for the corresponding variable.

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Table 2. HIV risk among contracted labour by sociodemographic and economic characteristics.

Characteristics	% Had sex with sex-workers in past 12 months	% Had sex with non-spousal, unpaid women	% Used condoms consistently[a]	% Reporting at least one STI symptom in past 6 months	Total
Age group, years	$P<0.001$	$P<0.001$	$P=0.549$	$P<0.001$	
≤19	6.0	12.0	20.0	60.7	117
20–24	16.2	18.9	38.0	62.1	1252
25–29	19.4	28.6	35.3	68.0	1333
30–34	18/0	26/1	33.6	62.0	677
35+	13.8	21.8	37.7	59.5	501
Education (classes)	$P=0.124$	$P=0.001$	$P<0.001$	$P=0.046$	
Illiterate (0)	14.6	25.5	24.9	66.9	664
Primary school (1–4)	19.0	29.1	27.0	66.4	605
Secondary school (5–8)	16.5	22.2	37.3	61.7	1708
High school+ (8+)	18.3	21.5	49.0	63.5	903
Current marital status	$P<0.001$	$P=0.013$	$P<0.001$	$P<0.001$	
Married and wife is at current place	13.2	25.9	24.1	68.8	1331
Married but wife is away at place of origin	22.0	24.6	46.4	61.0	800
Not married	17.6	21.5	39.5	61.1	1749
Occupation	$P<0.001$	$P<0.001$	$P<0.001$	$P<0.001$	
Construction workers	15.7	21.5	39.6	61.1	1104
Loading and unloading workers	16.3	31.4	20.6	77.1	258
Daily wage labourers	13.8	23.4	28.5	57.7	449
Industry workers	19.3	20.3	56.9	63.2	937
Stone cutters	23.1	29.9	19.0	57.5	221
Fishermen	32.1	35.0	24.5	85.0	234
Others	11.1	23.2	26.3	62.3	677
Monthly income	$P<0.001$	$P<0.001$	$P<0.001$	$P<0.001$	
≤2000	19.5	27.9	20.3	67.6	380
2001–3000	23.4	26.5	38.5	72.5	1128
3001+	13.5	21.6	37.4	58.9	2372

STI, Sexually transmitted infection.
[a]Only for those who had non-marital sex in the past 12 months ($n=1196$).
P values are from chi-squared test.

compared with those younger (<20 years of age: 6%) or older (35+ years of age: 14%); those who are single (18%) or married and reside away from their wife (22%) compared with those living with their wife (13%); those who are middle (23%) or lower (20%) income rather than upper (14%) income; those working as fishermen (32%) or stone cutters (23%) than men involved in any other occupation (see Table 2). Considerably higher proportions of men working as loading and unloading labourers (31%), fishermen (35%) and industrial labourers (30%) reported having sex with non-spousal unpaid female partners than men working in other occupations. Inconsistent condom use was more common among those who were married and residing with their wives (76%) rather than single (60%) or married and not residing with their wife (54%); lower (80%) rather than moderate (61%) or higher (63%) income; loading and unloading labourers (79%), stone cutting men (81%), fishermen (75%) than men in other occupations.

Differences in HIV risks between contracted and non-contracted male migrant labourers

Regression analyses adjusted for sociodemographic variables document that contracted migrant labourers were significantly more likely than non-contracted migrant labourers to drinking alcohol in the past 30 days [adjusted odds ratio (AOR) 1.5, 95% confidence interval (CI) 1.4–1.6], diverse alcohol use (AOR 1.5, 95% CI 1.4–1.7), sex with a sex worker (AOR 1.4, 95% CI 1.3–1.6), sex with multiple sex workers (AOR 1.3, 95% CI 1.2–1.5), sex with a non-spousal unpaid woman (AOR 1.8, 95% CI 1.6–2.0), sex with multiple non-spousal unpaid women (AOR 1.4, 95% CI 1.2–1.6), sex with a non-marital partner in place of origin (AOR 1.3, 95% CI 1.2–1.4), and STI symptoms (AOR 1.7, 95% CI 1.6–1.9) (see Table 3). Contracted labourers were significantly less likely than non-contract labourers to report never having used condoms (AOR 0.8, 95% CI 0.7–0.9), but were also less likely to report consistent condom use with sex workers (AOR 0.7, 95% CI 0.6–0.9) and moderate or high HIV risk perceptions (AOR 0.7, 95% CI 0.6–0.9).

Conclusion

In India the use of contract labour in employment is increasingly common, particularly in the industries of construction, industrial production, mining, fishing and market labour [26], which have traditionally employed migrants. Furthermore, migrant workers are a recognized HIV bridge population. Evidence in the present study

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Table 3. HIV vulnerability between men not under contract and those under contract ($N = 11\,219$).

	Not under contract (%)	Under contract (%)	OR[b] (95% CI)	AOR[a,b] (95% CI)
Reported alcohol use in past one month	67.4 [7339]	77.2 [3880]	1.6 (1.5–1.8)*	1.5 (1.4–1.6)*
Reported taking all of the following types of alcohol in past one month: beer, country liquor and whisky	12.6 [7339]	18.5 [3880]	1.6 (1.4–1.7)*	1.5 (1.4–1.7)*
Reported consumption of alcohol before sex in non-marital sex[e]	39.5 [1579]	36.9 [1209]	0.9 (0.8–1.0)	0.8 (0.7–0.9)*
Had sex with at least one sex worker in past 12 months	13.5 [7339]	17.0 [3880]	1.3 (1.2–1.5)*	1.4 (1.3–1.6)*
Had sex with 2+ sex workers in past 12 months	10.0 [7339]	11.9 [3880]	1.2 (1.1–1.4)*	1.3 (1.2–1.5)*
Had sex with 3+ sex workers in past 12 months	6.7 [7339]	6.8 [3880]	1.0 (0.9–1.2)	1.1 (0.9–1.3)
Had sex with at least one non-spousal, unpaid woman in past 12 months	14.6 [7339]	23.7 [3880]	1.8 (1.6–2.0)*	1.8 (1.6–2.0)*
Had sex with 2+ non-spousal, unpaid women in past 12 months	6.2 [7339]	8.7 [3880]	1.4 (1.2–1.7)*	1.4 (1.2–1.6)*
Had sex with 3+ non-spousal, unpaid women in past 12 months	3.0 [73390	3.9 [3880]	1.3 (1.1–1.6)*	1.3 (1.1–1.6)*
Had sex with both paid sex worker and unpaid non-spousal female partner in past 12 months	6.5 [7339]	9.5 [3880]	1.5 (1.3–1.7)*	1.4 (1.2–1.6)*
Had sex with either sex worker or non-spousal, unpaid female partner in the place of origin during past 2 years	25.1 [7339]	30.9 [3880]	1.3 (1.2–1.5)*	1.3 (1.2–1.4)*
Reported of never using condom in life so far	68.2 [7339]	64.7 [3880]	0.8 (0.7–0.9)*	0.8 (0.7–0.9)*
Reported using condoms consistently in sex with all sex workers in past 12 months[c]	65.8 [990]	57.8 [659]	0.7 (0.6–0.9)*	0.7 (0.6–0.9)*
Reported using condoms consistently in sex with all non-spousal, unpaid female partners in past 12 months[d]	20.7 [1071]	19.2 [918]	0.9 (0.7–1.1)	0.9 (0.7–1.1)
Reported using condoms consistently with all types of partners (sex workers, non-spousal unpaid female partner) in past 12 months[e]	45.2 [1579]	35.9 [1209]	0.7 (0.6–0.8)*	0.7 (0.6–0.8)*
Reported having at least one STI-like symptoms in past 12 months	48.9 [7339]	63.7 [3880]	1.8 (1.7–2.0)*	1.7 (1.6–1.9)*
Perceived high/moderate risk of HIV	4.6 [7339]	3.2 [3880]	0.8 (0.6–0.9)*	0.7 (0.6–0.9)*

AOR, Adjusted odds ratio; CI, confidence interval; OR, odds ratio; STI, sexually transmitted infection.
[a]Controlled for age, education, marital status, religion, occupation, and income of the respondent.
[b]The independent variable coding for the odds ratios presented are: men not under contract, 0; men under contract, 1.
[c]Among those who had sex with sex workers.
[d]Among those who had sex with non-spousal, unpaid female partners.
[e]Among those who had sex with either sex worker or non-spousal, unpaid female partners.
*$P < 0.05$.
[ ]Figures in brackets indicate the total sample size for the corresponding variable.

affirms these previous findings by documenting that more than one-third of male migrant workers are contracted labourers. In addition, findings document a hierarchical structure within these contract systems that support the social welfare and health of these workers and thus could be used to support HIV prevention efforts.

A notable proportion of mobile contracted labour in the study reported alcohol use in conjunction with risky sex, sex with multiple sex workers, sex with multiple non-spousal unpaid women, and sex with a non-marital partner in the place of origin. Despite multiple partnering, these men reported low condom use and HIV risk perceptions; corresponding to these risky sex behaviours, STI symptoms in the past 6 months were reported by the majority of these men. These findings are consistent with the results noted in other national and international settings regarding the behaviours of migrant male workers [2,11,14,24,31]. Although age and single-hood have effects on HIV risk behaviours irrespective of a labourer's contract status, they are not easily identifiable characteristics for targeted programme interventions. On the other hand, contract status is an easily identifiable characteristic and the contract system itself provides a potential mechanism for delivering health promotion interventions. There is no easy mechanism to group individuals by their demographic or social factors for designing or implementing preventive programmes.

Notably, the current findings further document that contracted labourers are significantly more likely to report alcohol use and HIV risk behaviours (e.g. sex with sex workers and other non-marital partners, unprotected sex) than non-contracted labourers. This may be attributable to contract labourers often living separate from their wives and migrating within male groups who may socialize through the consumption of country and cheap liquor, watching adult (pornographic) movies in theatres, and visiting beer bars or sex workers. More than two-thirds of contracted labour who had sex with a non-spousal unpaid female partner reported that the sexual partner was a workmate. This suggests that HIV prevention programmes are required for both male migrant workers and women at worksites.

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This analysis provides evidence and guidance to efforts by the Indian government for HIV intervention programmes for male migrant workers currently underway in the third National AIDS Control Programme [32]. The use of contract systems as structures to implement HIV prevention interventions among male migrant workers is a potentially feasible mechanism. This recommendation for using contract systems builds on the argument that individual behaviours associated with HIV risk may be difficult to regulate directly [33]. The challenge, however, is to have a macrosocial view of structures that adds to a workable response to the pandemic [34] in India.

The response for HIV prevention among migrant men in India can be greatly enhanced via delivery through mapped contractors and contract systems. For example, the findings indicate that the process of recruiting migrant men in real estate, bridge, dam and road construction industries includes multiple layers of the contract system: the construction agency authorities issue a subcontract to licensed contractors (also known as 'big contractors') at district or state levels to recruit and hire men (Table 4). These 'big contractors' have connections with various skilled subcontractors who in turn have small contractors/agents with more localized connections to recruit and hire workers. The small contractors/agents are the lowest denominators in the chain of the contract system. The small contractors are often skilled men from the local village who are already connected to the subcontractor(s) and upon receiving a specific 'contract' or 'work order' are able to recruit men for that particular job from their village of origin. The small contractors often accompany men in their migration to the workplace and stay as small workgroup overseers until the work is completed and provide information on lives at the places of destination. This chain of the contract system varies and is based on the type of work, volume of work and number of skills required for completing the work, and could become a potential for implementing HIV prevention programmes.

The contractors would also be interested in investing in HIV prevention interventions as it protects and promotes the health of their workers, which in turn increases productivity. Structural interventions, especially when bolstered with political, organizational support and government policy and regulation, are feasible, effective, and cost-effective [35]. This may mean that it requires greater participation of the contractors at all levels and such participation should be encouraged by the organizational, political and governmental authority. One intervention model could be the education of the contractors within prevention interventions on how to self-assess HIV risk and promote behavioural change using oneself as an example and personally endorsing the benefits of change. The trained contractors could become advocates for further communication with the contracted labourer on behavioural change and HIV prevention.

Table 4. The structural systems of contract in various occupations.

Occupation	Hierarchical structure of the contract system				Role of contractors/contract systems with male workers
	Level 1	Level 2	Level 3	Level 4	
Textile industry workers	Workers are contacted by agents/friends	Private recruitment agencies supports industries for recruitment	Recruited by textile industries		Provides shelter, connects with companies and other co-workers
Construction workers	Workers are recruited by local maistry or agency	Connected to subcontractors	Connected to contractors	Connected to industry/agency	Provides shelter in the work premise, give wages, supports in health
Loading and unloading workers (*Hamalis*)	Workers are recruited by supervisors	Workers register under the union (an association)	Supported and directed by the state government		Provides shelter in men's groups either at worksites or in neighbourhoods, keeps record of payment and support in basic needs
Fishermen	Workers are contacted by agents/friends	Recruited by companies			Provides introduction to companies, set up basic needs of shelter and food at initial period
Stone cutting workers	Workers are contacted by local maistry/agent	Recruited by contractors	Connected to industry		Provides shelter, payment, meets basic needs

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This requires an organizational policy in each sector of employment, including construction industries, fishing, mining, loading and unloading work.

Whereas the current research provides important insights to support better HIV prevention efforts for migrant men and possible ways for the implementation of interventions, findings must be interpreted with consideration of some limitations. As is true of a number of investigations, the information collected is based on self-reports, which is subject to recall and social desirability biases. To the extent possible, these biases have been reduced by using a shorter-term recall period and anonymous interviews. Contracted labour was defined based on simple questions on a given participant's actual association with contract on at least one of two occasions. As this variable does not involve any reference period, the estimate of the proportion of contracted labour obtained in this study could be an underestimate of ever contracted labour and an overestimate of current contracted labour. STI symptoms were also based solely on self-report and lack information on health provider diagnosis. Nonetheless, despite these study limitations, this large-scale study offers for the first time an analysis of contracted labour in high HIV prevalence states within India, and documents the utility of contract systems to address HIV risk in a major HIV bridge population within the country.

Finally, the large infrastructure of contract systems available in India can offer several strategic advantages for implementing HIV prevention policy to migrant men. They include opportunities for peer-based counselling, treatment for STI and condom distribution besides behavioural change communication from contractors to men recruited for work at a large scale in India.

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ORIGINAL PAPER

Alcohol and Sexual Risk Behavior among Migrant Female Sex Workers and Male Workers in Districts with High In-Migration from Four High HIV Prevalence States in India

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Abstract This paper examines the association between alcohol use and sexual risk in two critical migrant populations living within the same geographical areas—migrant men and female sex-workers (FSWs). Data are drawn from two independent surveys of migrant FSWs and male workers in 14 districts of four high HIV prevalent Indian states. In the paper we have examined the independent effects of degree of mobility and alcohol use prior to sex on HIV risk behaviors. Nearly two-thirds of FSWs and a similar proportion of male migrant workers, as well as nine out of ten clients of FSWs consume alcohol. More than half of the FSWs and their clients consumed alcohol prior to sex. The practice of alcohol use prior to sex among both FSWs and their clients has a significant association with inconsistent condom use during paid as well as unpaid sex, and these effects are independent of degree of mobility. The results suggest a need for developing an in-depth understanding of the role of alcohol in accentuating HIV risk particularly among migrant populations who move frequently from one place another.

Keywords Male migrant workers · Female sex workers · Alcohol use · Sexual risk · HIV risk · Mobility

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Introduction

Both alcohol use and mobility increasingly are identified as major factors associated with enhanced sexual risk contributing to HIV. Individuals with drinking behavior are more likely to have casual sex without condoms [1, 2], engage in transactional sex [3] and have more concurrent sex partners resulting in risk for HIV [4–6] and they are more likely to be HIV positive [7, 8]. At the same time, studies examining the role of migration or mobility on sexual risk behaviors show that men who are occupationally mobile are more likely to have one or more non-spousal sexual partners in the last 1 year than those who are not [2, 9–13]. Further, married migrant men who live away from their spouses are more likely to seek contacts with commercial female sex workers (FSWs), and become infected with HIV and other STIs/, than those living with their families [2, 9, 14].

Though alcohol and mobility separately have been found to affect sexual risk and HIV infection, there are few studies that have focused on assessing the combined impact of mobility and alcohol use on sexual risk behavior. Better understanding of the association of sexuality and alcohol use among migrant populations will help in developing effective multilevel approaches to mitigate the effects of this combination of risk factors.

Evidence suggests that highly mobile male migrants are more likely to engage in greater sexual risk behavior than those who are less mobile and to constitute the majority of the clients of FSWs [9, 14]. This paper examines the association between alcohol use and sexual risk in two high risk migrant populations within the same geographic areas—migrant men and mobile FSWs. We have selected a random sample of migrant men and FSWs who have been living in the current places of destinations for less than

2 years and are highly mobile, as defined by more than one move outside their current places of destination in the past 2 years prior to the survey. Choosing samples from the same geographical area allows us to explore the potential concordance of risky behavior between male migrant workers and FSWs as well as role of alcohol in such risky behaviors.

The analysis for the present paper is built around the following key questions: (a) Are those who consume alcohol more likely to engage in sexual risk behaviors than those who do not among both migrant FSWs and male workers; and (b) Is risk further elevated for the sub-set of male clients of FSWs due to the consumption of alcohol prior to sex? To answer these questions we have assessed risk behavior patterns as they relate to alcohol use separately for the FSWs, male migrants and a subset of male migrants who reported having sex with FSWs.

Methodology

Study Settings, Recruitment and Sampling

Data used in this study are derived from two separate surveys conducted independently among FSWs and male migrant workers from June 2007 to September 2008 as part of a study titled "Migration/Mobility and Vulnerability to HIV Among Male Migrant Workers and FSWs in High HIV prevalence States in India" funded by Avahan, Bill and Melinda Gates Foundation (BMGF), New Delhi. The participants were recruited from districts across four states in southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India, identified as high epidemic states by the Indian National AIDS Control Organization (NACO, 2006) [15]. The districts with the highest rates of in-migration in each state, as indicated by the 2001 Indian census were chosen for the male migration survey ($n = 21$ districts; 5 districts each in the states of Andhra Pradesh, Karnataka and Maharashtra; six districts in Tamil Nadu. For the survey of FSWs, the districts with more than 2,000 FSWs were chosen ($n = 22$ districts; 5 districts each in the states of Andhra Pradesh, Karnataka and Tamil Nadu; 7 districts in Maharashtra). This method of district selection resulted in a subsample of districts common to both male migrant workers and FSWs ($n = 14$ districts; 3 districts in Andhra Pradesh, 3 districts in Karnataka; 3 districts in Tamil Nadu and 5 districts in Maharashtra). In this paper, we focused on this subsample of 14 districts where both migrant FSWs and male workers are high in volume.

The survey samples for each group were identified and recruited following different protocols. Male migrant workers in each district were recruited through a two-stage systematic sampling procedure conducted in selected worksites and migrant worker residential colonies (either organized labor colonies or illegally occupied land with small, poor quality houses). Geographic maps drawn for each district were used to list all migrant worker residential areas and worksites and to define and select clusters within these sites. Clusters were created by combining smaller sites and dividing larger sites such that each cluster represented an area with approximately 5,000 male migrant workers. The number of clusters varied from a minimum 5 to a maximum of 13. Three clusters were then selected randomly from within each district, and migrant men within the chosen clusters were systematically sampled to obtain a minimum of 2,500 participants per state. The sample size was determined using an estimated proportion of 15% of men having sex outside marriage, an assumed difference of 3% increase in the proportion with every unit increase in degree of mobility, a confidence level of 95% and power of 80%. Eligibility criteria for inclusion in the study were age 18 years or older, and having migrated to at least two places in the past 2 years for work from among those who satisfied the inclusion criteria, a total of 11,635 male migrant workers from 21 districts across the four states were sampled. Of these, 145 (1.2%) men refused to be interviewed, and 271 (2.3%) men did not complete their interviews and were thus excluded from the analyses, giving us a final sample size of 11,219.

Female sex workers in each district were recruited through a two-stage sampling procedure. First, the small and large sex worker sites, including brothel areas and open solicitation points such as roads, highways, bus stands, railway stations, and market areas were mapped. These lists of solicitation sites were used to define and select site clusters. Clusters were formed by combining small areas or by segmenting the large areas such that each cluster included approximately 500 FSWs. Three such clusters from each district were selected randomly, and FSWs were systematically sampled from the brothel areas and from open solicitation points to obtain a minimum of 1,500 eligible participants per state. Eligibility criteria included: those age 18 years or older and having moved to at least two places in the past 2 years for sex work. The sample size was determined using an estimated proportion of 30% non-condom use, an assumed difference of 3% increase in the proportion with every unit increase in degree of mobility, a confidence level of 95% and power of 80%. In order to achieve the desired sample size, a much larger number of female-workers was contacted and screened using the eligibility criteria. Across the entire study 9,475 sex workers were screened with a screening questionnaire. From the screened sample, 59% ($n = 5,611$) were found eligible according to the criteria described above. Approximately 113 sex workers refused or did not complete the

interview because of the demands of their clients. This process generated a final study sample of FSWs of 5,498.

In this paper, we focus on both migrant FSWs and male workers from the same geographic region of 14 districts resulted into a total migrant FSWs sample of 3,412 and male workers sample of 7,602 for statistical analyses. There were no significant differences in socio-demographics and mobility characteristics between this subsample from 14 districts and participants from the remaining districts.

Interviews were conducted by trained researchers with multilingual expertise. All the researchers had at least 5 years of experience and a graduate and masters degree in sociology, anthropology and/or statistics. Data were obtained through face-to-face interviews conducted in private locations close to the respondent's residence or at their workplace. Verbal consent was obtained from all respondents before they were interviewed. Data quality control and management involved immediate review by field staff after interviews to ensure accuracy and completion, same-day review by the field supervisor and weekly transport of surveys to the data management team. Trained data entry officers then entered the survey data weekly and processed it monthly to verify consistency and accuracy, using SPSS (SPSS Version 16.0). Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the Population Council, New York, USA.

Measures

Socio-demographic assessments for male and female participants were similar with the same variables being used to assess participant age, level of education, marital status, whether or not male migrants were currently residing with their wives, caste and religion. The occupation of the male migrant workers was captured under the following categories: construction work, market place loading and unloading, daily wage work, industrial work, stone cutting, and fishing. Information on participants' marital status and partners' residential status was combined to derive a variable with categories: "currently married and living with spouse in destination area = 1"; "currently married and partner at the place of origin = 2", "not currently married = 3" For the current study, divorced, widowed, separated and deserted were combined and the category was named as 'previously married'.

The survey also collected information on caste. For the current study the items 'Scheduled Caste and Scheduled Tribes' were clubbed together to create three categories, 'Scheduled caste/tribe', 'OBC' and 'Others' (representing upper cast designations).

The survey instrument assessed the type of alcohol used at the place of destination in the 1 month period prior to the survey (past 30 day use). Type of alcohol included Beer, English liquor (whisky, brandy, rum) and desi (country) liquor. Responses were "Yes = 1" or "No = 0". We used any past 30 day alcohol use as a predictor of the sexual behavior of participants. The survey instrument also collected information on alcohol use prior to or during sex with a paying partner, and non-spousal casual unpaid partner. Alcohol use prior/during sex with either partner constituted the primary independent variable for assessing the key outcome indicators of HIV related risk behavior.

Degree of mobility, another key independent variable was derived from the survey item that asked how many different places the respondent visited in the past 2 years for work related purposes. Those indicating fewer than three places were coded as "0, lower mobility" and those indicating three or more places were coded as "1, high mobility".

The sexual risk outcome variables focused on sex with partners in the place of destination and included sex with paid female partners, number of paid sex partners, number of paid sexual encounters, sex with casual female partners, number of non-paying sex partners, consistent condom use in sex with paid female partners, consistent condom use with casual female partners. For male migrant workers the recall time period was past 12 months, and for FSWs the recall time period was past 1 week. Five sexual outcome variables were dichotomized (a) whether the male and female participants had sex with paying partner (yes = 1, no = 0), (b) whether they had sex with non-paying partner (yes = 1, no = 0), (c) whether they had sex with either partner (yes = 1, no = 0), (d) whether they had sex with both paying and non-paying partner (yes = 1, no = 0), (e) whether they had sex with more than three partners (yes = 1, no = 0).

Analysis

Data were analyzed separately for the samples of FSWs (n = 3,412) and male migrant workers (n = 7,602) from the 14 districts common to both to assess the role of alcohol in relation to sexual risk. Additionally, the data for the subsample of male migrant workers who were clients of FSWs (n = 1,103) were also analyzed in order to determine whether there were commonalities in the patterns of alcohol consumption and sexual risk for clients and FSWs interacting in the same districts. Thus, we are conducting two levels of comparison: (1) comparing male and female workers living within the same geographical areas, and (2) comparing male clients of FSWs with the FSWs and the total sample of migrant men from the same area.

Descriptive statistics were obtained for demographic variables, covariates and the independent and dependent

variables in the study. *t* Tests and Chi-square analyses were conducted to assess differences between independent and dependent variables. A series of multiple logistic regression models were generated, first to explore the effects of mobility on alcohol use, then to examine the effects of alcohol use on sexual behaviors, and finally, to determine the effects of alcohol use prior to sex on sexual risk behaviour.

Results

Participant Characteristics

Results in Table 1 show that the average age of FSWs was 30 years [standard deviation (SD) = 7.4) and the male migrant workers was 26.5 years (SD = 5.5). More migrant FSWs than the male workers were illiterate (31.4 vs. 14.7%, $t = 18.7$, $p < 0.001$). About one-fourth of male migrant workers were currently married and the spouse was living at the place of origin, an additional 25% were living with spouse at the place of destination and about 49% were unmarried. Among clients of FSWs, the proportion of unmarried respondents was somewhat higher than the total sample of male migrant workers (54.2 vs. 48.6%, $t = 3.48$, $p < 0.05$). Approximately two-thirds of migrant FSWs and one-third of male workers had moved to three or more places in the past 2 years for work purposes (met "high mobility" criterion). More clients of FSWs fall into the "high mobility" category than the total sample of male migrant workers in the study districts (47.3 vs. 36.9%, $t = 6.49$, $p < 0.001$.

Alcohol Use

Compared with the total sample of male migrant workers, the proportion of clients of FSWs who reported drinking any alcohol (88 vs. 66.2%, $t = 19.5$, $p < 0.001$, and drinking all types of alcohol in the past 30 days (22.8 vs. 13%, $t = 7.42$, $p < 0.001$ is significantly higher than those who did not report visiting FSWs. A similar proportion of FSWs (53.8%) and clients of FSWs (52.8%) reported alcohol use prior to sex.

Sexual Risk Behavior

Almost all the FSWs reported having sex with paying partners in the last week prior to the survey. About 15% of the total sample of male migrant workers reported sex with FSWs in the last 12 months prior to the survey. The average number of paying partners for FSWs in the past week was fifteen (SD = 10), whereas for male migrant workers in the past year it was four (SD = 6.0). Approximately one-third of the FSWs and the male migrant workers reported inconsistent condom use in sex with paying partners in case of FSWs and paid partners in case of male migrants (34.7 and 33.9%, respectively).

Approximately half of the total FSWs reported sex with non-paying partners in the week prior to the survey. In the total sample of male migrant workers 16% reported sex with unpaid partners in contrast to 45% among clients of FSWs. Inconsistent condom use in sex with unpaid partners is high in all three groups, FSWs (60.1%), all male migrant workers (79.7%) and clients of FSWs (65%).

Degree of Mobility and Alcohol Use

Table 2 shows the relationships between degree of mobility and alcohol use among both migrant FSWs and male workers. We note that higher mobility has very little association with alcohol use among the FSWs; but among the male migrant workers in both groups, the effects of higher mobility on alcohol use are significant. Alcohol use among male migrant workers with high degree of mobility is higher than the male migrant workers with low degree of mobility [77 vs. 60.1%, adjusted odds ratio (AOR) = 2.1, 95% confidence interval (CI) = 1.8–2.3]. The results also suggest that FSWs with higher mobility than those with lesser mobility are less likely to consume all different types of alcohol brands (22.6 vs. 18.9%, AOR = 0.7, 95% CI = 0.6–0.8). On the contrary, the male migrant workers with higher mobility are more likely to drink all the types of alcohol brands (7.7 vs. 22.1%, AOR = 3.4, 95% CI = 2.9–3.9) when compared to those men with lesser mobility.

Also, as shown in Table 2, alcohol use prior to sex is significantly higher in highly mobile male migrant workers in the total sample (10 vs. 6.6%, AOR = 1.5, 95% CI = 1.2–1.7), but not for clients of FSWs where there is no difference between highly mobile and less mobile men.

Alcohol Use and Sexual Behavior

Table 3 shows that among the FSWs alcohol use has a significant association with having a non-paying male partner and having sex with more than three partners per day. In the total sample of male migrant workers, alcohol users report higher rates of contact with sex workers than non-users (19.2 vs. 5.1%, AOR = 4.9, 95% CI = 4.0–5.9). The proportion of male migrant workers reporting sex with unpaid partners is also higher among alcohol users than among the non-users (22.1 vs. 5.9%, AOR = 4.7, 95% CI = 3.9–5.6) and among clients of FSWs (47 vs. 28.8%,

Table 1 Characteristics of female sex workers, male migrant workers for total sample and a sub-sample of those reported sex with female sex workers from selected states of India

Demographic characteristics	Female sex workers $n = 3,412$ n (%)	Male migrant workers	
		Total sample $n = 7,620$ n (%)	Clients of FSWs $n = 1,103$ n (%)
Age [mean (SD)]	30.0 (7.4)	26.5 (5.6)	26.5 (5.1)
Education			
Illiterates	1,073 (31.4)	1,122 (14.7)	145 (13.1)
Literates	2,339 (68.6)	6,498 (85.3)	958 (86.9)
Religion			
Hindu	2,590 (75.9)	6,448 (84.6)	903 (81.9)
Others	822 (24.1)	1,172 (15.4)	200 (18.1)
Marital status			
Currently married living with spouse	NA	1,930 (25.4)	202 (18.3)
Currently married but spouse is at native place	NA	1,985 (26.0)	303 (27.5)
Unmarried	555 (16.3)	3,705 (48.6)	598 (54.2)
Currently Married	1,243 (36.4)	NA	NA
Previously Married	1,614 (47.3)	NA	NA
Caste			
Scheduled caste/tribe	1,126 (33.0)	3,107 (40.8)	502 (45.5)
Others (11 cases missing)	1,760 (51.6)	4,502 (59.2)	598 (54.2)
Degree of mobility			
Less mobility (<3 places)	1,146 (33.6)	4,803 (63.1)	581 (52.7)
High mobility (3+ places)	2,266 (66.4)	2,817 (36.9)	522 (47.3)
Alcohol use in the last 1 month			
Any alcohol intake[a]	2,115 (62.0)	5,048 (66.2)	971 (88.0)
All types of alcohol[b]	662 (19.4)	988 (13.0)	251 (22.8)
Alcohol use prior to sex[c]	1,835 (53.8)	951 (12.5)	582 (52.8)
Injecting drug use	22 (0.6)	41 (0.5)	3 (0.3)
Sexual behavior in the place of destination			
Sex with paying partners[d,f]	3,408 (99.9)	1,103 (14.5)	1,103 (100.0)
Average number of paying sex partners (SD)[d,f]	15.4 (10.5)	4.1 (6.0)	4.1 (6.0)
Average number of paying sex encounters (SD)[e,f]	5.1 (3.2)	8.2 (9.5)	8.2 (9.5)
Inconsistent condom use in sex with paying partners[a]	1,185 (34.7)	374/1,103 (33.9)	374/1,103 (33.9)
Sex with casual, non-paying partners	1,550 (45.4)	1,267 (16.6)	496 (45.0)
Average number of non-paying sex partners (SD)[d,f]	2.1 (1.5)	1.9 (3.1)	2.6 (4.5)
Average number of non-paying sex encounters (SD)[e,f]	n/a	8.1 (12.4)	9.5 (14.2)
Inconsistent condom use in sex with non-paying, casual partners	931/1,550 (60.1)	1,010/1,267 (79.7)	326/496 (65.7)
Sex with both paying and non-paying/casual partners	1,020 (29.9)	496 (6.5)	496 (45.0)
Sex with either paying or non-paying/casual partners	3,412 (100.0)	1,874 (24.6)	1,103 (100.0)
Overall inconsistent condom use	1,995/3,412 (58.5)	1,052/1,874 (56.1)	368/1,103 (33.4)
Sex with 3+ sex partners[e,f]	2,240 (65.7)	945 (12.4)	816 (74.0)

SD Standard deviation

[a] Any of the following types of alcohol use in the 1 month prior to survey: beer, English liquor (whisky, brandy, rum, gin), desi (country) liquor

[b] Has taken all the following types of alcohol: beer, English liquor (whisky, brandy, rum, gin), desi (country) liquor

[c] Alcohol use prior to sex with either partner

[d] Per week for sex workers

[e] Per day for sex workers

[f] In the last 12 months for male migrant workers

Table 2 Association between mobility and alcohol use among female sex workers, male migrant workers for total sample and a sub-sample of those reported sex with female sex workers

Outcome variables[a]	Female sex workers			Male migrant workers					
				Total sample			Clients of FSWs		
	Less mobility (ref) (%)	High mobility (%)	AOR[b,c] (95% CI)	Less mobility (ref) (%)	High Mobility (%)	AOR[b,c] (95% CI)	Less mobility (ref) (%)	High mobility (%)	AOR[b,c] (95% CI)
Any Alcohol use[d]	60.5	62.8	1.0 (0.9–1.2)	60.1	77.0	2.1 (1.8–2.3)***	84.7	91.8	1.7 (1.2–2.6)**
All types of alcohol[e]	22.6	18.9	0.7 (0.6–0.8)***	7.7	22.1	3.4 (2.9–3.9)***	18.6	27.4	1.5 (1.1–2.1)**
Alcohol use prior to sex[f]	71.5	83.0	1.3 (1.1–1.9)*	6.6	10.0	1.5 (1.2–1.7)***	36.0	34.3	0.8 (0.6–1.1)

[a] Outcome variables: Any alcohol use in the last 1 month (0, no; 1, yes); All types of alcohol use (0, no; 1, yes); Alcohol use prior to sex (0, no; 1, yes)

[b] Key independent variable: Mobility (Less mobility, 0; High mobility, 1)

[c] Controlled for age, education, religion, caste, marital status and occupation of the male migrant workers

[d] Any of the following types of alcohol use in the 1 month prior to survey: beer, english liquor (whisky, brandy, rum, gin), desi (country) liquor

[e] Has taken all the following types of alcohol: beer, english liquor (whisky, brandy, rum, gin), desi (country) liquor

[f] Alcohol use prior to sex with either partner

AOR adjusted odds ratio, *CI* confidence interval, *ref* reference category

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 Association between alcohol use and sexual behaviors among female sex workers, male migrant workers for total sample and a sub-sample of those reported sex with female sex workers

Outcome variables[a]	Female sex workers			Male migrant workers					
				Total sample			Clients of FSWs		
	No alcohol (%)	Yes alcohol (%)	AOR[b,c] (95% CI)	No alcohol (%)	Yes alcohol (%)	AOR[b,c] (95% CI)	No alcohol (%)	Yes alcohol (%)	AOR[b,c] (95% CI)
Sex with paying partner[f]	–	–		5.1	19.2	4.9 (4.0–5.9)***	–	–	
Sex with non-paying/casual partner[d,f]	24.4	33.3	1.5 (1.3–1.8)***	5.9	22.1	4.7 (3.9–5.6)***	28.8	47.2	1.9 (1.2–2.8)**
Sex with either partner[f]	–	–		9.5	32.3	5.0 (4.3–5.8)***	–	–	
Sex with both paying and non-paying/casual partner[d,f]	24.4	33.3	1.5 (1.3–1.8)***	1.5	9.1	6.5 (4.6–9.1)***	28.8	47.2	1.9 (1.2–2.8)**
Sex with 3+ partners[e,f]	62.6	67.5	1.2 (1.1–1.5)***	3.1	12.9	5.1 (4.0–6.5)***	56.8	62.2	1.4 (0.9–1.9)

[a] Outcome variables: Sex with paying partner (0, no; 1, yes), sex with non-paying partner (0, no; 1, yes), sex with either paying or non-paying partner (0, no; 1, yes), sex with both paying and non-paying partner (0, no; 1, yes), sex with 3+ partners (0, no; 1, yes)

[b] Key independent variable: Any alcohol use in the last 1 month (No, 0; Yes, 1)

[c] Controlled for age, education, religion, caste, marital status and occupation of the male migrant workers

[d] Per week for sex workers

[e] Per day for sex workers

[f] In the last 12 months for male migrant workers

AOR adjusted odds ratio, *CI* confidence interval, *ref* reference category

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

AOR = 1.9, 95% CI = 1.2–2.8). The proportion of total male migrant workers who reported sex with both paid and unpaid partners *n* the last year prior to the survey was significantly higher among alcohol users than among the non-users (9.1 vs. 1.5%, AOR = 6.5, 95% CI = 4.6–9.1). This association was also significant for FSWs (AOR = 1.5, 95% CI = 1.3–1.8) and for clients of FSWs (AOR 1.9, 95% CI = 1.2–2.8).

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Table 4 Association between mobility, alcohol use prior to sex and inconsistent condom use among male migrant workers for total sample and a sub-sample of those reported sex with sex workers in India

Outcome variables[a]	Alcohol use prior to sex[d]			Degree of mobility		
	No (ref) (%)	Yes (%)	AOR[b,c] (95% CI)	Less (ref) (%)	High (%)	AOR[b,c] (95% CI)
Female sex workers						
Inconsistent condom uses in sex with paying partners	19.4	39.2	3.0 (2.3–3.9)***	21.0	44.6	3.4 (2.8–4.0)***
Inconsistent condom use in sex with non-paying/casual partners	45.8	56.6	1.5 (1.1–2.0)***	44.2	64.3	2.1 (1.6–2.8)***
Overall inconsistent condom use[e]	29.3	44.0	2.1 (1.7–2.6)***	25.0	49.9	3.2 (2.7–3.8)***
Male migrant workers						
Inconsistent condom uses in sex with paying female partners[f]	23.6	43.1	2.7 (2.0–3.5)***	27.2	41.4	1.9 (1.4–2.5)***
Inconsistent condom use in sex with non-paying/casual female partners[g]	80.2	78.7	0.9 (0.7–1.3)	74.1	83.9	2.1 (1.6–2.9)***
Overall inconsistent condom use[e]	58.9	51.7	0.7 (0.6–0.9)**	46.6	65.3	2.1 (1.7–2.6)***
Clients of female sex workers						
Inconsistent condom uses in sex with paying female partners[f]	23.6	43.1	2.7 (2.0–3.5)***	27.2	41.4	1.8 (1.4–2.4)***
Inconsistent condom use in sex with non-paying/casual female partners[g]	54.5	73.5	2.7 (1.8–4.1)***	62.4	68.0	1.8 (1.2–2.8)**
Overall inconsistent condom use[e]	23.2	42.4	2.7 (2.1–3.5)***	26.7	40.8	1.9 (1.4–2.5)***

[a] Outcome variable coding: Inconsistent condom use (by type of partner) (0, no; 1, yes)

[b] Key independent variables: Alcohol use prior to sex (0-no, 1-yes); Degree of mobility (less-0, high-1)

[c] Controlled for age, education, religion, caste, marital status, occupation and the other variables in the above table

[d] Alcohol use prior to sex with either partner

[e] Inconsistent condom use in sex with either partner: Not used condom in sex with either sex worker or non-paying casual partner

[f] Inconsistent condom use in sex with sex worker in the past 12 months

[g] Inconsistent condom use in sex with non-paying, casual partner in the past 12 months

AOR adjusted odds ratio, *CI* confidence interval, *ref* reference category

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Independent Effects of Degree of Mobility, and Alcohol Use Prior to Sex on Inconsistent Condom Use

Among FSWs, inconsistent condom use in sex with paying partners is higher among men who used alcohol prior to sex than among those who did not (39.2 vs. 19.4%, AOR = 3.0, 95% CI = 2.3–3.9) even after controlling for degree of mobility and socio-demographic characteristics. Additionally, inconsistent condom use with unpaid partners is also higher among men who consume alcohol prior to sex than among those who do not. Among male migrant workers, inconsistent condom use with paid partners is significantly higher if they consumed alcohol prior to sex than if they did not (43.1 vs. 23.6%, AOR = 2.7, 95% CI = 2.0–3.5). Among the subsample of male migrant workers who are clients of FSWs, inconsistent condom use with non-paying casual partners (73.5 vs. 54.5%, AOR = 2.7, 95% CI = 1.8–4.1) is significantly higher if they used alcohol prior to sex than those who did not consume alcohol prior to sex (Table 4)

Degree of mobility is significantly associated with inconsistent condom use among FSWs as well as among the total sample of male migrant workers, and the sub-sample of male migrant workers who are clients of FSWs.

Discussion

The analysis of our study data shows that alcohol use among FSWs and male migrant workers is widespread. Nearly two-thirds of FSWs and male migrant workers, and nine out of ten clients of FSWs consumed at least one type of alcohol in the past 30 days, with more than half of FSWs and clients of FSWs drinking prior to sex. Among both FSWs and their clients, the practice of drinking alcohol in association with sex is significantly associated with inconsistent condom use in paid as well as unpaid sex.

Prior studies in India have reported somewhat lower levels of 30 day alcohol consumption in (high risk populations) [16, 17] compared with the current study data,

suggesting that the alcohol use is more prevalent among migrant populations especially when involved in paid as well as unpaid sex and are thus at higher risk for HIV. Alcohol use increased with degree of mobility, suggesting the need to examine in greater depth alcohol meanings and drinking behaviors and their association with situational responses and sexuality in the lives of migrant populations who move from one place to another frequently.

This study result linking alcohol use and degree of mobility among migrant populations is the first of its kind in both India and global literature. Studies carried out in other geographical areas (mostly in North America and Africa suggest that alcohol use tends to relate with sexual risk through various psychological correlates such as sexual sensation seeking [18–21], fear of condom negotiation [22], and peer group influences [19]. Now what is important from the point of view of planning risk reduction strategies is to understand how some of these psychological correlates, particularly those relating to sensation seeking and peer group influences translate into the daily actions of mobile male migrants.

The study also shows that FSWs and clients in the same geographic area both use alcohol prior to or during sex. A gender perspective helps to understand why this might be the case. For example, a WHO study [22] linking alcohol use with sexual risk in eight countries including India also showed that there were instances when FSWs 'pretended' to use alcohol or took only small amounts prior to sex in order to maximize their potential for negotiating condom use or sex practices. Alcohol may also be used by FSWs to cope with the stress and violence associated with commercial sex work [23, 24]. At the same time, men have been reported to purchase beer before engaging in sexually risky behavior to impress women that they had money [2]. They may use alcohol to demonstrate masculinity norms and expectations and to promote a variety of sexual practices with their paid sex partners.

Increased sexual risk associated with higher rate of mobility, among men arise because they are away from home for longer time and less subject to the social controls that might be exerted in their native place. Further they may be faced with a high level of peer pressure to drink and visit FSWs. Studies among young men from similar low income migrant communities in India have shown that masculinity norms tend to result in sexually risky outcomes due to high peer pressure and need to prove their masculinity [25].

The study shows increased sexual risk within unpaid sexual encounters. Both migrant FSWs and male workers are involved in a significant number of unpaid sexual encounters during which condom use is inconsistent at best. Little is known about how these unpaid associations occur, and with whom. Inconsistent condom use is generally associated with some degree of intimacy between partners. Further, other resources exchanges in addition to monetary transactions may take place in these relationships. More research is required to understand how to address this area of high risk exposure among highly mobile migrant workers, both men and women. A gender sensitive program would help understand the relationship issues within the commercial sex context and help both the male clients and FSWs to protect themselves and at the same time care about each others' welfare.

A realistic HIV prevention program will need to promote consistent condom use and other safe sex behaviors with clear understanding of how alcohol use helps or inhibits its safe negotiation. To refine our understanding of the risk context more qualitative research is required among high risk, mobile groups, to obtain detailed information about the situations in which sexual encounters take place, through semi-structured ethnographic interviews and direct observation in selected sites, such as alcohol sales points, especially those that offer opportunities for paid or unpaid sex. This study points to the need for developing a greater in-depth understanding of the role of alcohol in accentuating the HIV risk among migrant populations with greater mobility.

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Male migration and risky sexual behavior in rural India: is the place of origin critical for HIV prevention programs?

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Abstract

Background: Recent studies of male migrants in India indicate that those who are infected with HIV are spreading the epidemic from high risk populations in high prevalence areas to populations in low prevalence areas. In this context, migrant men are believed to initiate and have risky sexual behaviors in places of destination and not in places of origin. The paucity of information on men's risky sexual behaviors in places of origin limits the decision to initiate HIV prevention interventions among populations in high out-migration areas in India.

Methods: A cross-sectional behavioral survey was conducted among non-migrants, returned migrants (with a history of migration), and active (current) migrants in rural areas across two districts with high levels of male out-migration: Prakasam district in Andhra Pradesh and Azamgarh district in Uttar Pradesh. Surveys assessed participant demographics, migration status, migration history, and sexual behavior along the migration routes, place of initiation of sex. District-stratified regression models were used to understand the associations between migration and risky sexual behaviors (number of partners, condom use at last sex) and descriptive analyses of migrants' place of sexual initiation and continuation along migration routes.

Results: The average age at migration of our study sample was 19 years. Adjusted regression analyses revealed that active migrants were more likely to engage in sex with sex workers in the past 12 months (Prakasam: 15 percent vs. 8 percent; adjusted odds ratio (aOR)=2.1, 95% CI 1.2-3.4; Azamgarh: 19 percent vs.7 percent; aOR=4.0, 95% CI 2.4-6.6) as well as have multiple (3+) sex partners (Prakasam: 18 percent vs. 9 percent; aOR=2.0, 95% CI 1.3-3.2; Azamgarh: 28 percent vs. 21 percent; aOR=1.9, 95% CI 1.2-3.0) than non-migrants. Contrary to popular belief, a high proportion of active and returned migrants (almost 75 percent of those who had sex) initiated sex at the place of origin before migrating, which is equivalent to the proportion of non-migrants who engaged in sex with sex workers as well as with casual unpaid partners. Moreover, non-migrants were more likely than migrants to engage in unprotected sex.

Conclusion: Findings of this study document that returned migrants and active migrants have higher sexual risk behaviors than the non-migrants. Most migrants initiate non-marital sex in the place of origin and many continue these behaviors in places of destination. Migrants' destination area behaviors are linked to sex with sex workers and they continue to practice such behaviors in the place of origin as well. Unprotected sex in places of destination with high HIV prevalence settings poses a risk of transmission from high risk population groups to migrants, and in turn to their married and other sexual partners in places of origin. These findings suggest the need for controlling the spread of HIV among both men and women resulting from unsafe sex in places of origin that have high vulnerability due to the frequent migratory nature of populations.

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Introduction

In the context of global industrialization and urbanization, migration for work is increasing around the world [1-3]. Migrant workers seeking employment in urban settings are often from tribal and rural communities with low levels of literacy and skills, making them ignorant about available HIV prevention services resulting in low utilization of these services at the places of destination [2]. A number of studies have documented that migrants have higher risky sexual behaviors than non-migrants [4-12] and that they serve as bridge population for spreading HIV from destination areas to their place of origin [13-16]. Migrants' sexual relationships with multiple partners in destination areas is assumed to be the main factor explaining the role of migration in the spread of HIV and other STIs [17]. It is widely believed that migrant men acquire infections at the workplace and continue to have sexual contact with their female partners upon returning to their native place, and hence spread infection from destination areas to places of origin [18,19].

Migration within India parallels the global phenomenon [1]. Published research studies on migration in India are limited to the risky sexual behavior of migrants at destination points [1,20-27]. Such research studies in India as well as other parts of the world suggest that migrants initiate and engage in risky sexual behaviors in places of destination due to separation from their family and spouse for extended periods [21,23,26,28,29], isolation coupled with loneliness [26,29], socio-cultural norms and the anonymity of living in a city [21,26,30], illegal residential status [29] and the nature of work [23,26,29]. These studies recommend that the destination areas and the work place are appropriate sites to reach migrant workers with HIV prevention interventions. A recently conducted study in the southern states of India of male migrants at their place of destination found that more than 30 percent had sex with women who were not their married partner in the place of origin [1,22] and about 10 percent had sex with sex workers. These results suggest that sex with sex workers is not limited to the city/town where migrant men work; rather such practices also exist in the place of origin; however, it is not known whether these men initiate such risky behaviors in the place of destination or the place of origin.

Few studies have been conducted to examine the extent of risky sexual behaviors among male migrants in their place of origin in India. A recent study of young unmarried migrants revealed that they were more likely to have had sex at the place of origin - before and after migration - than at the place of destination. The study also reported that 24 percent of migrants had ever had sex at the place of destination, and 80 percent of them reported having sex at the place of origin as well [31]. Despite the recommendations from such studies, places of origin have been neglected in research as well as in HIV prevention programs, may be in part due to the difficulty in identifying such places.

In order to fill the gap in understanding the need and urgency for initiating HIV prevention programs in places of origin, it is important to ascertain where migrant men initiate risky sexual behaviors and how they differ from non-migrants in such places. This area of research is important in view of rising HIV prevalence among antenatal care (ANC) clinic attendees in districts with high male out-migration as well in view of the fact that migrant men studied in destination areas report that they have engaged in risky sexual behavior even in their native places. This study addresses the following research questions to draw implications for initiating HIV prevention programs in places of origin as well: (i) Is sex behavior of migrants different from non-migrants in places of origin?; (ii) Where do migrants initiate commercial sex and sex with casual unpaid partners?; (iii) What proportion of men continue to practice risky sexual behaviors in destination and origin areas, after initiating sex in their place of origin?

Methods

This paper reports on research conducted as part of a 5-year (2005-10) knowledge building grant assessing the patterns of male migration and its relationship with HIV risk behaviors from 21 districts with high in-migration across four states in southern (Andhra Pradesh, Karnataka, Tamil Nadu) and western (Maharashtra) India, identified as high HIV epidemic states by the Indian National AIDS Control Organisation (NACO) prior to the year 2005. Districts with the highest rates of in-migration in each state were chosen, as per the 2001 Indian Census. The overall research design of the project has been described in detail elsewhere [1]. The data reported in this study is an extension of the in-migration (or destination) districts study, with a cross-sectional behavioral survey conducted among migrant and non-migrant men in two districts with high levels of out-migration. The two districts for this extended study were chosen based on the places of origin mentioned by migrants in the destination districts study [1,22] with the criterion that one district contains out-migration of men within the state (Prakasam district in Andhra Pradesh) and another district has out-migration of men outside the state (Azamgarh district in Uttar Pradesh) Figure 1).

Study setting

The study was conducted in Azamgarh district, one of 71 districts in Uttar Pradesh, a state in north India. Azamgarh district has a population of 4.6 million as per the 2011 Census, and is characterized by low female literacy (63

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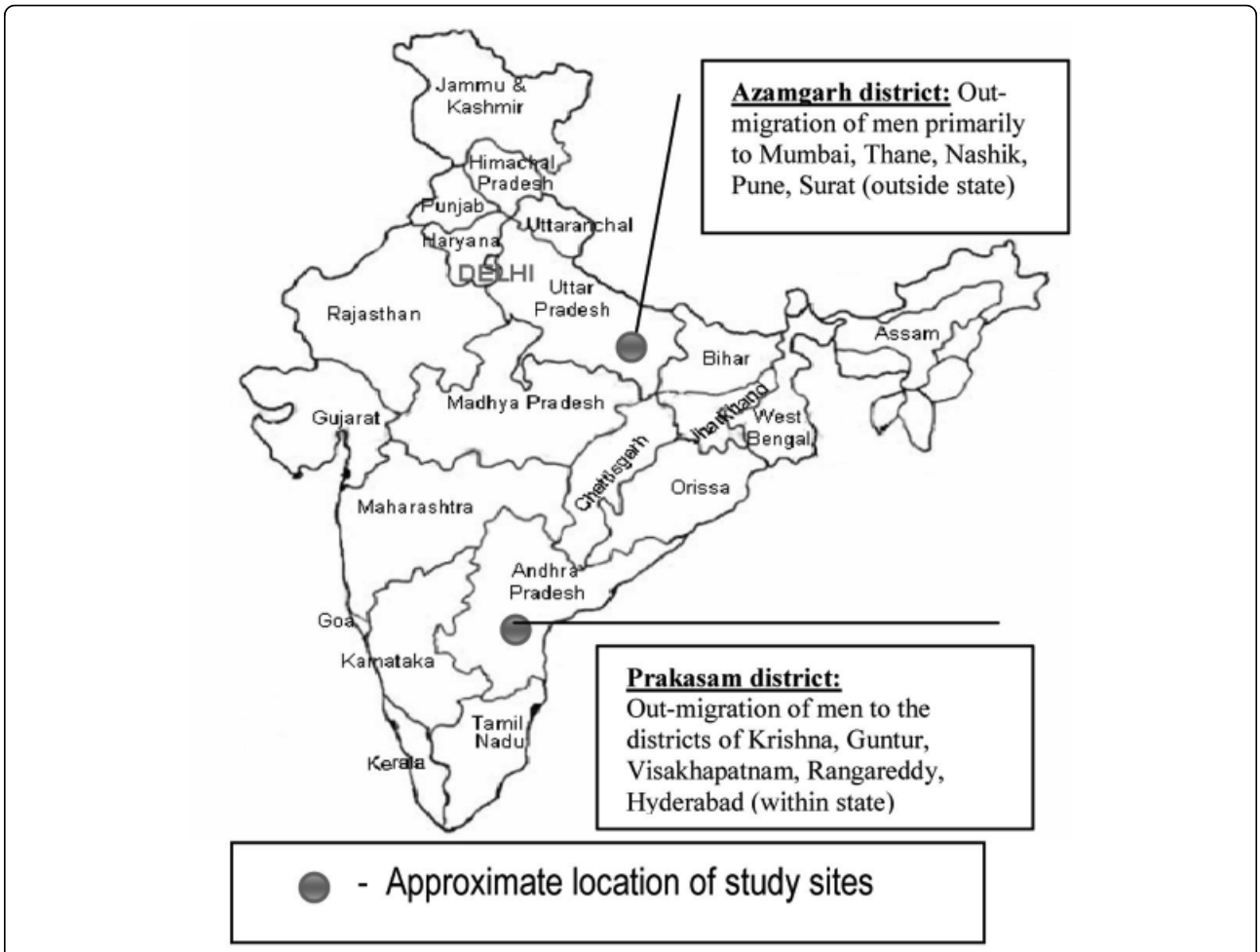

Figure 1 Map showing the approximate geographic locations of study sites within each state in India and the major routes of male out-migration.

percent) [32], high poverty (57 percent of households belonged to the lowest two categories of wealth quintiles) [33], lack of employment and high levels of out-migration. According to the 2001 Census data on migration, about 15 percent of males in the adult ages have migrated outside the district; and 75 percent of those who had migrated travelled outside the state for work. Data shows that male out-migration is a on a continuous increase since 1980s. The most preferred destination areas for migrants from the district are Mumbai and Thane in Maharashtra. Migrant men from the district work in the unorganized sector including as taxi drivers, daily wage laborers or in the cotton industry as laborers. In the recent HIV sentinel surveillance conducted by NACO, the HIV prevalence among ANC clinic attendees in Azamgarh district is close to 1 percent , which is above the national average of 0.3 percent [34].

Prakasam district, located in coastal Andhra Pradesh in south India, has a population of 3.4 million as per the 2011 Census. The district is spread across 17,626 sq.km, and is characterized by low literacy (63 percent) [35] and 24 percent belong to low economic status [36]. As per the 2001 Census data, 14 percent of male adults had migrated outside the district for work, of which 95 percent had migrated to districts within the state. Migration of males even within the district is common as there are a few industrial and mining establishments within the district. The most preferred destination districts for migrants from Prakasam are: Guntur and Krishna, which are neighboring districts. According to the recent HIV sentinel surveillance, the HIV prevalence among ANC clinic attendees is 2.6 percent which is significantly higher than the state average of 1.4 percent [34].

Participants

The study included a survey among three categories of men: (i) return migrants, defined as those who had returned to their native place (for at least one year)

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either due to completion of job contract or no job at the destination place and/or employed locally; (ii) active migrants, defined as those who are temporarily visiting the place of origin (e.g., to attend a marriage or some other function, on vacation, or illness) but are currently employed in a district other than the place of origin; (iii) non-migrants are those who had never moved out of their native place for work.

Sampling design

The first step in the sampling procedure was to estimate the sample size to detect a difference of at least 7 percent in sexual behavior outside marriage (ever) between non-migrants and returned or active migrants with 80 percent power using a cutoff for statistical significance of 0.05. These proportions indicated a sample of approximately 300 per group; we purposefully inflated the sample size of non-migrants (to cover 400 instead of 300), assuming that risky sexual behaviors would be significantly lower in this group.

The second step in the sampling procedure involved the identification and selection of villages with a sufficient number of out-migrants to attain the desired sample size for each of the three categories in each district. We first selected three *tehsils* (sub-district areas) from each district based on the *tehsil* name mentioned by migrants as their native place in the destination district study [1]. Several key individuals in each *tehsil*—staff from the block development office, primary health centres (PHCs), local non-governmental organizations (NGOs) and officials from revenue offices—were contacted to find out the villages from where most men out-migrate. These key individuals guided the preparation of the list of villages and the approximate percentage of households consisting at least one male member who had worked in the past or was currently working outside the district. Six villages from each *tehsil* were randomly chosen following the preparation of the list of villages.

The third step involved the preparation of household lists and the selection of households. It was decided to fix the number of completed interviews at 50-60 men per village with an approximate target of 40 percent non-migrants, 30 percent returned migrants and 30 percent active migrants. From the household lists in each village, 80 households per village were randomly selected estimating a 20 percent loss. In each selected household, a key individual (usually the head of the household) was asked to give information on himself (or herself), and other family members, and the migration status of the men. From the list of household members, one eligible individual (>18 years old, non-migrant, returned migrant or active migrant) from each household was randomly selected using KISH tables (a method developed by Lesley Kish), which allows the data collection team to randomly select potential participants with equal probability from the list of eligible household members [37]. Through this approach, 1,440 households were contacted from each district, and interviews conducted with men from a total of 2,104 households across two districts: 1,034 from Prakasam district and 1,070 from Azamgarh district. Of the remaining 776 households, in 680 households all the men were working outside the district at the time of survey, in 76 households men refused to participate in the survey, and in 20 households men did not complete the interview and were excluded from the database.

Ethical considerations

Procedures for this study were reviewed and approved by the institutional review board of the Population Council. Verbal consent was obtained from all respondents before the interview.

Assessment

Participants received a 45 minute interviewer-administered questionnaire in Hindi (for Azamgarh district) and Telugu (for Prakasam district) assessing demographics, migration history, sex risk behaviors, and history of STI-like symptoms. Survey questionnaires were developed in English and then translated into the local language. The translated questionnaires were reviewed by a study investigator fluent in all three languages. Interviews were conducted by graduates or postgraduates in sociology, anthropology or statistics. Interviewers were experienced in quantitative data collection techniques and field-based public health and HIV/AIDS research. They were trained in data collection using the questionnaire for this study. Data quality and management involved immediate review of the completed questionnaire by each interviewer after completing the interview to ensure accuracy and completeness, same-day review by the supervisor, and weekly transport of questionnaires to the data management team in Delhi. Trained data entry officers entered the data weekly and processed it to verify consistency and accuracy, using SPSS.

Measures

Demographic data were collected based on questions modified or taken from the Demographic and Health Survey and Population Council surveys and included age, level of education, income, religion, marital status, and number of children.

Sexual behaviors were assessed for each type of sex partners: sex worker, casual unpaid sex partner, and male sex partner. For each type of partner, participants were asked about the number of partners with whom they had sex as well as the number of sexual encounters

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in their lifetime and in the past year. They were also asked, again by type of partner, the frequency of unprotected sex out of all sex encounters (indicated by condom use in number of sex episodes) in the past year. All these items were used to provide descriptive data on the sexual behaviors of the population.

To determine the place where migrants had initiated such behaviors– in the place of destination or place of origin– migrants (both returned as well as active) were asked to indicate by partner type, their history of sex with sex workers at the place of origin prior to first migration, at the places of destination during migration, and the place of origin during past and current visits. Participants were also asked about whether or not they had used condom all the times that they had sex in each of these places (coded as 1=yes, used all the times; 2=no, not used all the times).

Data analysis

All analyses were conducted separately for Prakasam and Azamgarh districts due to different patterns of male out-migration as well as different cultural norms and behaviors in these two regions. Basic descriptive analyses were run on selected socio-demographic characteristics to describe the sample. All analyses were performed using SPSS software (version 16.0; SPSS Inc.).

Association between migration status of the participants and risky sexual behaviors

The outcome variables used in the analyses were: (a) ever had sex with sex workers or casual unpaid female partners, (b) ever had sex with a male partner, (c) consistent condom use in sex with female sex workers and casual unpaid partners in the past year, and (d) overall risky sexual behavior (computed from the following indicators: had sex with both sex worker and casual unpaid partners, inconsistent condom use with sex workers and inconsistent condom use with casual unpaid partners in the past year). Migration status of the individual was the main independent variable of interest. Logistic regression models were used to estimate the effects of migration status after controlling for potential demographic confounders such as age, education, marital status (currently married vs. not currently married) and occupation (agriculture vs. others). To avoid possible collinearity, pair-wise Spearman correlations between the independent variables and covariates were assessed prior to regression modelling, and no covariate from the pair of variables with correlation greater than 0.40 was included in the model.

Assessment of migrants' places (origin and destination) of initiating and continuing sex

Information on participants' sexual history on timing of initiating sex at the place of origin (prior to first move, during current visit, between first move and current visit) and initiating sex at place of destination was used to describe the place of initiating and continuing sex with either paid or unpaid partners. Using this information, the descriptive statistics estimated (a) the proportion of men who continued to have sex in the place of destination, among those who initiated sex at the native place before their first move, and (b) the proportion of men who continued to have sex in the native place among those who initiated sex in the destination place. Additionally, the question on consistent condom use in sex with each type of partner (in order to reduce recall bias with condom use in a specific number of episodes) in each of the places of origin and destination during migration history was used to describe safe sex behavior in these places.

Results

Participant characteristics by migration status

The demographic characteristics of the participants by migration status for Prakasam and Azamgarh districts are shown in Table 1. In both the study districts, returned migrants were older than non-migrants and active migrants. Relatively higher proportions of returned migrants were currently married than active migrants and non-migrants. In Prakasam district, a relatively higher percentage of non-migrants than the migrants had completed high school (42 percent vs. 34 percent, z-value=2.60; p=0.009). Similar findings are noted in Azamgarh district. The large majority of surveyed men (irrespective of migration status) from Prakasam district were engaged in agricultural work, while fewer in Azamgarh district reported that they were engaged in agricultural work. The mean age at first migration for migrants in the study districts ranged between 18 and 20 years. Both migrants and non-migrants in Prakasam district had initiated sex at the age of about 19 years. In Azamgarh district, returned migrants had initiated sex about a year later than non-migrants or active migrants. In both districts, migrants had spent an average of 5-6 months at home during their last visit to their place of origin. Reasons for their last visit to the place of origin included agriculture purpose (Prakasam - 5 percent, Azamgarh - 22 percent), vacation (Prakasam - 1 percent, Azamgarh - 27 percent), to attend a marriage/function (Prakasam - 6 percent, Azamgarh - 15 percent), for rest/break in between work (Prakasam - 84 percent, Azamgarh - 23 percent), to attend a festival (Prakasam - 4 percent, Azamgarh - 9 percent).

Association between migration status and risky sexual behavior

The proportion of men having sex with paid or casual unpaid partners in the past 12 months shows significant

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Table 1 Socio-demographic characteristics of non-migrants, returned migrants and active migrants in Prakasam and Azamgarh districts, India

	Non-migrants	Returned migrants	Active migrants	Total
	%	%	%	
Prakasam district				
Total sample size	401	317	316	
Age (Mean±SD)	26.6 ± 6.1	28.8 ± 5.1	26.5 ± 5.5	27.3 ± 5.7
Currently married	66.8	86.4	70.6	74.0
Median age at marriage	20.0	21.0	20.0	20.0
Education				
Illiterates	10.5	8.2	10.8	9.9
High school and above education	42.4	30.3	38.3	37.4
Engaged in agricultural work	38.7	24.9	22.5	29.5
Age at first migration (Mean±SD)	–	20.3 ± 3.9	18.8 ± 3.9	19.6 ± 4.0[#]
Duration of stay in place of origin in the last visit*	–	-	5.7±4.6	-
Age at first sex (Mean±SD)	18.9±2.5	18.9±2.2	18.7±2.3	18.8±2.3
Azamgarh				
Total sample size	431	319	320	
Age (Mean±SD)	28.5 ± 6.7	35.2 ± 5.8	27.6 ± 6.1	30.2 ± 7.1
Currently married	67.8	96.9	71.3	77.5
Median age at marriage	19.5	20	20	20
Education				
Illiterates	7.2	3.1	5.3	5.4
High school and above education	39.2	34.2	51.9	41.5
Engaged in agricultural work	12.3	5.0	3.8	7.8
Age at first migration (Mean±SD)	–	19.1 ± 3.6	18.7 ± 3.2	18.9 ± 3.4[#]
Duration of stay in place of origin in the last visit	–	-	4.8±5.1	-
Age at first sex (Mean±SD)	18.4±3.6	19.6±4.0	17.5±3.8	18.5±3.9

[#] Computed only for migrants.

* Computed for the last visit of migrants (active) to their native place.

variation between non-migrants and migrants (Table 2). In both districts, active and returned migrants engaged more often than non-migrants in risky sexual behavior. For example, active migrants from Prakasam district were significantly more likely than non-migrants to report sex with a sex worker (14.6 percent vs. 7.5 percent; z-value= 3.06, p=0.002), sex with a casual unpaid partner (34.5 percent vs. 25.2 percent; z-value=2.72, p=0.007), sex with both a sex worker and a casual partner (13.9 percent vs. 7.5 percent; z-value=2.81, p=0.005) and sex with more than three sexual partners (17.7 percent vs. 9.2 percent; z-value=3.36, p<0.001) in the 12 months prior to the survey. Similarly, active migrants from Azamgarh district were significantly more likely than non-migrants to report sex with a sex worker (19.4 percent vs. 6.5 percent; z-value=30.53, p<0.001), sex with both a sex worker and unpaid casual partners (4.2 percent vs. 15.3 percent; z-value=32.60, p<0.001) and risky sexual behavior (6.8 percent vs. 16.5 percent; z=value=12.42, p=0.002) in the 12 months prior to the survey. Consistent condom use in sex with sex workers in both districts was higher than with casual unpaid partners.

Table 3 presents the results of multiple logistic regression analyses, which confirm the differences noted above in risky sexual behavior between migrant and non-migrant men. The results show that even after controlling for socio-demographic characteristics, risky sexual behaviors are higher among both active and returned migrants than non-migrants. Returned migrants were two times more likely to have had sex with paid partners in last 12 months (in Prakasam: aOR=1.7, 95% CI: 1.0-2.9; in Azamgarh: aOR=1.7, 95% CI: 1.0-2.9) than non-migrants. Similarly, active migrants were significantly more likely to have sex with paid partners than non-migrants (in Prakasam: aOR=2.1, 95% CI: 1.2-3.4; in Azamgarh: aOR=4.0, 95% CI: 2.4-6.6). The likelihood of having sex with a casual unpaid partner is significantly higher among migrants than non-migrants in Prakasam district but not in Azamgarh district. Consistent condom use with a casual unpaid partner was reported to be higher among active migrants than non-migrants in both the study districts (in Prakasam: 31 percent vs. 16 percent, aOR=2.3, 95% CI: 1.1-4.6; in Azamgarh: 33 percent vs. 11 percent, aOR=4.0, 95% CI: 1.6-9.9).

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Table 2 Number and type of sex partners, unprotected sex practices, STI risk of non-migrants, returned migrants and active migrants in Prakasam and Azamgarh districts, India

	Prakasam district				Azamgarh district			
	Non-migrants	Returned migrants	Active migrants	p-value[1]	Non-migrants	Retuned migrants	Active migrants	p-value[1]
Total sample size	**401**	**317**	**316**		**431**	**319**	**320**	
	%	**%**	**%**		**%**	**%**	**%**	
Ever had sex with								
Either sex worker or casual unpaid partner	40.4	57.7	57.6	<0.001	38.3	42.3	47.8	0.033
Male partner	1.5	0.9	1.9	0.602	3.0	4.4	1.9	0.184
Had sex in past 12 months with								
Sex worker	7.5	12.0	14.6	0.009	6.5	10.3	19.4	<0.001
Casual unpaid partner	25.2	33.4	34.5	0.011	21.1	16.9	27.5	0.005
Both sex worker and casual partner	7.5	11.4	13.9	0.019	4.2	6.3	15.3	<0.001
3+ sex partners	9.2	15.5	17.7	0.003	10.4	10.0	17.2	0.007
Consistent condom use[#] in past 12 months with								
Sex worker[2]	76.7 (30)	68.4 (38)	73.9 (46)	0.732	28.6 (28)	42.4 (33)	41.9 (62)	0.435
Casual unpaid partner[4]	15.8 (101)	22.6 (106)	31.2 (109)	0.031	11.0 (91)	16.7 (54)	33.0 (88)	0.001
Risky sexual behavior[$]	9.3	12.3	13.1	0.334	6.8	8.6	16.5	0.002

[1] Chi-square test.
[2] Among those who had sex with sex workers in last 12 months.
[3] Among those who had sex with sex workers.
[4] Among those who had sex with casual unpaid female partners in last 12 months.
[5] Among those who had sex with casual unpaid female partners.
[#] Every time condom use in sex episodes in past12 months prior to the survey with specific type of partner (irrespective of place of origin or destination).
( ) Data in parenthesis indicates the total sample size for that variable.
[$] No consistent condom use in sex with both sex worker and/or casual unpaid partner, and having sex with both sex worker and casual unpaid partners.

Where do migrants initiate risky sexual behavior?

Results presented in Table 4 indicate that sexual relationships among migrants initiated at the place of origin were primarily non-commercial. A higher proportion of migrants initiated sex with a paid partner at the place of destination than at the place of origin. However, a higher proportion of migrants initiated sex with a casual unpaid partner at the place of origin than at the place of destination.

Among those who initiated sex with a female partner (either a sex worker or a casual unpaid partner) in the place of origin, nearly half (47 percent in Prakasam and 48 percent in Azamgarh) in both the districts reported continuing the practice at the place of destination. Surprisingly, a considerable proportion of those who initiated sex in the place of origin (Prakasam: 33 percent, Azamgarh: 36 percent) reported having sex only at the place of origin during migration and not at the destination area. Nearly half of the migrants (46 percent) in Prakasam and one-fifth (21 percent) in Azamgarh who had initiated non-spousal sex at the place of destination continued the practice at the place of origin as well. Results in Table 5 suggest that among migrants, consistent condom use in sex with either a sex worker or a casual unpaid partner is lower in the place of origin than in the place of destination. For instance, in Azamgarh district, only 14 percent (n/N=3/21) of returned migrants who had sex with sex workers in place of origin in present visit reported consistent condom use as compared to 54 percent of those returned migrants who had sex with sex workers in the places of destination during migration reported consistent condom use ($p<0.05$). Similar results are noted for returned migrants on condom use in sex with either sex workers or casual unpaid partners in Prakasam district. The consistent condom use in sex with either sex workers or casual unpaid partners by active migrants in Prakasam district (as a place of origin) is significantly low as compared to level of consistent condom use by these men in sex at the places of destination.

Discussion

The current study documents higher rates of risky sexual behaviors among migrant than non-migrant men in the place of origin, a finding consistent with previous research studies conducted in the place of destination [1,20-24,38]. Our study results also suggest that returned migrants continue to practice such behaviors in the place of origin and a higher proportion of active migrants are engaged in risky sexual behaviors in the place of origin than in destination areas. Further, results suggest that initiation of sexual behavior among

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Table 3 Associations between migration status and sexual behaviors, unprotected practices of study participants in Prakasam and Azamgarh districts, India

	Prakasam district		Azamgarh	
	Returned migrants/Non-migrants	Active migrants/Non-migrants	Returned migrants/Non-migrants	Active migrants/Non-migrants
	AOR[1] (95% CI)	AOR[1] (95% CI)	AOR[1] (95% CI)	AOR[1] (95% CI)
Ever had sex with				
Either sex worker or casual unpaid partner	1.85 (1.36-2.54)*	1.86 (1.36-2.53)*	1.19 (0.86-1.64)	1.43 (1.06-1.96)**
Male partner	0.56 (0.13 – 2.40)	1.19 (0.36 – 3.89)	1.78 (0.73 – 4.31)	0.60 (0.22 – 1.64)
Had sex in past 12 months with				
Sex worker	1.72 (1.02 – 2.91)**	2.05 (1.24 – 3.38)*	1.68 (0.96 – 2.94)	4.00 (2.43 – 6.59)*
Casual unpaid partner	1.57 (1.11 – 2.23)**	1.50 (1.06 – 2.11)**	0.95 (0.63 – 1.43)	1.41 (0.98 – 2.02)
Both sex worker and casual partner	1.63 (0.95 – 2.77)	1.93 (1.17 – 3.20)**	1.44 (0.72 – 2.88)	4.45 (2.47 – 8.02)*
3+ sex partners	1.78 (1.10 – 2.88)**	2.03 (1.28 – 3.22)*	1.22 (0.72 – 2.06)	1.92 (1.23 – 3.01)*
Consistent condom use[#] in past 12 months with				
Sex worker[2]	0.98 (0.29-3.31)	0.80 (0.25-2.60)	1.42 (0.46-4.42)	1.53 (0.55 - 4.23)
Casual unpaid partner[4]	1.40 (0.66-3.00)	2.29 (1.13-4.60)**	1.15 (0.39-3.39)	4.00 (1.62 - 9.93)*
Risky sexual behavior[$]	1.79 (1.01-3.19)*	1.54 (0.87-2.72)	1.46 (0.68-3.12)	3.05 (1.59-5.87)

AOR, Adjusted odds ratio; CI, confidence interval; STI, sexually transmitted infection.

The independent variable coding for the odds ratios presented are: Returned migrants (coded as 1) /Non-migrants (coded as 0); Active migrants (coded as 1) /Non-migrants (coded as 0).

[1] Controlled for age, education, marital status and occupation.

[2] Among those who had sex with sex workers in last 12 months.

[3] Among those who had sex with sex workers.

[4] Among those who had sex with casual unpaid female partners in last 12 months.

[5] Among those who had sex with casual unpaid female partners.

[#] Condom use at last time sex in 12 months prior to the survey with specific type of partner (irrespective of place of origin or destination).

* p<0.01, ** p<0.05.

migrants is mostly connected to their native place rather than their destination place. Most migrants initiate sex in the place of origin before their first migration to a destination area, and continue to practice such activities in the place of destination. However, migrants' behaviors in destination areas are strongly linked to their exposure to sex workers, and their behaviors in the place of origin are strongly linked to sex with casual unpaid female

Table 4 Migrants' initiation into sex work and their continuation of sex between places of origin and destination

	Prakasam district			Azamgarh district		
	Sex worker	Casual unpaid partner	Any partner[#]	Sex worker	Casual unpaid partner	Any partner[#]
	%	%	%	%	%	%
Total sample size	**633**	**633**	**633**	**639**	**639**	**639**
Migrants who never had sex	75.0	44.9	42.0	75.9	54.1	48.8
Migrants who initiated sex in place of origin	9.8	42.5	43.4	7.5	42.7	43.7
Migrants who initiated sex in place of destination	15.2	12.6	14.5	16.6	3.1	7.5
p-value	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Number who initiated sex in place of origin	**62**	**269**	**275**	**48**	**273**	**279**
Had sex in destination after initiating at place of origin [total]	59.7	39.4	46.9	49.0	23.5	47.7
Had sex in destination only	19.4	6.7	6.9	29.2	2.6	9.0
Had sex both in destination and in origin during their migration	40.3	32.7	40.0	18.8	20.9	38.7
Had sex in only origin areas during their migration	16.1	39.4	32.7	43.8	53.1	35.5
Did not have sex in any area during migration after they first had sex before migration	24.2	21.2	20.4	8.3	23.4	16.9
Number who initiated sex in place of destination	**96**	**80**	**92**	**106**	**20**	**48**
Had sex in destination areas only but not in origin	45.8	56.3	54.4	85.9	75.0	79.2
Had sex in both destination and origin areas	54.2	43.8	45.7	14.2	25.0	20.8

[#] Sex either with sex worker and/or casual unpaid female partner.

Table 5 Percent male migrants who reported consistent condom use[$] during sex in places of destination and places of origin by type of partner

Consistent condom use in sex with	Prakasam district			Azamgarh district		
	Sex worker	Casual unpaid partner	Any partner[#]	Sex worker	Casual unpaid partner	Any partner[#]
	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)
Both returned and active migrants sample[@]	**158**	**349**	**367**	**154**	**293**	**327**
At place of origin before first move	72.4 (42/58)	19.6 (43/220)*	28.9** (68/235)	36.4 (12/33)	17.2* (44/256)	19.1** (50/262)
At place of origin during migration	59.4* (41/69)	25.9 (45/174)	38.8** (76/196)	30.6* (11/36)	27.9 (53/190)	28.1** (57/203)
At place of origin in present visit	71.9 (41/57)	20.0 (38/190)	35.9** (71/198)	23.3** (7/30)	26.1 (36/138)	27.2** (40/147)
At places of destination during migration[(R)]	74.4 (99/133)	26.9 (50/186)	55.7 (123/221)	53.5 (69/129)	27.4 (23/84)	44.2 (80/181)
Returned migrants sample[@]	**77**	**176**	**182**	**84**	**142**	**159**
At place of origin before first move	64.0 (16/25)	21.2 (24/113)	28.9** (35/121)	25.0** (4/16)	13.1** (16/122)	14.3** (18/126)
At places of origin during migration	67.7 (23/34)	27.0* (24/89)	40.4 (40/99)	23.8* (5/21)	25.0 (23/92)	24.8** (25/101)
At places of origin in present visit	76.7 (23/30)	19.8 (19/96)	38.0* (38/100)	14.3** (3/21)	24.2 (16/66)	25.4** (18/71)
At places of destination during migration[(R)]	71.2 (47/66)	22.7 (20/88)	51.8 (57/110)	54.1 (40/74)	31.6 (12/38)	46.9 (45/96)
Active migrants sample[@]	**81**	**173**	**185**	**70**	**151**	**168**
At place of origin before first move	78.8 (26/33)	17.8* (19/107)	29.0** (33/114)	47.1 (8/17)	20.9 (28/134)	23.5** (32/136)
At place of origin during migration	51.4** (18/35)	24.7 (21/85)	37.1** (36/97)	40.0 (6/15)	30.6 (30/98)	31.4 (32/102)
At place of origin in present visit	66.7 (18/27)	20.2 (19/94)	33.7** (33/98)	44.4 (4/9)	27.8 (20/72)	29.0 (22/76)
At places of destination during migration[(R)]	77.6 (52/67)	30.6 (30/98)	59.5 (66/111)	52.7 (29/55)	23.9 (11/46)	41.2 (35/85)

n - number used condoms consistently in sex; N - number who had sex with that specific partner within that place.

[@] - Total sample who had sex with the specific partner either in place of origin or place of destination.

* p<0.05, ** p<0.01

[(R)] - Reference Category for comparison between proportions.

[$] - Based on separate questions that asked about every time condom use in sex with different type of partners (sex worker or casual unpaid female partner) in places of origin and destination.

[#] - Consistent condom use in sex either with sex worker or casual unpaid or both partners (as applicable) in places of origin and/or destination.

Note: p-value refers to test for difference between proportions. Place of destination is used as the reference category to measure the differences in condom use behavior at place of origin at different times during the migration.

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partners. These findings are consistent with growing evidence from India over the past few years documenting a growing concern regarding the sexual behavior of individuals and increasing HIV incidence among ANC clinic attendees in places of origin that are known to have very low HIV prevalence a decade ago [31,39,40]. More importantly, a considerable proportion of non-migrant men were also found to have engaged in sex with sex workers as well as casual unpaid partners, which indicates the existence of a high level of local sexual networks in the places of origin. This, in combination with unprotected sex among non-migrant and returned migrant men in places of origin and unprotected sex with sex workers among migrants in destination areas, may contribute to the spread of the HIV epidemic in the places of origin.

Notably, few migrants reported sexual debut with a casual unpaid partner in the destination areas. Those who initiated sexual activity with a paid or unpaid partner in the destination area continued to have sex with such partners upon return to the place of origin, particularly in Prakasam district. The pattern of sexual behavior in Prakasam district (largely within-state migration) seems to parallel the situation in other settings, which indicates that the enhanced social status of migrants and exposure to commercial sex in the destination place enables them to seek and receive sexual favors more successfully from women in their village of origin [41]. Perhaps, in the case of Prakasam district, the high frequency of migration to the place of origin between periods of work in the destination area provides them more opportunities to seek and practice the sexual risk behaviors that were initiated in places of destination. In contrast, in Azamgarh district, the large majority of those who initiated sex in the destination area continued to have sex only in the destination area and not in the place of origin. Unprotected sex by migrants is relatively higher in places of origin than in places of destination, and more so in Azamgarh district than in Prakasam district. Relatively high rates of consistent condom use by migrants (particularly with sex workers) in Prakasam district of Andhra Pradesh than the Azamgarh district of Uttar Pradesh can be explained by the differences in intensive HIV prevention efforts in Andhra Pradesh state versus Uttar Pradesh state [40].

Nonetheless, unprotected sex is high in places of origin in general, though patterns differ for migrants and non-migrants. Although the percentage of migrants having sex with sex workers in the place of origin is relatively low, almost all those who had sex with paid partners also had sex with a casual unpaid partner, a finding that highlights the concurrent relationships in this group of men. Moreover, unprotected sex with casual unpaid sexual partners among non-migrant as well as migrant men was much higher than unprotected sex with paid partners. This may be because casual unpaid partners are known and trusted individuals living within their area or nearby. An exploratory analysis in this direction from the study data in Prakasam district indicates that about one-third of men who had sex with casual unpaid partners reported their last sexual partner was a neighbor while about one-fourth reported that their last sexual partner was a friend or acquaintance. In Azamgarh district, about half of the total men who had sex with a casual unpaid partner reported that their last sexual partner was a neighbor, and one-fifth reported that their last sexual partner was a relative. These findings suggest that infected returned or active migrants are likely to transmit infection to their neighbors, friends, and relatives in places of origin through the continuation of risky sexual behavior.

In sum, the overall level of risky sexual behaviors varies significantly by district, as do the associations between migration and unprotected sex with different type of partners. There could be several reasons for such differences. First, men in Prakasam district migrate mainly to neighboring districts (short distance migration) within the state of Andhra Pradesh whereas men from Azamgarh district migrate mostly to other states (long distance migration) particularly to the state of Maharashtra. Such short distance migration provides them opportunity for frequent visits to the native place where they may have already established sexual networks with other women. The availability of disposable money and frequent visits create opportunities for expanding existing sexual networks at the native place. In contrast, migrants from Azamgarh district visit their native place less frequently and therefore probably have less opportunity to continue or expand their sexual networks at their native place. Second reason for such variations in the level of sexual risk behaviors may be that in contrast to migrants from Azamgarh, those from Prakasam do not face language or cultural barriers as their place of destination and origin are similar. The lack of cultural barriers is an advantage for migrants when buying sex from sex workers or soliciting sex from casual unpaid partners in both the place of destination and origin. This can be substantiated by the finding that a higher proportion of multiple sexual partners are reported in Prakasam district than in Azamgarh district. In contrast, a small proportion of migrants from Azamgarh district initiated sex with a casual unpaid partner at the place of destination. Moreover, the proportion of migrants who initiated non-spousal sex at the place of origin and continued similar practices at the place of destination is quite low. This result to an extent supports the finding that language barriers faced by the migrants in case of inter-state migration play a critical

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role in limiting risky behaviors at the places of destination [24]. Third, these differences may also reflect cultural variations to the extent that a much higher proportion of men in south India have non-regular sexual partners than in the north [34]. The persistent risk of HIV transmission is notable given that both the districts included in the study show high and rising HIV prevalence among women attending ANC clinics [34]. For women attending ANC clinics, the primary source of infection may be sex with infected men—migrant husband as well as others when husband is away. Due to lack of information on sexual networks of women in the place of origin as well lack of biological data in the current study, it was difficult to document the potential role of migration in the spread of HIV infection to both men and women and to their married partners. Further research is needed to understand the migration-related spread of HIV infection versus the spread through local sexual networks in districts with high out-migration and high HIV prevalence. Research is also needed to examine systems of sexual networks for both men and women and the potential utility of tapping such networks for HIV prevention interventions in selected places of origin. Some insights into this issue are provided via an exploratory analysis in the current study, which indicates that a large proportion of non-migrants and migrants reported having sex with sex workers as well as casual unpaid partners including unmarried women, married women in the neighborhood, as well as wives of migrant men who have been left behind. These results highlight that there are specific groups of sexual partners with whom these different categories of migrant men continue to have sex in the place of origin. In the context of rural India (often the places of origin), there are complex sexual relationships men may have with women that pose greater risk for HIV, particularly migrant men's wives who have been left behind.

Findings from this study have important implications for the current strategies and design of national HIV/AIDS prevention programs. The existing intervention approaches in places of destination [1] among migrants completely ignore the fact that many migrants initiate sex outside marriage and some initiate sex with sex workers even in their native place. Existing interventions in destination areas are based on the assumption that condom use promotion among female sex workers can protect migrant men and thus prevent further transmission, but do not consider secondary transmission from infected migrant men to their spouses and other female populations, including sex workers in the places of origin. More importantly, interventions in the destination areas do not focus on returned migrants as well as on non-migrants who represents a pool of potential migrants. The present study shows that a greater proportion of returned migrants continue to have unprotected sex with sexual partners in their native place and a considerable proportion of non-migrants also engage in risky sexual behavior. Moreover, both groups initiated sex at about the same age. These results indicate the need for initiating HIV prevention efforts in places of origin with high out-migration. While such efforts may not be necessary in all places of origin because such places are difficult to identify, initial efforts could focus on districts identified to have high male out-migration and emerging HIV prevalence among women in ANC clinics or men in integrated counseling and testing centres (ICTCs). Through this strategy, potential migrants can be counseled about safe sex practices even before they migrate as well as informed about HIV prevention services available at places of destination.

While the present study contributes important information to guide future research and programmatic work relevant to primary and secondary HIV prevention in districts with high out-migration in India, it must be considered in the light of a few study limitations. The sample was drawn from two high HIV prevalence districts with net out-migration at the district level, and included a sample of men from households in the villages who were available at the time of survey. These factors may limit the generalization of findings to a total sample of migrants and non-migrants in districts with high out-migration. However, given that the data were collected from areas with within-state and out-of-state migration, it is expected that the potential risks in patterns of migration would be reduced while examining the linkage between migration and HIV risk behaviors of men in their native place. Additionally, much of the data in this study came from self-reports of behavior and covered the period of their migration history, and are thus subject to both social desirability and recall biases, particularly in case of retrospective data from migrant men. Male interviewers of similar age were recruited to increase comfort and reduce social desirability bias. Additionally, major events were referred in the questionnaire, such as prior to first move, during migration at the destination areas, during migration at the place of origin and in the current visit, to reduce recall biases in retrospective data. Finally, the use of retrospective information rather than the prospective longitudinal data precludes claims of causality based on the observed associations. Additional research with longitudinal data would be useful to confirm current findings and explore in greater detail issues that could not be explained from the results.

Conclusions

The present study contributes to the growing literature on sexual risk among populations in their place of origin

in India by examining risky sexual behavior among three categories of men - active migrants, returned migrants and non-migrants. Findings document that a higher proportion of both returned and active migrants engaged in risky sexual behaviors than the non-migrants. Most migrants initiate non-marital sex in the place of origin and many continue these behaviors in places of destination. Migrants' destination area behaviors are linked to sex with sex workers and they continue to practice such behaviors in the place of origin as well. Unprotected sex in places of destination with high HIV prevalence settings poses a risk of transmission from high risk population groups to migrants, and in turn to their married and other sexual partners in native places. More importantly, the finding that returned migrants reported having sex with unpaid sexual partners, such as unmarried women or wives of married migrant men left behind, points to an area of concern in places of origin. These findings support the need for HIV prevention interventions in selected places of origin with high male out-migration and emerging HIV prevalence among ANC clinic attendees or ICTC centres in India. These interventions would need to be tailored to focus on the populations most at risk for HIV – potential and active migrants and their sexual partners including left-behind wives.

List of abbreviations used

AIDS: Acquired immune deficiency syndrome; AOR: Adjusted Odds Ratio; CI: Confidence Interval; HIV: Human Immunodeficiency Virus; NACO: National AIDS Control Organisation; NGO: Non-Governmental Organization; ANC: Antenatal care; PHC: Primary Health Centre; ICTC: Integrated Counseling and Testing Centre; SPSS: Statistical Package for Social Sciences; STI: Sexually Transmitted Infections.

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Authors' contributions

NS led the study design, conception, analyses, and drafted the manuscript. BM assisted with the analyses and manuscript writing. SNS participated in the design of the study and performed the statistical analysis. AKJ provided overall guidance with analytical approach and interpretation of study findings. All authors read and approved the final manuscript.

Competing interests

The authors have no financial benefits or competing interests related to this submitted work.

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Male migrants' non-spousal sexual partnerships in the place of origin: an in-depth investigation in two rural settings of India

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Male migrants' non-spousal sexual partnerships in the place of origin: an in-depth investigation in two rural settings of India

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Male migrants in India are at disproportionately high risk for HIV, not only because of their sexual behaviours in destination areas but also due to their risk behaviours in their place of origin. While studies have documented male migrants' risky behaviours in the home setting, few have attempted to understand the underlying socio-cultural context in which they engage in such behaviours. This paper examines the patterns and context of male migrants' non-spousal sexual partnerships in two high-out-migration districts of India. Data, drawn from a cross-sectional behavioural mixed-methods study conducted in 2008, included a structured survey with 1272 migrants, followed by in-depth interviews with 33 male migrants. Results suggest that sexual activity was common in the place of origin: around 50% of migrants had sex with a non-spousal female partner and two-fifths had initiated sex in this setting. Migrants' non-spousal sexual behaviours in the home village were influenced by the prevailing socio-cultural context, including migrants' enhanced socio-economic status, attitudes to non-spousal sex and accessibility of sexual partners. Male migrants' non-spousal sexual partnerships in source areas are influenced by socio-cultural factors, which must be considered when designing HIV programmes in India and elsewhere.

Keywords: socio-cultural context; male migrants; India; place of origin; HIV

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Background

Studies in India document that migration plays an important role in the spread of HIV among both men and women in migrants' place of origin (Saggurti et al. 2011a, 2012). Migrants are likely to acquire HIV due to their high-risk behaviours in destination areas (Deering et al. 2008; Saggurti et al. 2008, 2009), and transmit the infection to their sexual partners in the place of origin due to their continued risk behaviours (Dhapola et al. 2007; Saggurti et al. 2011a). Studies conducted in the place of origin suggest that migrants engage in unprotected sex with both commercial and unpaid non-spousal female partners, many of whom are left-behind wives of migrants (Dhapola et al. 2007; Halli et al. 2007; Saggurti et al. 2011a). A study in rural Jharkhand indicates that among migrants who ever had sex, the vast majority (80%) reported sex in the place of origin, while around one-quarter (24%) had engaged in sex at their destination (Dhapola et al. 2007).

In-depth investigations reveal that the socio-cultural environment has a significant influence on men's sexual behaviours. These factors include community norms and practices (McCreary et al. 2008; Soskolne and Shtarkshall 2002), traditional gender roles and gender power inequalities (Gupta 2002; McCreary et al. 2008), stigma and

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discrimination (Nguyen et al. 2012) and low education status (Ordóñez and Marconi 2012). Research in different settings shows that social and cultural norms, including those condoning gender inequities and male dominance, shape sexual interactions such as types of sexual relationships (non-spousal/premarital/transactional), the frequency of and opportunities for sexual contact, and condom use (Halli et al. 2007; Parker 2001; McCreary et al. 2008; McMillan and Worth 2011). Prevailing traditional gender norms allow men greater sexual freedom, opportunity and mobility than women, and condone multiple sexual partnerships (Gupta 2000).

A few researchers have explored the role of socio-cultural factors in shaping male migrants' sexual behaviour in their place of origin (Poudel et al. 2004; Dhapola et al. 2007; Halli et al. 2007; Saggurti et al. 2011a). A study in south India has documented that migrants' extramarital sexual relationships are perceived as normal and attributable to the 'polygamous nature of men' (Halli et al. 2007). Prior research suggests that along with socio-cultural factors, economic conditions also shape men's, particularly migrants', sexual behaviour. The literature indicates that the economic resources generated by migration in destination areas allow migrants access to multiple sexual partners in the home setting, and that they may engage in multi-partner sex as a symbol of socio-economic success (Chirwa 1997; Dhapola et al. 2007; Poudel et al. 2004). Against this background, a further understanding of the context underlying migrants' risky sexual behaviours in the place of origin will help design appropriate HIV-prevention programmes.

Building on previous quantitative research findings (Saggurti et al. 2011a), this mixed-method (qualitative and quantitative) study examines the socio-cultural context of non-spousal sexual partnerships among a sample of migrant men in two high male out-migration districts of rural India. It explores the nature of sexual partnerships, extent of sexual activity, sexual partner characteristics, partners at first and recent sex and the contexts in which migrants are likely to engage in HIV-risk-related behaviours.

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Study setting

The study was conducted in 2008 in the rural areas of two districts: Prakasam in the southern state of Andhra Pradesh, and Azamgarh in the northern state of Uttar Pradesh. Both districts report varying levels of development; for example, female literacy is 53% and 63% in Prakasam and Azamgarh, respectively (Registrar General of India [RGI] 2011a, 2011b), and 24% of households in Prakasam versus 57% in Azamgarh are of low-economic status (International Institute of Population Sciences [IIPS], 2010a, 2010b). Prakasam reports high intra-state migration; of the 14% of adult men who had out-migrated for work, 95% had migrated to other districts in the state (RGI 2011a). Azamgarh is characterised by high inter-state migration; around 15% of adult men had migrated outside Azamgarh for work, of whom 75% had travelled outside the state (RGI 2011b). HIV prevalence among antenatal clinic attendees in Prakasam is 2.6%, while the corresponding figure for Azamgarh is close to 1% (National Institute of Health and Family Welfare [NIHFW] and National AIDS Control Organisation [NACO], 2007). Details of the study context and setting are available elsewhere (Saggurti et al. 2011a).

Methods

This paper uses qualitative and quantitative information drawn from a cross-sectional behavioural study. In each district, key individuals – staff from the block development office, primary health centre, local non-governmental organisations and revenue

offices – helped prepare a village list to provide information on the number of households with at least one male member who had worked/was currently working outside the district. Following the preparation of the village list, six villages with more than 40% adult male out-migration from each *tehsil* (sub-district) were randomly selected.

Quantitative survey

A structured survey was conducted among both migrant and non-migrant men in the selected villages. Migrant men were divided into two categories: (1) returned migrants, defined as those who had returned to their place of origin (for at least one year) either due to completion of their job contract or no job at the destination place, and/or employed locally; active migrants, defined as those who were temporarily visiting their place of origin (e.g., to attend a marriage, for a vacation or due to illness) but were currently employed in a district other than their place of origin.

A household listing was done in the selected villages, with details of members in each household. Completed interviews of around 50–60 men per village were targeted. Hence, 80 households per village were randomly selected estimating a 20% loss. In each selected household, a key member (generally the household head) was asked to provide information on himself (or herself) and other family members, and men's migration status. From the list of household members, one eligible individual (18+ years, non-migrant, returned migrant or active migrant) from each household was randomly selected using Kish tables (Kish 1965). Through this approach, 1440 households were contacted from each district, and interviews conducted with men from a total of 2104 households across two districts: 1034 from Prakasam and 1070 from Azamgarh. Of the remaining 776 households, in 680 households all the men were working outside the district at the time of survey, in 76 households men refused to participate in the survey, and in 20 households men did not complete the interview. The analytical sample for the current study includes 1272 male migrants – 636 returned migrants (317 from Prakasam and 319 from Azamgarh) and 636 active migrants (316 from Prakasam and 320 from Azamgarh).

Qualitative study

Following the quantitative survey, 33 male migrants (10 from Prakasam, 23 from Azamgarh) from the surveyed participants were purposively selected for the qualitative study based on their reported sexual behaviour in the survey interview (unmarried men reporting sex with a female partner and married men reporting non-spousal sex with a female partner) in the place of origin in the past 12 months. Every fourth individual (per investigator) reporting sexual risk behaviour was invited to participate in the qualitative study, and those who gave their consent were interviewed. An in-depth interview guide with open-ended questions was used, which provided a structure for the interview while allowing interviewers to ask questions in detail to clarify particular issues. Key topics explored were migrants' first and recent sexual experiences, partner characteristics, types of sexual exchange (paid or unpaid), condom use and the context of sexual partnership formation in the home village. Interviews were conducted in private locations that ensured confidentiality and were convenient to respondents. Each interview lasted approximately 90 minutes. Interviews were audio-taped after seeking the respondent's permission, transcribed, translated and typed in English by the interviewer, and saved as Word files. The translated Word files were reviewed for data quality and developing codes.

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Trained research investigators, fluent in the local language, conducted the qualitative and quantitative interviews. Interviews were conducted in Telugu in Prakasam and Hindi in Azamgarh. Procedures for this study were reviewed and approved by the Population Council's Institutional Review Board. Verbal consent was obtained from each respondent prior to the survey and in-depth interview.

Measures

For the quantitative survey data, demographic information was collected on age, education, income, religion, marital status and number of children. Sexual behaviours were assessed in terms of behaviours associated with non-spousal sex, including unpaid casual sex. Non-spousal sex was defined to include any sexual relationship with a female partner in the village outside the context of marriage. Based on age differences between respondents and their sexual partners, a variable with the following four categories was created for partner at first sex and partner at most recent sex: partner younger-older, younger-younger, older-older and older-younger. Similarly, based on partner type (relative/friend or neighbour), another variable was created with the following four categories for partner at first sex and partner at most recent sex: partner relative/friend-relative/friend, relative/friend-neighbour, neighbour-neighbour and neighbour-relative/-friend.

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Data analysis

The qualitative data were used to explore migrants' sexual partnerships patterns, the nature of sexual relationships and the underlying socio-cultural context of non-spousal sex in their place of origin while the quantitative data were used to describe the profile of respondents and the patterns of first and most recent sexual relationships. For the survey data, basic descriptive analyses were run on selected socio-demographic characteristics to describe the sample. All analyses were conducted using SPSS 16.0. For the qualitative data, a list of mutually exclusive but possibly linked codes was developed. Thematic code lists were generated following repeated readings of the transcripts; then the coded data were further reviewed and summarised. Key ideas and recurring themes were identified, such as the context of first sex, condom use, recent sexual partnerships in the village, types of sexual partners and attitudes to non-spousal sex. The data were coded using Atlas Ti 5.0, and the coded data were used to answer the key research questions in this paper. Participants have been given fictitious names in this paper to ensure confidentiality.

Results

Socio-demographic profile

Respondents in Prakasam were younger than those in Azamgarh (mean age 27.3 years versus 30.2 years). In both districts, three-quarters or more respondents were currently married, around two-fifths were educated up to high school or above and, on average, had spent five or six months in their place of origin on their last visit. A detailed socio-demographic profile of the respondents and an in-depth analysis of migrants' risky behaviours in the place of origin, based on the quantitative survey, have been published elsewhere (Saggurti et al. 2011a).

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Table 1. Migrants' sexual behaviour, Prakasam and Azamgarh, India.

	Prakasam			Azamgarh		
Characteristics	Returned migrants	Active migrants	Total	Returned migrants	Active migrants	Total
Total respondents	$N = 317$	$N = 316$	$N = 633$	$N = 319$	$N = 320$	$N = 639$
% who never had sex	42.6	41.5	42.0	50.2	47.5	48.8
% who had sex with a female partner in place of origin[1]	49.2	51.0	50.1	44.8	45.6	45.2
% who initiated sex in place of origin[1]	43.2	43.7	43.4	43.0	44.4	43.7
Consistent condom use in last 12 months with casual unpaid partner[2]	22.6 ($N = 106$)	31.2 ($N = 109$)	27.0 ($N = 215$)	16.7 ($N = 54$)	33.0 ($N = 88$)	26.8 ($N = 142$)
Initiated sex in place of origin:	$N = 137$	$N = 138$	$N = 275$	$N = 137$	$N = 142$	$N = 279$
Type of partner[3]						
Spouse	8.8	9.4	9.1	3.7	0.7	2.2
Sex worker	2.2	4.4	3.3	6.6	5.6	6.1
Casual unpaid partner[4]	89.1	85.5	87.3	87.6	88.7	88.2

[1] Sex with either casual unpaid female partner and/or sex worker.
[2] Among those who had sex with casual unpaid female partners in the last 12 months.
[3] Sum of the categories may not add to 100 due to 11 missing observations (1 in Prakasam; 10 in Azamgarh).
[4] Includes relatives, neighbours and wives of other migrants.

Sexual activity and sexual partners

Most respondents described first sexual encounters with village women and sex with multiple non-spousal partners in the home setting:

> [Un]til now I have had sex in the village with about 10 women [known unpaid partners]. (Ram, unmarried, age 22, Prakasam)

> I [first] had sex when I was 15. … She was the daughter of a neighbouring relative. … In these two months [since coming to the village] I had sex with 8–10 village women. … I had a desire for sex. She [first sex partner] had a younger sister. I started having sex with her when nobody was in the house. Sometimes I would go to my friend's house. He would leave in the morning and his wife would be alone at home. We became close and we started having sex. I did this for some months. Whenever I got a chance I would have sex. In this way I had relationships [sex] with many village girls. After some time I got married. Then I had sex with her [wife] as well as outside [other women]. (Suneet, married, age 22, Azamgarh)

> There are many village girls with whom we have sex. After sex I give them money. … Girls in the village do not have sex for money but people who like them give them money. … They are from the neighbourhood so work is done [sex is possible]. (Nandu, married, age 26, Azamgarh)

As seen in Table 1, half (45–50%) of all migrants reported ever engaging in sex with a non-spousal female partner in their home village while around two-fifths had initiated sex in this setting.

Migrants described first sex with casual unpaid non-spousal partners, who were primarily known village women, such as relatives, friends and neighbours (hereafter referred to as 'known partners'). None had initiated sex with a sex worker and just one Azamgarh migrant had first sex with a spouse in the place of origin:

> I first had sex when I was 17. … She was my childhood friend. … At the time she was around 16 years. (Gopal, married, age 25, Prakasam)

> The first time I had sex was with my sister-in-law. She was staying nearby. Her husband had gone to Punjab [another state] to work. At that time I must have been 17. (Tapan, married, age 24, Azamgarh)

Subsequent sexual encounters were also primarily with known village women, including wives of other migrant men/co-workers and first sexual partners when they visited their natal village after marriage:

> I am having sex with a neighbouring woman. … She and her husband are labourers. (Manoj, unmarried, age 22, Prakasam)

> My friend [co-worker] had given me money and clothes to give his wife [in the village]. … I went to his house. …. I got attracted to his wife and I wanted to have sex with her. … She was also willing. … I had sex with her five times that month. Then I went back to Mumbai [destination area]. (Deepak, unmarried, age 20, Azamgarh)

> Now she [first sexual partner] is married [and has left the village]. I have sex with her each time she comes to the village. (Vikram, married, age 26, Azamgarh)

Less frequently reported were casual partners who engaged in both paid and unpaid sex with multiple partners from the village or nearby villages:

> There are girls [from the village/nearby villages] who take money for sex. We sometimes pay them but sometimes we do not give them money. Whenever you need them they come. (Vipin, married, age 28, Azamgarh)

A few migrants (n=3) in Azamgarh also reported commercial sex partners in their home village:

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> I asked my friend [in the village] to get a girl for me [for sex]. He arranged a girl for Rs 50. After drinking alcohol we went to her house at night. After that whenever I wanted to have sex I would go there. (Tapan, married, age 24, Azamgarh)

Socio-cultural context

The socio-cultural context prevailing in the home village determined migrants' non-spousal sexual practices in these settings. These factors include migrants' enhanced socio-economic status, relieving the boredom of spousal sex, attitudes to and practices of non-spousal sex, and accessibility of sexual partners in the village.

Migrants' socio-economic status

Migrants returned to their village after earning money in destination areas. These resources were used to build a house and purchase consumer goods in the home village. Migrants' enhanced social status and access to resources attracted village women to form sexual partnerships. Migrants sometimes offered gifts such as clothes and ornaments to their female partners in return for sexual favours:

> I came to the village after one year. I constructed a house [in the village]. Girls and young women from the village started liking me. I had sex with … a village woman. (Ajay, married, age 24, Azamgarh)

> When I came back from Mumbai, I purchased a Compact Disc (CD) player and a television in the village. She [sexual partner] would come to watch CDs … that is how I became close to her. I was also wearing good clothes. Sometimes I would give her money. (Vipin, married, age 28, Azamgarh)

> I came to the village 25 days ago. Since then I have had sex with two women. … I purchased a nice sari for the women and gave them Rs 100. (Vijay, unmarried, age 23, Azamgarh)

Relieving the boredom of spousal sex

Men also engaged in non-spousal sex for variety and to relieve the boredom of spousal sex. Instances of non-spousal sex were reported when migrants' wives visited their natal village, which in some cases continued even after their wife returned:

> When I came home [to the village] … I stayed with my wife for two months. Then my wife went to her village. For that one month I had sex with a neighbour. When my wife came back [from her village] I continued to have sex with my neighbour because I was enjoying sex with her. There was a friend of a girl in the neighbourhood. I offered to pay her for sex. Initially she said no but one day she agreed. (Vipin, married, age 28, Azamgarh)

> I go home for one month and have sex with my wife. Sometimes I go to a sex worker because I enjoy sex with different people. (Tapan, married, age 24, Azamgarh)

Migrants' attitudes to and practices of non-spousal sex

Migrants' described non-spousal sex as a customary practice but also noted that these relationships took place clandestinely in the village. Rather than a major transgression, such sexual contact was perceived to be a sign of 'friendship' between the partners:

> Extramarital relations are common … and cannot be considered a major misconduct. (Ram, unmarried, age 22, Prakasam)

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> Girls in the village allow sex without money … most think it is friendliness. (Vikram, married, age 26, Azamgarh)
>
> These days it is natural, having extramarital sex; in a family a woman has sex with her neighbour. If her brother-in-law gets to know [about the relationship] then she may oblige [have sex] him. In the name of friendship some people have [extramarital] sex. (Shyam, unmarried, age 21, Prakasam)
>
> Several women in this village engage in [non-spousal] sex … they do it secretly without the family's knowledge. (Manoj, unmarried, age 22, Prakasam)
>
> I have been having sex with a woman for the last five years. … Her husband does not know anything [about us]. (Ajay, married, age 24, Azamgarh)

Migrants also considered sex with left-behind wives of other migrants to be a common practice in the village, by which both partners' sexual needs were met. One Azamgarh migrant noted that left-behind wives themselves encouraged such relationships:

> Some women who stay back when their husband migrates engage in extramarital sex with local men. (Ram, unmarried, age 22, Prakasam)
>
> After eight months of marriage, my sister-in-law's husband went to Saudi Arabia … then we became close and started having sex. … She had a need also [for sex] and so did I. (Mangal, married, age 27, Azamgarh).
>
> [Left behind] wives only encourage this behaviour [non-spousal sex]. (Ajay, married, age 24, Azamgarh)

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Accessibility of sexual partners

Women and young girls in the village, particularly migrants' relatives and neighbours, were accessible for sex. Sexual contact with relatives was perceived to be 'easy' because being family members, these friendships were seldom questioned or misconstrued:

> Girls [in the village] are available for sex anytime. … Whenever I want, I have sex with a neighbourhood girl. When she goes out she signals to me for sex … whether it is day or night I meet her in the fields and have sex with her. (Vipin, married, age 28, Azamgarh)
>
> There is an 'aunty' [older woman] who lives next door. … Her husband works in nearby villages. Whenever we feel like we have sex in her house. (Ram, unmarried, age 22, Prakasam)
>
> She is my sister-in-law so nobody doubts us. Sex is possible easily. (Tilak, married, age 32, Azamgarh)
>
> My sister-in-law lives nearby. Whenever I feel like, I have sex with her. There is no problem. (Mangal, married, age 27, Azamgarh)

There were specific occasions such as festivals, marriages and at harvest time when migrants had greater opportunities to have sex with women from the village:

> There are more chances of having sex during festivals and marriages. (Shyam, unmarried, age 21, Prakasam)
>
> In our village the Ramlila [a festival] takes place for 15 days. … [at that time] people drink alcohol at night and sex work takes place … . When the wheat ripens, at that time too, sex takes place. At these times people get more opportunities [for sex]. (Tapan, married, age 24, Azamgarh)
>
> When the crop ripens, many women come to harvest the crop. They have sex with many men. I pay them a little more and have sex with them. … Whenever I come home I have sex with many persons. (Vijay, unmarried, age 23, Azamgarh)

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Table 2. Sexual partnership patterns among migrants who initiated sex in place of origin and had sex with unpaid female partner in place of origin in the 12 months preceding the survey, Prakasam and Azamgarh, India.

	Prakasam			Azamgarh		
	Returned migrants	Active migrants	Total	Returned migrants	Active migrants	Total
Total respondents	$N = 317$	$N = 316$	$N = 633$	$N = 319$	$N = 320$	$N = 639$
% who initiated sex in place of origin and had sex with unpaid female partner in place of origin in last 12 months	24.9	24.3	24.6	12.9	20.6	16.7
% who had migrated for less than six years:	14.5	13.9	14.2	2.2	7.5	4.9
Sexual partnerships						
Sexual mixing by age (first sex – most recent sex)[5,6]	$N = 79$	$N = 77$	$N = 156$	$N = 41$	$N = 66$	$N = 107$
Partner younger-older	3.8	7.8	5.8	2.4	9.1	6.5
Partner younger-younger	32.9	46.8	39.7	43.9	45.5	44.9
Partner older-older	10.1	15.6	12.8	17.1	16.7	16.8
Partner older-younger	53.2	29.9	41.7	36.6	28.8	31.8
Sexual mixing by partner type (first sex – most recent sex) [5]						
Relative/Friend-Relative/Friend	43.0	49.4	46.2	24.4	27.3	26.2
Relative/Friend-Neighbour	29.1	23.4	26.3	12.2	10.6	11.2
Neighbour-Neighbour	16.5	14.3	15.4	36.6	47.0	43.0
Neighbour-Relative/Friend	11.4	13.0	12.2	26.8	15.2	19.6
Sexual partnerships among recent migrants						
Sexual mixing by age (first sex – most recent sex)[6,7]	$N = 46$	$N = 44$	$N = 90$	$N = 7$	$N = 24$	$N = 31$
Partner younger-older	6.5	13.6	10.0	14.3	8.3	9.7
Partner younger-younger	19.6	38.6	28.9	42.9	33.3	35.5
Partner older-older	13.0	20.5	16.7	42.9	33.3	35.5
Partner older-younger	60.9	27.3	44.4	0.0	25.0	19.4

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Table 2 – *continued*

	Prakasam			Azamgarh		
	Returned migrants	Active migrants	Total	Returned migrants	Active migrants	Total
Sexual mixing by partner type (first sex – most recent sex)[7]						
Relative/Friend-Relative/Friend	45.7	47.7	46.7	0.0	33.3	25.8
Relative/Friend-Neighbour	32.6	29.6	31.1	14.3	4.2	6.5
Neighbour-Neighbour	13.0	13.6	13.3	71.4	50.0	54.8
Neighbour-Relative/Friend	8.7	9.1	8.9	14.3	12.5	12.9

[5] Among those who initiated sex in place of origin and had sex with an unpaid female partner in the 12 months preceding the survey in place of origin.
[6] Same age partners were considered in the older age group.
[7] Among men who had migrated for less than 6 years.

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Sexual partnership characteristics

Sexual partnerships in the village were long-term in nature. However, instances of short-term relationships were also described, which ended because the partner moved out of the village. As seen in Table 2, some migrants who initiated sex with a particular type of partner also reported recent sex with a similar partner:

> I am having sex with a village woman. … I have been having sex with her for the past five years. (Ajay, married, age 24, Azamgarh)

> I had sex with my neighbour when I was 25. Her husband is a truck driver. She no longer lives in the village. (Mukesh, married, age 35, Prakasam)

Migrants also noted that their sexual partners engaged in sex with other men from the village or nearby villages:

> She [sexual partner] told me she only has sex with me but I know she has sex with two or three other men. One man lives in the village and the others live nearby; when they come to the village they have sex with her. (Vipin, married, age 28, Azamgarh)

Migrants reported sexual relationships with both older and younger women in the village. Most initiated sex with younger women, but generally, on visits home, engaged in sex with older partners:

> The first time I had sex was in my village. … At that time I was 18. The girl was 17. … She was a neighbour. … There is a sister-in-law in my neighbourhood with whom I always have sex. Her husband lives in Dubai. She is 28 years. (Tilak, married, age 32, Azamgarh)

> I had sex for the first time with a neighbourhood girl. At that time I was 22 and she was 20. … She was studying with me. … In the village I have sex with a woman from the neighbourhood. She is 32. Every time I visit the village I have sex with her. (Puneet, married, age 23, Azamgarh)

The survey results indicate that among high-risk migrants (who initiated sex in the home village and had recent sex with an unpaid partner in the home village), both first and most recent sexual partners were generally younger than respondents, or older at first sex and younger at recent sex. Recent migrants (who had migrated for less than six years) in Prakasam (44%) typically reported an older first partner and a younger subsequent partner; in Azamgarh, an equal percentage (36%) respectively reported younger partners, or older partners, at both first and recent sex (Table 2). In Prakasam, relatives/friends were both first and recent partners, while in Azamgarh neighbours were mainly both first and recent partners. Around two-fifths reported different first and recent sexual partners (relative/friend-neighbour in Prakasam and neighbour-relative/friend in Azamgarh for first and recent sex partner respectively).

Condom use

Sexual encounters were seldom protected; only 27% of migrants in each district reported consistent condom use with an unpaid partner in the 12 months preceding the survey (Table 1). Migrants described unprotected sex with village partners because they were 'known' and trusted women and perceived to be safe from infection. In contrast, condom use with sex workers was considered to be necessary because sex workers have multiple sexual partners:

> There [destination areas] I have sex with sex workers. If you have sex with a sex worker without a condom, there is a risk of AIDS. But in the village I have sex with my sister-in-law,

> so there is no danger of AIDS. I rarely use a condom in the village. (Tilak, married, age 32, Azamgarh)

> In our village many people have extramarital sex. … But they do not use condoms …. They feel they will not get infected [HIV] because the girls are known. (Manoj, unmarried, age 22, Prakasam)

Condom use with known partners was also considered a breach of trust in the relationship, and indicated a lack of commitment to the partner:

> I use a condom only with sex workers. … If I use a condom with a known woman or relative she may think I am a womaniser. (Shyam, unmarried, age 21, Prakasam)

Migrants did not use condoms during first sex either because they were unaware of condoms at the time or were unprepared due to the suddenness of the encounter:

> When I first had sex I did not use a condom because it happened suddenly. At that time without thinking of a condom I had sex. (Mangal, married, age 27, Azamgarh)

The clandestine nature of non-spousal sex influenced condom use as people were not able to purchase condoms easily in their village. While a few migrants mentioned they were 'ashamed' to buy condoms in the village, one migrant noted:

> If someone in the village gets to know I purchased condoms then a lot of commotion is made that he is having illicit sex. (Vijay, unmarried, age 23, Azamgarh)

Although migrants reported unprotected sex with multiple partners in the home village, they did not perceive themselves to be at risk of HIV:

> I never use a condom when having sex in the village because village girls are not in any danger of getting HIV. So I too am not in any danger of getting HIV. (Nandu, married, age 26, Azamgarh)

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Use of contraceptive pills

A few migrants from Azamgarh reported that their non-spousal sexual partners used contraceptive pills to prevent pregnancy. One Azamgarh migrant reported using the withdrawal method. Men said that if their sexual partner got pregnant, they would buy pills, which were available locally, to terminate the pregnancy:

> There is a risk of pregnancy … for that [contraceptive] tablets are used. We buy these tablets and give them to the woman [sexual partner]. … Women know there is a risk of pregnancy … so they take the tablets. (Vikram, married, age 26, Azamgarh)

> In the village I have sex without a condom. … Yes, I am afraid she [sexual partner] will get pregnant … even then I do it [unprotected sex]. … If it [pregnancy] happens I will give her medicine … here medicine is available in the shop to stop pregnancy. … Girls are ready to take the medicine if they get pregnant … but till now it [pregnancy] has not happened. … because while having sex we practice withdrawal. (Nandu, married, age 26, Azamgarh)

Discussion

The study findings indicate that around half the migrants had engaged in non-spousal sex with a female partner in their home village. Sexual partnerships in the village were primarily non-commercial, and included friends and relatives from the neighbourhood, though there were instances of payment in cash/kind in some relationships. Such widespread sexual activity in the place of origin puts migrants and their sexual partners at risk for HIV, as several studies in India document that migrants are likely to engage in

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unsafe sex in destination areas with both sex workers and unpaid female partners (Saggurti et al. 2008, 2009, 2011a). The qualitative study findings provide insights on the contexts in which migrants engage in risky sexual behaviours. Additionally, the quantitative data show the extent and patterns of sexual mixing by age and type of sexual partner and regional differences among high-risk migrants.

The study findings reveal that several socio-cultural factors facilitate migrants' extensive sexual activity in their home village. For example, migrants' changed lifestyle and habits as a result of migration and their enhanced social status on their return to the home village tend to attract women from the village, and in many cases, may lead to the formation of sexual relationships (Chirwa 1997; Dhapola et al. 2007). The findings also suggest that migrants offer gifts and other types of assistance to female partners in their place of origin in return for sexual favours; as also argued elsewhere, the material rewards of migration create sexual networking opportunities for migrants in their home community (Chirwa 1997). As seen in this study, migrants had fairly liberal attitudes towards non-spousal sex and perceived such relationships to be a sign of friendship. These findings are similar to a study from Karnataka, India (Halli et al. 2007). Further, the practice of non-spousal sex in these settings may be rooted in prevailing traditional norms that link masculinity with sexual prowess and condone multiple-partner sex among males. All these factors could, to an extent, be working in tandem to promote non-spousal relationships in migrants' home villages.

Condom use with non-spousal sexual partners was limited in the home setting because these known partners were perceived to be safe and trusted, and considered not at risk for HIV. The perception that condom use could signify a breach of trust in sexual partnerships, thereby negating condom use, has been highlighted in other studies as well (Aube-Maurice et al. 2012; Dhapola et al. 2007; McMillan and Worth 2011; Puri and Cleland 2006). Additionally, as reported elsewhere (Aube-Maurice et al. 2012), Indian culture is characterised by complex gender-based power dynamics, which could influence condom use in such partnerships, particularly in instances where male migrants provide gifts to their sexual partners. Findings from this study as well as other studies suggest a high level of condom use by migrants with female sex workers in destination areas (Saggurti et al. 2011a). However, this practice is limited in non-commercial partnerships in migrants' place of origin. Possibly, in destination areas, it is sex workers who insist on condom use as a result of ongoing HIV-prevention programmes in these settings. These findings suggest that migrants need to be informed about their vulnerability to HIV risk in sexual relationships in the home setting in the context of low condom use with known non-spousal partners from the village.

As seen in our study, despite the non-use of condoms with multiple sexual partners, the use of other modern contraceptive methods was also low. Possible reasons for the limited use of contraceptive methods could be associated with the local context. For example, empirical evidence suggests that female sterilisation is the most commonly adopted contraceptive method in Prakasam; as a result, women may not be concerned about using other methods of contraception. Similarly, the low level of female literacy and lack of awareness of modern contraceptive methods could have led to limited contraceptive use in Azamgarh (IIPS 2010a, 2010b). These results suggest that HIV programmes need to focus on building awareness among migrants and their sexual partners in the place of origin regarding the importance of condom use to prevent the transmission of HIV and other infections and promote its use in all sexual relationships.

The nature of sexual partnerships also has implications for HIV transmission in these settings. Long-term sexual relationships were reported, which continued on migrants'

visits home. Additionally, the study findings document migrants' sexual partnerships spread across geographical areas. The quantitative survey also indicates sexual mixing, such as older partners at first sex and younger at recent sex, and different types of first and recent sexual partners. Our findings indicate that migrants' sexual partners were primarily married women from the village and, as documented in other studies (Halli et al. 2007; Saggurti et al. 2011b), these partners also engage in extramarital sex in the home setting. These overlapping sexual partnerships could fuel the further transmission of infection to sexual partners beyond migrants' own sexual networks. Additionally, migrants' risk behaviours with sex workers in destination areas and with non-spousal partners in the place of origin could accelerate the transmission of HIV infection from destination (high-HIV-prevalence areas) to source areas (low-HIV-prevalence areas) (Saggurti et al. 2012).

While the study provides insights into migrants' sexual partnership patterns in the context of high out-migration in rural India, the findings need to be considered in light of a few limitations. For one, as the qualitative study includes a sub-sample of purposively selected respondents interviewed in the quantitative survey, the findings may not be generalised to all migrants. However, the qualitative analysis suggests that the socio-cultural context reported by migrants was more or less similar across all the survey respondents, hence, the findings on the socio-cultural context underlying non-spousal sexual relationships may not differ even if a larger sample size is considered. Further, this paper could explore only the socio-cultural factors reported by respondents; however, there may be many more external factors prevailing in society, which need to be examined in future studies. Additionally, there may have been some recall bias, particularly in describing first sexual experiences. Moreover, certain nuances of respondents' reports may have been overlooked when translating interviews into English. Finally, there may have been a social desirability bias in reporting sensitive information during in-depth interviews. As the study interviews were conducted by trained and experienced investigators, who ensured privacy during the interviews and were sensitive to the local context, we believe that our study has been able to minimise potential reporting biases and limit inconsistencies in the translation of interviews.

Despite these limitations, the study findings have important policy implications for the design of HIV-prevention programmes in India and elsewhere. Thus far, HIV-prevention programmes have focused on migrants' destination areas. However, this research and findings from the quantitative study (Saggurti et al. 2011a) recommend implementing programmes at migrants' place of origin, taking into account the local socio-cultural factors that underlie migrants' sexual behaviours. At the same time, continued HIV-prevention efforts are required in destination areas where migrants can be reached multiple times: a previous modelling exercise has demonstrated that targeting migrants locally and in their destination areas could have up to 1.6 times the impact of targeting migrants only at their destination (Deering et al. 2008). Interventions would need to sensitise migrants about their HIV vulnerability and promote the adoption of safe-sex practices with both known and commercial sexual partners in destination and home settings.

Our study also emphasises the need for special efforts to target migrants' non-spousal partners, such as left-behind wives of other migrants, who are at high risk of HIV, to build awareness regarding their HIV risk from sexual partners in the village, and to provide them with appropriate information and services to practice safe sex, including condom use, with all sexual partners in these settings. Additionally, community-level interventions would need to address the common belief that condoms are necessary only in commercial sex and to promote condom use with all sexual partners even if they have adopted sterilisation.

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Condom promotion messages need to be designed in the context of the local cultural dynamics underlying migrants' non-spousal sexual partnerships.

While this study points to migrants' extensive sexual partnerships in the place of origin, further in-depth research is needed on local sexual networks and their characteristics, which would have programmatic implications in these areas. Detailed information is needed on migrants' and non-migrants' entire network of sexual partners, and the networks of their sexual partners, and their partners' risk behaviours, to better identify the HIV transmission routes as well as all the sub-populations at risk for HIV in these settings. In the context that migrants' sexual partners are primarily married women, HIV information and prevention services could be mainstreamed within available maternal health services, and delivered through primary health centres and frontline health workers at the community level in the place of origin. However, operations research is needed to understand the extent to which integration with primary health centres will help address the prevention of HIV transmission in the places of origin.

In conclusion, the nature of migrants' non-spousal sexual relationships in the place of origin, such as multiple sexual partnerships, and high-risk behaviours, including limited condom use, put them and their sexual partners at high risk for HIV. These partnership patterns, influenced by socio-cultural factors, provide potential routes for HIV transmission in source areas, and must be considered when designing HIV-prevention programmes for migrants and their sexual partners in their place of origin.

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Résumé

En Inde, les migrants de sexe masculin sont exposés à un risque lié au VIH démesurément élevé, en raison non seulement de leurs comportements sexuels dans les régions oú ils se rendent, mais aussi de leurs comportements à risque dans leurs régions d'origine. Alors que des recherches ont permis d'approfondir les connaissances sur les comportements à risque de ces hommes dans leur environnement d'origine, peu d'études ont examiné le contexte socio-culturel sous-jacent à ces comportements. Cet article examine les modèles et le contexte des partenariats sexuels non conjugaux des migrants de sexe masculin dans deux zones à forte migration externe en Inde. Les données obtenues à partir d'une étude comportementale (transversale et multi-méthodes) conduite en 2008, incluent celles d'une enquête structurée menée parmi 1272 migrants, qui a été suivie d'entretiens en profondeur avec 33 migrants de sexe masculin. Les résultats suggèrent que l'activité sexuelle est courante sur le lieu d'origine : environ 50% des participants y avaient eu des rapports

sexuels avec des femmes auxquelles ils n'étaient pas mariés, et deux cinquièmes d'entre eux y avaient initié leur sexualité. Ces comportements sexuels non conjugaux des migrants dans leur village d'origine étaient influencés par le contexte socio-culturel prédominant, englobant la situation socio-économique améliorée des migrants, les attitudes vis-à-vis des rapports non conjugaux et l'accessibilité des partenaires sexuelles. Les partenariats sexuels non conjugaux des migrants de sexe masculin dans les zones source sont influencés par des facteurs socio-culturels qui doivent être pris en compte dans l'élaboration des programmes de lutte contre le VIH en Inde et ailleurs.

Resumen

Los emigrantes masculinos en la India corren un riesgo desproporcionadamente alto de contagiarse con el virus del sida no solamente por sus conductas sexuales en sus áreas de destino sino también debido a sus comportamientos de riesgo en su lugar de origen. Aunque en algunos estudios se han documentado las conductas arriesgadas de los emigrantes masculinos en su lugar de origen, en pocos se ha intentado entender el contexto sociocultural subyacente en el que participan con tales conductas. En este artículo examino los modelos y el contexto de las relaciones sexuales de emigrantes masculinos con parejas no conyugales en dos distritos de la India con un alto nivel de emigración. Los datos proceden de un estudio transversal con métodos variados sobre comportamientos llevado a cabo en 2008 y de un estudio estructurado en el que participaron 1272 emigrantes, en el que se realizaron entrevistas exhaustivas con 33 emigrantes masculinos. Los resultados indican que la actividad sexual era común en el lugar de origen: aproximadamente el 50% de emigrantes tuvieron relaciones sexuales con una pareja femenina no conyugal y dos quintas partes se habían iniciado en el sexo en este entorno. Las conductas sexuales no conyugales de los emigrantes en las aldeas de origen estaban influenciadas por el contexto sociocultural predominante, incluyendo un mejor estado socioeconómico de los emigrantes, las actitudes hacia el sexo no conyugal y el nivel de acceso a parejas sexuales. Las relaciones sexuales no conyugales de los emigrantes masculinos en las zonas de origen están influenciadas por factores socioculturales, que deben tenerse en cuenta al desarrollar programas contra el sida en la India y otros lugares.

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Vulnerabilities of other bridge populations

Vulnerabilities of other bridge populations

- HIV prevention interventions for bridge populations at risk for HIV, such as male clients of sex workers, should include components that build positive attitudes to and perceptions of condom use. For example, communications can focus on an individual's self-efficacy to buy condoms from public places, and increase their perception of HIV risk in the absence of condom use. This is because research documents that an individual's attitudes and perceptions influence sexual risk behaviors; for example, male clients of female sex workers with low perceived self-efficacy for condom use, low perceived vulnerability to HIV, and low perceived social support (from peers and social networks) are more likely to engage in multiple partner sex and unprotected sex with sex workers and regular partners and have sexually transmitted infections than others (Roy et al., 2012).
- Programs must further strengthen HIV prevention efforts with unmarried long-distance truck drivers. As documented in one of the articles, truckers' marital status determines their risk behaviors and HIV status; unmarried long-distance truckers are more likely to engage in unprotected sex with non-regular partners and to be HIV-infected than married truck drivers (Pandey et al., 2012).
- More importantly, adolescent truckers need to be reached by the program during their initial years of work, when they are likely to initiate risk-taking behaviors. For this, middle-men in the trucking industry could be trained to communicate with adolescent truckers on the need for HIV prevention, as middle-men are their first point of contact. The importance of intensive interventions for adolescent truckers is suggested because truckers' age at entry into the trucking industry is linked to their sexual risk behaviors; long-distance truck drivers who enter the industry in adolescence are more likely than those who enter the industry as adults to engage in high-risk sexual behaviors and to have sexually transmitted infections/HIV (Mishra et al., 2012).

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Psychosocial Correlates of HIV-related Sexual Risk Factors among Male Clients in Southern India

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Abstract Psychosocial theories suggest that individuals' behavior is a reflection of their intention and ability to carry out a typical behavior. This study proposes to examine the psychosocial correlates of HIV-related sexual risk factor among male clients of female sex workers (FSWs). Data were used from a cross-sectional survey, collected using two-stage sampling, conducted among 2382 clients of FSWs in four states of India in November 2008. Clients were males who had engaged in paid sex with a FSW in the 12 months preceding the survey. Multiple logistic regression models were fitted to assess the effect of different psychosocial measure on HIV-related sexual risk factors: multiple sexual partners, inconsistent condom use and self reported sexually transmitted infections (STIs). The odds of inconsistent condom use with FSWs was more among clients with low self-efficacy (Adjusted Odds Ratio (AOR): 2.2, 95% Confidence Interval (CI): 1.7-3.0), low perceived social support (AOR: 1.8, 95% CI: 1.3-2.6), low perceived personal norms (AOR: 1.7, 95% CI: 1.2-2.3) and low perceived access to condoms (AOR: 1.5, 95% CI: 1.1-2.0) than others. Similarly, experience of STI-related symptoms in the last 12 months was associated with low self-efficacy, low perceived social support and low perceived vulnerability. Findings highlight strong influence of psychosocial attitudes on HIV-related sexual risk factors among male clients of FSWs, suggesting the need for designing HIV prevention strategies to address psychosocial issues like self-efficacy, vulnerability and social support.

Keywords Self-efficacy, Perceived Vulnerability, Social Norms, Condom, HIV

1. Introduction

Socio-demographic and behavioral characteristics of a population are considered to be the key parameter for designing HIV prevention programs. Over the year program implementers have consistently ignored the role of psychosocial perspectives of program beneficiaries[1-3]. A growing body of literature suggests that translating psychological theories into practice can help in implementing more effective HIV intervention programs[1, 3, 4]. These studies suggest that individuals' behavior is a reflection of their intention and ability to carry out the behavior. Although the relationship between behavioral intention and actual behavior cannot be accurately measured, the intention to act can be considered as a proximate measure of behavior. Therefore, behavioral intentions can be measured in terms of attitudes, perceived social norms, perceived self-efficacy and perceived severity [5, 6].

A review of psychosocial theories related to health seeking behavior suggests that psychosocial factors like perceived vulnerability, self-efficacy, social support, accessibility and personal norms are central to most of these theories[7, 8]. Self-efficacy refers to beliefs about the ability and effort required to perform a promoted health behavior effectively[9]. According to Bandura[10], perceived self-efficacy denotes people's belief that they can exercise control over their motivation as well as behavior. Perceived vulnerability is another factor which has received attention from researchers and program planners as it can influence health seeking behavior of individuals. According to Rogers[11], vulnerability is the risk perception of being infected with HIV if the recommended behavior is not adopted. Further, along with self-efficacy and perceived vulnerability, individual's perception about things matters a lot while adopting a behavior[12, 13]. Empirical research shows that personal norms have strong anticipated affective outcomes to perform a behavior[7]. Personal norm is an individual's self regulated influence on own functioning with respect to intention to perform a behavior[10]. Personal norms are primarily used to identify internalized cognitive processes that are based on an individual's perception of the ethical correctness of performing a behavior[7].

Individuals' effort to perform a behavior cannot be

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attributed to only their own attitudes and perception, but also can be due to social support and availability of services supportive to perform such behavior. In addition to personal motivation and attitudes, an individual's social support network can act as a source of information, source of emotional and practical support, approving institution to perform a behavior[14, 15]. Personal network norms and normative beliefs about what others in the social and personal networks are actually doing are critical in adopting a new behavior. Non-availability and poor access to services can hamper the individuals' utilization of services. Regardless of self motivation and positive social support, the perceived accessibility of a service can be detrimental in the utilization of that service.

Several studies have documented a positive effect of these psychosocial factors on HIV risk behavior among general populations[16-18] including female sex workers (FSWs)[19] and their clients[20]. Empirical research investigating psychosocial correlates of condom use have found that positive attitude towards condom use[5, 21], self-efficacy[4, 5, 16, 17, 21] and perceived susceptibility to sexually transmitted infections (STIs)[22, 23] are positively correlated to condom use practice. A few studies reveal that perceived barriers to condom use and peer norms can hamper condom use practices[18, 24].

In India, the national AIDS control program has identified FSWs and their clients as two priority groups for HIV prevention interventions. The focus of such interventions are mainly providing HIV prevention education through peer educators combined with free condom distribution and treatment for STIs[25]. Recent research report suggests that in 2009 about 6% of clients of FSWs were HIV seropositives and nearly 60% reported using condom consistently with occasional FSWs[26]. A number of research studies have been undertaken in diverse settings to understand the correlates of condom use among clients of FSWs[4, 21, 27-29]. Only a few studies have been undertaken in India in this area of research; these studies have focused on understanding the socio-demographic and behavioral determinants of condom use. The role of psychosocial attitude in determining an individuals' HIV risk behavior is yet to be explored in the Indian context. The current research is an attempt to document the relationship between different psychosocial measures and HIV risk behaviors among male clients of FSWs.

2. Methods

2.1. Subjects and Procedures

A cross-sectional survey among clients of FSWs was conducted simultaneously in the Indian states of Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra in November 2008. These states had been identified as high epidemic states by the Indian National AIDS Control Organization (NACO) prior to the year 2005[25]. The study protocol was approved by an ad-hoc ethical committee chaired by the Indian Council of Medical Research (ICMR). Data were collected using a stratified two-stage cluster sampling approach; in the first stage hotspots were selected while participants were selected in the second stage. States were considered as strata except for Maharashtra, where Mumbai and rest of Maharashtra were treated as separate strata. The sampling frame was developed based on a list of hotspots of sex work activity (a place where FSWs gather to solicit clients), prepared with the help of local non-governmental organizations (NGOs) implementing the HIV intervention among clients of FSWs in the survey states. The target sample size for the survey was 2400 individuals (480 per stratum). This desired sample size was arrived at after assuming a 15% change in the behavioral indicators over time with a 95% significance level and 80% power.

The primary sampling units (PSU) were the hotspots of sex work activity which were selected by probability proportional to size sampling approach. A total of 30 hotspots per strata were selected. For each PSU, the number of interviews to be conducted was fixed and interviews were conducted between 10 a.m. and 7 p.m. on all days of the week. Multiple rounds of visits were made to the same PSU in case the target number of interviews could not be completed in one visit. Trained interviewers were stationed at selected points in the hotspots and instructed to approach every fifth man passing by during a specified timeframe to avoid introducing selection bias based on the interviewer's judgment. Interviewers were male graduates in a social science subject or statistics and had prior experience in data collection among most at risk population. Males who were 18 years or older and were involved in commercial sex (paid to have sex with an FSW) in the 12 months preceding the survey were eligible to participate in the study. Continuous monitoring mechanisms were in place to ensure smooth data collection and quality control. Each interview took approximately 45 minutes to complete.

By the end of the survey, 20,850 individuals were approached; all of them were informed about the study and asked about their willingness to participate in the survey; of these 14,413 individuals were not interested in participating in the survey due to lack of time or indifference. Individuals who volunteered to participate in the survey were asked for informed consent. These individuals were further screened for their eligibility to participate in the survey. In all 3,810 individuals were found to be ineligible for the survey. Further, 245 individuals did not complete the interviews resulting in a total sample of 2,382 individuals.

2.2. Measures

2.2.1. Psychosocial Measures

The survey instrument was designed to collect extensive information on different psychosocial dimensions of condom use. The items measuring psychosocial attitudes in

the quantitative survey were selected based on the information gathered in another qualitative research study conducted earlier in the study areas[30]. Measures of perception related to condom use and HIV/AIDS were collected using five-point Likert type scales (ranging from 'strongly agree' to 'strongly disagree'). Some statements were worded 'negatively' in order to avoid artificially high consistency within the responses. Most of these statements were used in previous research on health behavior information.

Information was collected for the following domains: perceived self-efficacy, perceived vulnerability, perceived social support, perceived accessibility of condoms, and personal norms. Composite scores were computed for each dimension by using the mean value of the items included in the scale. During the analysis stage, items worded 'negatively' were reverse coded to reflect the positive response in those items. Cronbach's alpha values were computed for each of the scales to demonstrate the reliability of the score (Table 1). In order to examine the effect of psychosocial variables on the outcomes, these scores were further divided into three equal parts to generate a scale with the categories low, moderate and high, where low represents the lowest scores and high represents the highest scores.

2.2.1.1. Perceived Self-Efficacy

Twelve items were used to measure perceived self-efficacy for condom use (see Appendix 1 for a complete list of items included in the scale). Typical items included: "I find it difficult to dispose off a condom after using it", "I would hesitate to buy condoms from a shop if the shopkeeper is a woman", "Even if I am drunk, I can remember to use a condom with an FSW" and "Even in situations when I get excited by an FSW, I can remember to use a condom". The Cronbach's alpha coefficient for the composite scale was 0.76 (Table 1).

2.2.1.2. Perceived Vulnerability

Items that were meant to assess respondents' self perception of the likelihood of contracting STI/HIV and their perception about HIV/AIDS in society were considered here. Typical items were: "If a man knows an FSW well, it is safe not to use a condom with her", "If the pimp recommends an FSW who does not have any disease, it is safe to have sex without a condom", "Very few people get HIV/AIDS" and "HIV/AIDS is happening only in big cities." (Cronbach's alpha: 0.67).

2.2.1.3. Perceived Social Support

Social support has been assessed in terms of the kind of assistance an individual has received from friends, family members, FSWs and other stakeholders. Though eight items were presented to respondents, we considered only five items to increase the reliability of the scale (Cronbach's alpha= 0.84). Typical items included were: "Most of my friends encourage me to use a condom"; "Most of my friends often tell me about diseases I can get by not using condoms" and "An FSW once explained the importance of using condoms to me".

2.2.1.4. Perceived Accessibility

Eight items were used to measure perceived barriers to condom use (Cronbach's alpha= 0.60). Of these eight items, four were related to condom availability and the remaining four reflected barriers to condom use. Some of the items included in this measure are: "Generally, condoms are always available near the places where one can find FSWs", "If needed, I can get a condom within the next 5-10 minutes walking distance from this place" and "I want to use a condom but the FSW does not want me to use a condom".

2.2.1.5. Personal Norms

Twelve items were used to assess an individual's person norms towards condom use. Some of the items included in the scale were: "I don't trust an FSW even if I have known her for sometime", "I have developed a relationship with the FSW and I don't want to ruin it by introducing condoms", "I enjoy sex more if I use a condom" and "sex is for fun, so why bother about condoms" (Cronbach's alpha= 0.73).

2.2.2. Outcome Measures

The following measures of HIV-related sexual risk factors were examined in this study: inconsistent condom use with FSWs, inconsistent condom use with regular non-paying partners, multiple sexual partners and self reported STI symptoms.

2.2.2.1. Inconsistent Condom Use with FSWs

Inconsistent condom use with FSWs was derived by taking three separate questions together that assessed "condom use in last sex (no, yes)", "frequency of condom use in last 12 months (every time, most of the time, sometimes, very few times)" and "any occasion of not using a condom with an FSW in the last 12 months (no, yes)". An individual was defined as an inconsistent condom user (coded as 1) with FSWs in the 12 months prior to the survey if he did not use a condom at last sex with an FSW, or did not use a condom "every time" with FSWs in the last 12 months or reported at least one instance of not using a condom with an FSW in the last 12 months; otherwise he was identified as a consistent condom user (coded as 0).

2.2.2.2. Inconsistent Condom Use with Regular Partners

Single item questions about the number of sexual acts with regular partners (wife, fiancée and girlfriend) in the last 30 days and condom use in those sexual acts were asked. Respondents who reported condom use in all sex acts were consistent condom users with regular partners (coded as 0), else considered inconsistent condom users with regular partners (coded as 1).

2.2.2.3. Multiple Sexual Partners in the last 12 Months

Information on the number of sexual partners in the last 12 months was collected from each survey participant. The total number of sexual partners was regrouped into two groups based on the median split: < 10 (coded as 0), 10+ (coded as 1).

2.2.2.4. Self Reported Sexually Transmitted Infections

Information about experience of the following five STI symptoms in the last 12 months was collected: (a) burning sensation/pain during urination, (b) thick discharge from penis, (c) ulcers/sores in the groin area, (d) scrotal swelling and pain, and (e) enlarged and/or painful inguinal lymph nodes. Experience of any of these STI symptoms in the last 12 months was considered as experience of STIs and coded as 1, else coded as 0.

2.2.3. Socio-Demographic Variables

Information on socio-demographic variables like age, marital status and education were assessed using single item questions. Similarly, single item questions were used to collect information on occupation (recoded as unskilled worker, skilled worker, self-employed, salaried and unemployed) and alcohol consumption (never, occasional consumption, regular consumption). We used age (continuous), marital status (unmarried, married living with wife, married living without wife), education (no formal education, Class 1-9, Class 10-12, graduation or more), alcohol consumption and occupation as covariates when predicting a particular outcome with different psychosocial measures.

2.3. Statistical Analyses

Univariate, bivariate and multivariate analyses were performed. Pearson's Chi-square test was used to measure the strength of association in the bivariate analyses between psychosocial measures and outcome variables. Multiple logistic regression models were used to predict different HIV risk behavior variables for different psychosocial measures. Two sets of regression analyses were performed; in the first case, the effect of one psychosocial measure was measured after controlling for respondents' socio-demographic covariates; in the second case, the effect of all psychosocial measures was measured simultaneously after adjusting for socio-demographic covariates. The significance level for all statistical tests was 5% or otherwise specified. Results were presented in the form of percentages, adjusted odds ratios (AOR) and 95% confidence interval (CI) of point estimates. Data were analyzed using STATA 11.1.

3. Results

Clients of sex workers were, on average, 30 years old (Standard deviation (SD): 7.3 years) and around one-quarter (26%) were 25 years or less (Table 2). Most respondents (88%) had some education and more than half (55%) were educated up to class 10th or more. Nearly two-thirds (67%) were married and about half (52%) were residing with their wife. About two-thirds of respondents were either unskilled workers (34%) or skilled workers (33%) and only 6% were unemployed. Twenty-eight percent did not consume alcohol and 46% consumed alcohol regularly.

Table 1. Summary statistics for the attitudinal measures

Item	Reliability score	Mean	SD	Min-Max	Number of items
Perceived self-efficacy	0.760	3.39	0.48	1-5	12
Perceived vulnerability	0.673	1.87	0.72	1-5	6
Perceived social support	0.835	3.86	0.99	1-5	5
Perceived accessibility	0.600	3.01	0.42	1-5	8
Personal norms	0.732	3.33	0.45	1-5	12

SD: Standard Deviation

Table 2. Socio-demographic profile male clients of female sex workers, India, 2008

	%ge or mean (SD)	Number (n)
Age		
% 25 years or less old	26.0	620
% 35 years or more old	28.0	666
Mean age (SD)	30.7 (7.3)	2382
Education		
No formal education	11.8	282
1-9th grade	33.3	794
10-12th grade	41.8	996
Graduate or above	13.0	310
Marital status		
% Married not living with wife	14.6	347
% Married living with wife	52.4	1248
Occupation		
% Unskilled worker	34.3	816
% Skilled worker	33.4	796
% Salaried	12.7	302
% Unemployed	6.0	142
Alcohol consumption		
% never consumed alcohol	28.2	671
% consuming alcohol regularly	45.9	1094
Total (N)	100	2382

SD: Standard Deviation

Around 16% of clients reported inconsistent condom use with FSWs in the last 12 months and 82% reported inconsistent condom use with their regular non-paying partners in the last 30 days (Table 3). Inconsistent condom use with FSWs was reportedly higher among individuals with low self-efficacy (21%), low perceived social support (24%), low perceived accessibility of condoms (19%) and low perceived personal norms as compared to those identified as high in these psychosocial measures. Furthermore, 24% of individuals with high perceived vulnerability reported inconsistent condom use with FSWs as compared to 10% among those with low perceived vulnerability (P<0.001). The pattern of differentials in inconsistent condom use with regular partners was similar to that of inconsistent condom use with FSWs. For example, 88% of respondents with low self-efficacy reported inconsistent condom use as compared to 78% with high self-efficacy (P<0.001). About two-fifths (44%) reported experiencing an STI-related symptom in last 12 months. Higher levels of STIs were reported by respondents with low self-efficacy (46%), high perceived vulnerability (49%) and low perceived personal norms (48%) than their counterparts.

The multivariate analyses confirmed the findings from bivariate analyses (Table 4). Logistic regression model adjusted for socio-demographics revealed that respondents with low self-efficacy were two times more likely to use condom inconsistently with FSWs than those with high self-efficacy (AOR: 2.2, 95% CI: 1.7-3.0). The association between self-efficacy and inconsistent condom use hold true even after controlling for other psychosocial measures (AOR: 1.9, 95% CI: 1.4-2.5). The other psychosocial factors associated positively with inconsistent condom use with FSWs were low perceived social support (AOR: 1.8, 95% CI: 1.3-2.6), low perceived accessibility (AOR: 1.5, 95% CI: 1.1-2.0) and low perceived personal norms (AOR: 1.7, 95% CI: 1.2-2.3). Associations of these psychosocial measures with inconsistent condom use with regular partners and experience of STI-related symptoms were statistically significant and in directions similar to inconsistent condom use with FSWs. Perceived vulnerability was negatively associated with multiple sexual partners, but positively associated with inconsistent condom with FSWs and regular partners and experience of STIs.

4. Discussion

This study, based on a cross-sectional survey, examined the effect of five different psychosocial measures on inconsistent condom use, multiple sexual partners and experience of STI-related symptoms among male clients of FSWs. This research adds to existing evidence and demonstrates a strong relationship between individuals' attitudes and perceptions with HIV-related sexual risk factors. Perceived self-efficacy and perceived vulnerability to HIV were associated with practices such as multiple sexual partners, inconsistent condom use with FSWs and regular partner as well as with experience of STI-related symptoms. The current study also demonstrated that inconsistent condom use with FSWs is more likely to occur among individuals perceiving low self-efficacy, low social support, low personal norms and high perceived vulnerability. Similar associations were documented for other HIV-related sexual risk factors.

Consistent with earlier studies among youths and IDUs[6, 12], our study also observed positive effect high self-efficacy on consistent condom use with FSWs and regular partners. This indicates that clients of sex workers had the ability to understand the risk associated inconsistent condom use. This, further, is supported by the post-hoc analysis which suggests that individuals with low perceived self-efficacy have higher perceived vulnerability than those with high perceived self-efficacy. Furthermore, inconsistent condom use with FSWs and regular partners was higher among individuals with high perceived vulnerability than with low vulnerability. This can be a reflection of their actual behavior, that is, those not using condoms consistently were aware of engaging in some kind of activity carrying a certain risk leading to STI/HIV infection. A similar relationship between perceived vulnerability and condom use has been documented in a recent study among sex workers[31]. Though individuals have accurately assessed their vulnerability to HIV infection, such assessments have not been translated into behavior. Behavior change communication interventions should make an additional effort to promote a positive behavior change.

The study results further suggest that high perceived social support can have a positive influence on consistent condom use and reduce exposure to STI-related symptoms. The importance of a supportive environment of peers and social networks for condom use has been highlighted in past research which corroborates our study finding[14, 32-34]. This indicates that not only the personal motivation level of an individual, but also the perception that condom use is encouraged and approved by the people in the surroundings is important for consistent condom use. Another important predictor of condom use is perceived personal norms about condoms. However, perceived personal norms have no significant effect on multiple sexual relationships. This suggests that personal norms do not restrict individuals from selecting sexual partners but rather make them aware of the need to adopt safe sexual practices. The study findings also show that inconsistent condom use was higher with regular partners than with sex workers, suggesting that even with the same degree of psychosocial attitudes individuals do not use condoms with regular partners. This suggests that motivation to use condoms with sexual partners depends on whether the relationship is casual or steady in nature.

Table 3. HIV-related sexual risk factors as reported by clients of FSWs by different measures of psychosocial attitudes, India, 2008

Psychosocial measures	10+ sexual partner in last 12 months (N=2382)	Inconsistent condom use with FSW in last 12 months (N=2382)	Inconsistent condom use with regular partner in last 30 day (N=1981)	Self reported STI in last 12 month (N=2382)
Perceived self efficacy	P<0.001	P<0.001	P<0.001	P=0.032
Low (N=921)	37.7	20.8	87.5	46.1
Moderate (N=744)	38.2	13.6	77.5	44.9
High (N=717)	29.0	10.7	78.0	39.9
Perceived vulnerability	P=0.001	P<0.001	P<0.001	P=0.002
Low (N=1058)	39.1	10.4	78.3	43.0
Moderate (N=560)	33.6	14.3	78.6	38.9
High (N=762)	31.1	23.6	88.2	48.6
Perceived social support	P=0.002	P<0.001	P<0.001	P=0.007
Low (N=879)	38.0	23.7	87.0	42.1
Moderate (N=825)	36.8	11.9	79.3	48.1
High (N=675)	29.8	9.5	77.0	40.7
Perceived accessibility	P=0.018	P=0.004	P=0.099	P=0.394
Low (N=909)	38.5	18.7	83.8	42.1
Moderate (N=887)	34.3	13.5	80.5	45.2
High (N=586)	31.6	13.7	79.3	44.5
Perceived personal norms	P=0.006	P=0.001	P<0.001	P<0.001
Low (N=819)	35.7	18.8	84.1	47.5
Moderate (N=806)	38.7	15.5	84.1	47.4
High (N=757)	31.0	12.0	75.9	36.2
Total	35.2	15.5	81.5	43.9

Table 4. Adjusted effects of psychosocial measures on HIV-related sexual risk factors among male clients of FSWs, India, 2008

Variable	10+ sexual partner in last 12 months (N=2382)		Inconsistent condom use with FSW in last 12 months (N=2382)		Inconsistent condom use with regular partner in last 30 day (N=1981)		Self reported STI in last 12 month (N=2382)	
	AOR-1 (95% CI)	AOR-2 (95% CI)	AOR-1 (95% CI)	AOR-2 (95% CI)	AOR-1 (95% CI)	AOR-2 (95% CI)	AOR-1 (95% CI)	AOR-2 (95% CI)
Perceived self efficacy								
Low	1.8 (1.3-2.4)	1.8 (1.3-2.4)	2.2 (1.7-3.0)	1.9 (1.4-2.5)	1.9 (1.4-2.6)	1.6 (1.2-2.3)	1.3 (1.1-1.6)	1.2 (1.0-1.5)
Moderate	1.5 (1.1-2.0)	1.5 (1.1-2.0)	1.3 (1.0-1.8)	1.2 (0.9-1.7)	0.9 (0.7-1.2)	0.9 (0.6-1.2)	1.2 (1.0-1.5)	1.2 (0.9-1.4)
High	Referent	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Perceived vulnerability								
Low	1.3 (1.0-1.8)	1.3 (1.0-1.8)	0.6 (0.4-0.8)	0.7 (0.5-0.9)	0.5 (0.4-0.7)	0.6 (0.4-0.8)	0.7 (0.6-0.9)	0.7 (0.6-0.9)
Moderate	1.1 (0.8-1.6)	1.1 (0.8-1.6)	0.6 (0.5-0.9)	0.6 (0.5-0.9)	0.5 (0.4-0.8)	0.6 (0.4-0.8)	0.6 (0.5-0.8)	0.6 (0.5-0.8)
High	Referent	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Perceived social support								
Low	0.9 (0.7-1.3)	0.9 (0.7-1.3)	1.8 (1.3-2.6)	1.4 (1.0-2.0)	1.7 (1.2-2.4)	1.4 (1.0-2.0)	1.3 (1.0-1.7)	1.2 (1.0-1.6)
Moderate	1.1 (0.8-1.5)	1.1 (0.8-1.5)	1.1 (0.8-1.5)	0.9 (0.7-1.3)	1.0 (0.7-1.4)	0.9 (0.7-1.2)	1.3 (1.0-1.6)	1.3 (1.0-1.6)
High	Referent	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Perceived accessibility								
Low	1.0 (0.8-1.4)	1.0 (0.7-1.4)	1.5 (1.1-2.0)	1.2 (0.9-1.7)	1.3 (1.0-1.8)	1.2 (0.9-1.7)	0.9 (0.8-1.2)	0.9 (0.7-1.1)
Moderate	1.0 (0.7-1.3)	1.0 (0.7-1.4)	1.0 (0.7-1.3)	0.9 (0.6-1.2)	1.1 (0.8-1.5)	1.0 (0.7-1.4)	0.9 (0.8-1.2)	0.9 (0.7-1.1)
High	Referent	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Perceived personal norms								
Low	1.0 (0.7-1.4)	0.9 (0.7-1.3)	1.7 (1.2-2.3)	1.4 (1.0-1.9)	1.4 (1.0-2.0)	1.2 (0.9-1.7)	1.3 (1.0-1.6)	1.2 (0.9-1.5)
Moderate	1.3 (0.9-1.7)	1.2 (0.9-1.6)	1.4 (1.0-1.9)	1.3 (0.9-1.8)	1.5 (1.1-2.1)	1.4 (1.1-2.0)	1.2 (1.0-1.6)	1.2 (1.0-1.5)
High	Referent	Referent	Referent	Referent	Referent	Referent	Referent	Referent

AOR: Adjusted Odds Ratio, CI: Confidence Interval
AOR-1: Adjusted for socio-demographic covariates such as age, education, marital status, occupation, alcohol consumption and state.
AOR-2: Adjusted for psychosocial measures and socio-demographic covariates such as age, education, marital status, occupation, alcohol consumption and state.

There are potential limitations to our study and hence some caution is required while interpreting and drawing conclusions. First, the findings are based on a cross-sectional study and hence, the causality of measures cannot be established. For example, it is difficult to infer whether low condom use led to higher perceived vulnerability or otherwise. Second, as data collection in the survey was confined to day-time, that is, from 10a.m.-7p. m., there may be some kind of bias regarding the representativeness of the client population. A preliminary assessment before the initiation of the study suggested that profile of clients at any time of a day remain same. Third, responses on the frequency of condom use can be biased due to social desirability. In order to reduce such bias, interviews were conducted in a private location after ensuring confidentiality of the information provided. Further, we asked different questions, such as condom use at last sex and any instances when the respondent did not use a condom, to validate the responses on frequency of condom use. While generating the variable on inconsistent condom use, these checks were considered, which helped in reducing the effect of social desirability bias.

The study findings presented here have important implications for policy makers on HIV interventions. First, there is a need to improve realization of risk associated with commercial sex as the study findings suggest inconsistent condom use to be associated with high risk perception. Second, the role of an individual's social environment should not be ignored, as higher perceived acceptability of condoms in the informant's peer group is related to more consistent condom use. Hence, efforts should be made to promote condom acceptability among male groups, in order to increase the acceptability of condom use. One possible approach to developing "environments of approval" could be to design programs reaching locally known informal leaders who can help to develop positive attitudes about condom use among their networks of young men. In addition, prevention programs should explore mechanisms for enhancement of perceived self-efficacy of individuals. A first step towards this would be to develop skills among individuals that can help them to buy condoms from either shops or vending machines placed in public places. Also, programs should continue to increase the availability of condoms at suitable locations.

5. Conclusions

In summary, an individual's psychosocial characteristics are part of the complex set of factors that influence unsafe sexual behaviors. This study documented positive association of perceived self-efficacy, perceived social support, perceived accessibility and perceived personal norms on use of condoms among clients of sex workers in India. Several of these psychosocial factors were also associated with the experience of STI-related symptoms and sex with multiple partners, highlighting the important role played by psychosocial factors in shaping sexual behaviors of individuals. Integrating psychosocial factors into the existing framework of HIV prevention programs can lead to better outcomes. Comprehensive interventions for preventing HIV/AIDS should include components directed to self-efficacy, perceived social support, and other psychosocial characteristics.

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Authors' Contribution

KPR conceptualized the study design and led the manuscript preparation; BM conducted analysis and literature review and assisted in conceptualization, writing of the manuscript and interpretation of the findings; AM, AK and SSN implemented the research, assisted in interpretation of study findings and manuscript writing; All authors have read and approved this version of the paper.

Conflicts of Interest

The authors declare no conflict of interest.

Appendix: Definition of Psychosocial Measures

Measures	Questions
Perceived self efficacy	1. I find it difficult to dispose off a condom after using it. 2. I would hesitate to buy condoms from a shop in my locality. 3. I would hesitate to buy condoms from a shop if the shopkeeper was a woman. 4. I would hesitate to buy condoms from a shop if there were a lot of people in the shop. 5. Even if I am drunk, I can remember to use a condom with a female sex worker. 6. Even in situations when I get excited by a female sex worker, I can remember to use a condom. 7. Even in situations when I need to hurry due to fear of a police raid, I can remember to use a condom with a female sex worker. 8. Even though I get very little time with a female sex worker, I can remember to use a condom. 9. I can buy a condom from any shop without any fear or embarrassment. 10. I would not be embarrassed or scared to carry a condom in my pocket throughout the day. 11. I am confident that I can carry a condom packet with me without anyone coming to know about it. 12. I always carry a condom with me while going to a female sex worker.
Perceived vulnerability	1. If a man knows the female sex worker well, it is safe not to use a condom with her 2. If the pimp recommends a female sex worker who does not have any disease, it is safe to have sex without a condom. 3. If the female sex worker looks young, it is safe to have sex without a condom. 4. HIV/AIDS is not a big problem in our country. 5. Very few people get HIV/AIDS. 6. HIV/AIDS is happening only in big cities.
Perceived social support	1. My friends and I have discussed the correct use of a condom. 2. Most of my friends encourage me to use a condom. 3. Most of my friends encourage me to carry a condom if I am going to have sex with a female sex worker. 4. Most of my friends often tell me about diseases I can get by not using condoms. 5. A female sex worker once explained the importance of using condoms to me.
Perceived accessibility	1. Generally, condoms are always available near the places where one could find female sex workers. 2. Condoms are available within 5-10 minutes walking distance from the place where I meet female sex workers. 3. If needed, I can get a condom within next 5-10 minutes of walking distance from this place (place of interview). 4. There is no need to carry a condom as the female sex worker will always have one with her. 5. The female sex worker forces me to use two condoms because of fear of bursting 6. I want to use a condom but the female sex worker does not want me to use a condom. 7. I get angry if the female sex worker forces me to use a condom. 8. I do not use a condom as I am paying to have sex.
Personal norms	1. I do not trust a female sex worker even if I know her for some time. 2. I do not trust a female sex worker even if she looks beautiful. 3. I do not trust a female sex worker if she tells me that she does not have any sexual disease. 4. I have developed a relationship with the female sex worker and I don't want to ruin it by introducing condoms. 5. I enjoy sex more if I use a condom. 6. I use condoms with the female sex worker so that I can confidently try new positions. 7. The female sex worker will be nicer to me if I use a condom. 8. I can feel the heat of the body even if I use a condom. 9. I can get the feel of skin-to-skin contact even if I use a condom 10. Sex is for fun, so why bother about condoms. 11. When I use a condom, I do not get satisfaction as the semen does not get into her vagina. 12. Though I carry a condom, after foreplay, I do not feel like using one.

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Heterosexual risk behaviour among long distance truck drivers in India: Role of marital status

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***Background & objectives*: The long distance truck drivers play an important role in the spread of HIV and sexually transmitted infections (STIs). The present study was carried out to examine association of marital status with heterosexual risk behaviour, condom use and prevalence of STI and HIV among long-distance male truck drivers in India.**

***Methods*: Using the time location cluster sampling approach, major transshipment locations covering the bulk of India's transport volume were surveyed in 2007. A total of 2,066 long-distance male truck drivers were surveyed and, after consent, interviewed about their socio-demographic characteristics, sexual behaviours, condom use practices, and tested for HIV, reactive syphilis serology, *Neiserria gonorrhoeae* and *Chlamydia trachomatis*. The key variable of this study marital status was divided in two categories: married and unmarried. Data were analyzed using multiple logistic regression methods with following four binary outcome variables (*i*) whether had sex with any non-regular partners in past 12 months; (*ii*) whether used condom consistently in past 12 months; (*iii*) whether tested positive for any STI; and (*iv*) whether tested positive for HIV.**

***Results*: Compared to married truck drivers, unmarried were significantly more likely to have sex with non-regular female partners (30.2 versus 66.9%, OR: 5.7, 95% CI 3.6-8.9), less likely to use condom consistently with non-regular female partners (50.1 versus 38.8%, OR: 0.7, 95% CI: 0.4-1.1) and more likely to have HIV (3.7 versus 3.4%, OR: 2.7, 95% CI: 1.1-6.5).**

***Interpretation & conclusions*: Unmarried truck drivers have a higher HIV risk behaviour and consequently they were more likely to have HIV than married drivers. Despite of high-risk behaviours, risk-perception remains low among both married and unmarried truck drivers. This belief coupled with inconsistent condom use put currently married long distance truck drivers as well as their wives at risk of getting infected from STI and HIV.**

Key words HIV - long distance truck drivers - marital status - sexual behaviour

It is well documented that long distance truckers play an important role in the spread of HIV epidemic worldwide. The sexual behaviour of long distance truckers has been linked with transmission of sexually transmitted infections (STIs) and HIV in India and elsewhere in Asia, Africa, South America and the United States[1-7]. HIV prevention interventions in India and elsewhere in the world have often focused on long distance truckers because of their high-risk behaviour, mobility and ability to spread infections to new geographic areas[1,2,4,7].

India has a large trucking population estimated at 5-6 million truckers and helpers, and about 2-2.5 million are classified as long-distance truckers[1,8]. It has been found that around one-third of the long distance truck drivers in India have sex with female sex workers (FSWs) and a substantial proportion of them have sexual relationships with unpaid casual female partners[9,10]. Consistent condom use among truck drivers in India is still low, at 58-74 per cent with FSWs, and 20 per cent with unpaid or casual female sex partners[9,11-13]. Studies in the country have found high HIV (2-13%) and high STI prevalence (3-16%) among long distance truck drivers[7,9,12,14]. However, truck drivers in India constitute heterogeneous population where age, education, marital status, length of time away from home, consumption of alcoholic beverages, and specific routes on which truck drivers usually travel correlate with different levels of risk behaviours and prevalence of STI and HIV among them[7,9-15].

Studies suggest that due to less social support and less frequent and lower satisfaction in sexual activity; unmarried men are more likely to have risk-taking behaviours as compared to married men[16,17]. Also, married men are believed to have more favourable attitudes toward obtaining, discussing and using condoms with non-marital partners possibly because they attempt to protect themselves and their wives by using condoms with non-regular sexual partners, rather than using it with their wives[17,18]. Condom use with wife or with intimate partners could send a strong signal of infidelity, and thus both partners have a disincentive to insist on using these[10,12,16,17]. Although differentials in sexual behaviours between married and unmarried truck drivers have been noted in various studies conducted in India[9,12-14], no specific effort has been made to understand the role of marital status in predicting the heterosexual risk behaviour and also STI and HIV prevalence among them. Therefore, the present study was aimed to examine the difference between the heterosexual risk behaviour and the prevalence of STI/HIV among married and unmarried long distance truck drivers in India.

Material & Methods

We used data from Integrated Behavioural and Assessment along National Highways (IBBA-NH) a large-scale cross-sectional survey among long distance truck drivers in India conducted in 2007 as part of the evaluation strategy of an up-scaled HIV prevention intervention among long distance truck drivers and helpers in the country. Details of the intervention programme are available elsewhere[15]. The survey was undertaken at seven transshipment locations covering the bulk of India's transport volume along four routes, North-East (NE), North-South (NS), North-West (NW) and South-East (SE). Transshipment locations are the places where transporters and brokers operate by linking truckers with individuals wanting their goods to be transported and the route categories are the road corridors traveled by long distance truck drivers.

Sampling method: A two-stage time-location cluster (TLC) sampling approach was used. Transport establishments (brokers and transporters) in different days of the week functioned as time-location clusters for the study. Separate sampling frame consisting of time-location clusters were developed for each route category. The sampling strategy consisted of two stages. In the first stage the required number of TLC were selected by using probability proportional to size approach. In second stage trucks were selected randomly from the selected TLC, and subsequently the main drivers of selected trucks were approached for participation.

Data collection: Behavioural data were collected by face-to-face interview using a pre-tested, pre-coded questionnaire translated into local languages by native speakers. Information about demographics, work, female sexual partners (wife, paid partner and non-paid partner) and condom use practices were obtained from the participants.

Biological testing: Blood and urine samples were collected from all participating long distance truck drivers. Anticubital venipunctured blood sample (5 ml) collected in a vacutainer was allowed to clot for separation of serum and was stored at 2 to 8^{o}C. From each participant, 30 ml urine sample was collected and from this 2 ml quantity only was stored in a urine specimen transport tube as per the protocol of M/s Gen-Probe

Aptima Combo 2 Assay (Gen-Probe Incorporated, USA). Serum samples were tested for both HIV-1 and HIV-2. All cases with rapid plasma reagin (RPR) reactive serology of any titre with treponema pallidum haemagglutination (TPHA) positivity were considered positive. For the diagnosis of *Neisseria gonorrhoeae* and *Chlamydia trachomatis,* urine samples were tested using Transcription- Mediated Amplification Assay and Dual Kinetic Assay (Gen-Probe Incorporated, USA).

Ethical issues: The study was approved by the relevant institutional review boards (Health Ministry Screening Committee, Government of India; Protection of Human Subjects Committee of Family Health International and Scientific Advisory Committee and Ethical Committee of National Institute of Medical Statistics). Participation followed written informed consent and all data were recorded in a linked anonymous manner using numerically coded cards. The project clinics (established as part of the intervention programme) were used to enable participants to obtain syphilis test results and treatment upon presentation of the numerically coded cards.

The survey covered a total of 2,066 long distance truck drivers (NE- 498; NS- 540; NW- 515; SE- 513) with an overall participation rate of 97 per cent (NE- 97%; NS- 96%; NW- 98% and SE- 98%). More information about the survey methodology can be found elsewhere[9,19].

Measures

Marital status: Marital status of the long distance truck drivers was the key independent variable in this study. Long distance truck drivers were grouped in two categories (married, unmarried) based on their current marital status. Unmarried respondents included those who were never married, widowed or divorced.

Heterosexual risk behaviour: Two types of female sexual partners were considered: paid female partner (PFP) and non-paid female partner (NPFP). A paid female partner was defined as a female from whom truck drivers bought sex and paid her in cash. A non-paid female partner (NPFP) was defined as a female that truck drivers were not married to and they did not pay her in cash for sex. Among married truck drivers, we also examined their sexual behaviour with their wives. Long distance truck drivers who had sex either with paid or non-paid female partners were termed to have non-regular partner. The heterosexual risk behaviour of the participants was measured by following indicators: sex with paid and non-paid female partners in past 12 months (no, yes), number of paid and non-paid female partners (up to 2, 3-6, 7 and more), age at first sex (up to 17, 18 yr or more) and age at first paid sex (up to 17, 18 yr or more).

Condom use practices: Consistent condom use with any given sexual partner (PFP, NPFP and wife) was assessed in terms of condom use in last sex and consistent condom use. Consistent condom use with any given sexual partner was defined as use of condom in every sexual encounter with that particular partner (no, yes). Information about reasons for inconsistent condom use was also elicited.

Knowledge about HIV/AIDS and risk-perception: The knowledge about HIV/AIDS was quantified using responses to a series of questions about ways a person could prevent becoming infected with HIV. Investigators read seven ways to prevent HIV infections and long distance truck drivers were asked whether or not they agree with those statements. The seven statements were: abstaining from sex, use of condom every time while engaging into sex, avoid sharing injections/needles, avoid being bitten by mosquito or other insects, not sharing clothes or eating utensils, eat nutritious food and have sex with only one uninfected partner. Those who gave correct response to all these questions were considered to have comprehensive knowledge about HIV. Participants were also asked whether or not they feel to be at risk of being infected with HIV/AIDS.

Prevalence of STI and HIV: Prevalence of following four STIs is given- Syphilis, *Neisseria gonorrhoeae*, *Chlamydia trachomatis* and HIV. Any STI was defined as presence of at least one of the above three STIs.

Socio-demographic and work related characteristics: Besides marital status, the survey collected information on other socio-demographic and work related characteristics. The socio-demographic characteristics were: age (up to 24, 25-34, 35 yr or more), literacy (no, yes), route category on which the respondent usually travels (NE, NS, NW and SE), duration of working as truck driver (up to 5, 6-10, 11 yr or more), duration of working as a helper (up to 2, more than 2 yr), time taken to complete last round-trip between main cities of operation (up to than 10, 10-12, 13 days or more) and time spent at destination in last trip (up to 48, 49-72, 73 h or more).

Statistical techniques: Cross-tabulations were made to examine the differences between the background characteristics, heterosexual behaviour, condom use

practices and prevalence of STI and HIV among married and unmarried long distance truck drivers. Differences in the percentages were tested using χ^2-test statistic. Separate multivariate logistic regression models were estimated with following four binary (no, yes) outcome variables (*i*) whether had sex with non-regular partners in past 12 months; (*ii*) whether used condom consistently in past 12 months with non-regular partner in past 12 months; (*iii)* whether tested positive for any STI; and (*iv*) whether tested positive for HIV. All socio-demographic and work related characteristics along with variable measuring age at first sex were controlled while carrying out multivariate analyses. Statistical software STATA (version 11) was used for statistical analyses.

Results

Socio-demographic and work related characteristics: Of the total 2,066 respondents, 1,576 (76.3%) were married and 490 (23.7%) were unmarried. Compared to married truckers, unmarried were younger (median age: 32 vs 25 yr) and had lesser duration of working as truck driver (median duration: 8 vs 4 yr). There were no significant differences between married and unmarried truck drivers in terms of literacy, duration of working as helper, number of days taken for roundtrip and time spent at destination (Table I).

Heterosexual behaviour with non-regular female partners: Compared to married, unmarried truck drivers were significantly more likely to have sexual debut before age of 18 yr (33.0 vs 39.8%, $P<0.001$) sex with paid female partners (23.4 vs 44.0%, $P<0.001$), sex with non-paid female partners (12.9 vs 41.3%, $P<0.001$) and sex with non-regular partner (30.2 vs. 66.9%, $P<0.001$). Compared to unmarried, larger proportion of married truck drivers used condom consistently with non-regular partner (38.8 vs 50.1%, $P<0.001$). Prevalence of any STI was higher (4.2%) among married truckers as compared to that (2.1%) among unmarried truckers ($P<0.05$). HIV prevalence was 3.4 per cent among married truckers and 3.7 per cent of the unmarried truckers (Table II).

Heterosexual behaviour of married long distance truck drivers with wife: About two-fifth (42.8%) respondents visited their wives five or more times in the past one month preceding the survey. The median number of sexual encounters with wife was 10 during last one month. Condom use with wife in last sexual encounter was found to be as low as 11.4 per cent and the percentage was further low to a level of 3 per cent when examined for consistent condom use (Table III).

Table I. Socio-demographic characteristics of married and unmarried long distance truck drivers, India, 2007

Socio-demographic characteristics	% and summary statistics		
	Married (N=1576)	Unmarried (N=490)	Total (N=2066)
Age (yr)***			
<25	12.6	45.6	21.3
25-34	48.1	46.8	47.7
>35	39.2	7.5	30.9
Median	32	25	30
Mean (SD)	33.8 (8.0)	25.8 (5.0)	31.9 (8.1)
Literate	87.4	84.1	86.5
Duration of working as a truck driver (yr)***			
<5	32.7	71.6	42.9
5-10	29.0	21.9	27.1
>11	38.3	6.5	30.0
Median	8	4	7
Mean (SD)	11.8 (7.2)	4.7 (4.5)	9.5 (7.2)
Duration of working as helper (yr)			
<3	49.4	55.6	51.1
>3	50.6	44.4	56.3
Median	3	2	3
Mean (SD)	8.9 (21.0)	6.2 (17.0)	8.2 (20.7)
Number of days taken for round trip			
<10	24.5	21.0	23.6
10-12	30.7	31.8	31.0
>13	44.8	47.2	45.4
Median	10	10	10
Mean (SD)	11.3 (5.6)	11.4 (2.7)	11.4 (5.0)
Time spent at destination (h)			
<48	61.9	63.4	62.3
49 – 72	16.2	13.9	15.6
>73	21.9	22.7	22.2
Median	48	48	48
Mean (SD)	65.9 (52.1)	63.0 (43.3)	65.2 (50.0)

P values *<0.05, **<0.01, ***<0.001

Note: Truck drivers who were married at the time of interview were considered as currently married. Unmarried respondents included those who were never married, widowed or divorced at the time interview

Table II. Heterosexual risk behaviour and STI and HIV status of married and unmarried long distance truck drivers in India, 2007

Heterosexual risk behaviour and STI and HIV status	% and summary statistics		
	Married (N=1,576)	Unmarried (N=490)	Total (N=2066)
Age at first sex[a] (yr)[**]			
<18	33.0	39.8	34.6
≥18	67.0	60.2	65.4
Median	18	18	18
Mean (SD)	19.4 (7.2)	16.5 (10.4)	18.6 (8.3)
Non-regular female partner in past 12 months			
Had sex with non-regular female partner[***]	30.2	66.9	39.8
Consistent condom use with non-regular female partner[**]	50.1	38.8	45.1
Paid female partners (PFP) in past 12 months			
Had sex with PFP[***]	23.4	44.0	28.8
Consistent condom use with PFP[b]	73.7	68.0	71.4
Age at first paid sex[b] (yr)			
<18	14.6	9.6	12.6
≥18	85.4	90.4	87.4
Median	21	20	20
Mean (SD)	24.4 (14.6)	21.9 (11.7)	23.4 (13.5)
Number of PFP[b]			
<3	45.8	39.3	43.2
3-6	34.8	36.9	35.7
≥7	19.5	23.8	21.2
Median	3	4	3
Mean (SD)	4.9 (6.0)	5.9 (6.8)	5.3 (6.4)
Reasons for not using condom with PFP[b,#]			
Condom not available at the time of sex	24.0	49.0	35.2
Sex worker did not have condom	20.3	10.8	16
Condom reduces sexual pleasure	28.6	36.9	32.4
The thought of using condom did not occur	14.9	2.5	9.4
Partner did not want	7.4	0.7	4.4
Non-paid female partners (NPFP) in past 12 months			
Had sex with NPFP[***]	12.9	41.3	20.4
Consistent condom use with NPFP[c]	17.8	20.3	19.1
Number of NPFP[c]			
1	63.4	63.7	63.5
2 or more	36.6	36.3	36.5
Median	1	1	1
Mean (SD)	2.4 (7.6)	2.1 (2.1)	2.2 (5.4)

Contd...

Heterosexual risk behaviour and STI and HIV status	% and summary statistics		
	Married (N=1,576)	Unmarried (N=490)	Total (N=2066)
Did not have a condom at the time of sex	17.2	12.1	14.5
Condom reduces pleasure	27.4	20.6	23.9
The thought of using condom did not occur	2.1	5.5	3.9
Used other contraceptives	1.4	2	1.7
Do not think it is necessary	47.1	57.4	52.5
Comprehensive knowledge of HIV & risk perception			
Comprehensive knowledge about HIV[+]	16.9	17.8	17.1
Risk perception: High[++]	8.9	12.7	9.9
Prevalence of STI/HIV			
Any STI[*]	4.2	2.1	3.7
HIV	3.4	3.7	3.5

P values [*]<0.05, [**]<0.01; [***]<0.001

Truck drivers who were married at the time of interview were considered as currently married. Unmarried respondents included those who were never married, widowed or divorced at the time interview

[a]Among those who reported to have sexual intercourse at least once in their lifetime; [b]Among those who reported to have sex with paid female partner in past 12 months; [c]Among those who reported to have sex with non-paid female partner in past 12 months.

[#]Multiple response. Consistent condom use refers to use of condom in every sexual encounters.

[+]Those who gave correct response to all HIV related questions asked by the investigator have been considered to have comprehensive knowledge of HIV; [++]Risk perception of HIV is defined as whether or not respondents feel to be at risk of getting infected with HIV

Factors associated with having sex with non-regular partner in past 12 months: The unmarried truck drivers were significantly more likely to have sex with non-regular partner in past 12 months than those who were married (OR 5.7; 95% CI 3.6-8.9; *P*<0.001). Drivers traveling on South-East routes were significantly more likely to have sex with non-regular partner as compared to those traveling on North-East route (South-East: OR 3.1; 95% CI 2.1-4.6; *P*<0.001). Compared to drivers aged 35 yr or more, likelihood of having sex with non-regular partner was higher among those who were less than 24 yr of age (OR 2.6; 95% CI 1.2-5.3; *P*<0.001) and those aged between 25-34 yr (OR 2.2; 95% CI 1.3-3.7; *P*<0.001). The propensity of having sex with non-regular partners was significantly higher among drivers who had their sexual debut before reaching adulthood (OR 1.8; 95% CI 1.3-2.7; *P*<0.001) and those who felt themselves to be at risk of HIV (OR 3.3; 95% CI 1.8-6.0; *P*<0.001) (Table IV).

Factors associated with consistent condom use with non-regular partner: Unmarried truck drivers were less likely to use condoms consistently than their married counterparts (OR 0.7; 95% CI 0.4-1.1; *P*<0.05). Respondents who had their sexual debut before reaching the adulthood were less likely to use condom consistently with non-regular partners than their counterparts (OR 0.6; 95% CI 0.4-0.9; *P*<0.01).

Factors associated with having any STI: Drivers traveling on South-East routes were significantly less likely to have STI as compared to those traveling on North-East route (South-East: OR 0.3; 95% CI 0.1-0.7; *P*<0.05). As compared to drivers who worked for 11 years or more, STI prevalence was lower among those who worked as driver for less than 5 years (OR 0.2; 95% CI 0.02- 0.4; *P*<0.05) and 5-10 years (OR 0.5; 95% CI 0.2- 1.1; *P*<0.05) (Table IV).

Factors associated with having HIV: Unmarried truck drivers were more likely to have HIV than their married counterparts (OR 2.7; 95% CI 1.1-6.5; *P*<0.05). Drivers traveling on South-East routes were significantly more likely to have HIV as compared to those traveling on North-East route (South-East: OR 2.3; 95% CI 0.8- 6.0; *P*<0.05). Compared to drivers who worked for 11 years or more, HIV prevalence was lower among those who worked as driver for less than 5 years (OR 0.1; 95% CI 0.02-0.4; *P*<0.001) and those who worked as driver for 5-10 years (0.2; 95% CI 0.1-0.8; *P*<0.001).

Table III. Sexual behaviour of married long distance truck drivers with wife in India, 2007

Sexual behaviour of married truck drivers with wife	Percentage and summary statistics
No. of visits to wife during last one month	
None	11.6
1-4	45.6
5 or more	42.8
Median	4
Frequency of sex with wife during last one month	
None	10.4
1-4	29.0
5 or more	60.6
Median	10
Condom use with wife	
Used in last sexual encounter	11.4
Consistent user	3.0
Reasons for not using condom with wife[#]	
Did not have a condom at the time of sex	1.1
Condom costs too much	7.4
Do not like using condom	3.7
The thought of using condom did not occur in mind	6.7
Used other contraceptives/wife operated	4.3
Wife did not want	67.9
Not necessary with wife	5.0
Against religion	3.7

Analysis was based among currently married respondents (N = 1576). Truck drivers who were married at the time of interview were considered as currently married. [#]Multiple response. Consistent condom use refers to use of condom in every sexual encounters

Pick-up addresses of paid-female partners: Most of the married (87.5%) and unmarried (79.6%) truck drivers picked up paid female partners while traveling on the roads (Table V). Larger proportion (20.9%) of unmarried truck drivers reported having sex with paid female partners while staying at home whereas this proportion for married truck drivers was as low as 6.9 per cent.

Discussion

The findings provide evidences that marital has a significant bearing on the heterosexual behaviours among long distance truck drivers in India. Unmarried truckers were more likely to have sex with non-regular partners, less likely to use condom consistently and more likely to have HIV. As compared to married truck drivers unmarried truckers were more likely to have sexual debut before reaching 18 year. The finding is in agreement to what has been reported in some of the other studies conducted in India[7,10,13,14,20,21].

The higher vulnerability of unmarried drivers compared to those who were married may be explained at least partially by the differential effects of the environmental factors associated with trucking industry. Unmarried truck drivers who are generally younger and do not have any socially accepted steady sexual partners are more likely to engage in riskier behaviours, including commercial sex, and sex with other women, if exposed to the environmental factors associated with trucking industry, such as high mobility with anonymity, easy availability of female sex workers and other women. This study corroborated the findings from the studies in different settings which concluded that due to less social support and less frequent and lower satisfaction in sexual activity, unmarried men were more likely to have risk-taking behaviours than that among married men[16,17]. The high-risk behaviour reported by the unmarried truck drivers coupled with the finding that unmarried truck drivers were more likely to have sexual debut before reaching the adulthood, corroborates with other studies across the world in various other settings which suggest that early initiation of sexual intercourse was linked with high HIV risk behaviour and it is also associated with longer periods of risk taking in later adolescence and early adulthood[22-25]. These evidences suggest that early sexual debut might be another factor behind differentials in high-risk sexual behaviour among married and unmarried truck drivers.

Consistent condom use with non-regular female partners was very low among both married and unmarried truck drivers. Despite of considerable high HIV-risk behaviour, very few truck drivers have comprehensive knowledge of HIV and only some of them considered themselves to be at risk of acquiring HIV. This implies towards the need to provide truck drivers more information about transmission of HIV and to address their myths and misconceptions. Further, very few married truckers reported consistent condom use with their wives. This may be due to greater level of intimacy and trust in such relationships, lower risk perception among married drivers and also the

Table IV. Model based estimates of odds of factors associated with sexual behaviour and STI/ HIV status of long distance truck drivers, India, 2007

	Odds of sex with any non-regular female partner	Odds of consistent condom use with any non-regular female partner	Odds of having any STI	Odds of having HIV
Marital status				
Married	1.00[a]	1.00[a]	1.00[a]	1.00[a]
Unmarried	5.7*** (3.6-8.9)	0.7* (0.4-1.1)	0.7 (0.3-1.8)	2.7* (1.1-6.5)
Routes				
North-East	1.00[a]	1.00[a]	1.00[a]	1.00[a]
North-South	1.2 (0.8-1.8)	1.0 (0.5-1.8)	0.8 (0.4-2.0)	0.9 (0.3-2.5)
North-West	1.2 (0.8-1.8)	0.8 (0.4-1.5)	0.7 (0.3-1.7)	1.9 (0.7-5.0)
South-East	3.1*** (2.1-4.6)	0.5 (0.3-1.0)	0.3* (0.1-0.7)	2.3* (0.8-6.0)
Age (yr)				
Up to 24	2.6*** (1.2-5.3)	0.7 (0.2-1.7)	3.2 (0.4-23.2)	0.6 (0.1-4.4)
25-34	2.2*** (1.3-3.7)	1.1 (0.5-2.3)	0.9 (0.4-2.0)	2.3 (0.7-7.1)
35 or more	1.00*	1.00[a]	1.00[a]	1.00[a]
Duration of working as a truck driver (yr)				
Less than 5	1.1 (0.7-1.6)	0.6 (0.3-1.0)	0.2* (0.02-1.2)	0.1*** (0.02-0.4)
5-10	1.1 (0.8-1.6)	0.6 (0.3-0.9)	0.5* (0.2-1.1)	0.2*** (0.1-0.8)
11 or more	1.00[a]	1.00[a]	1.00[a]	1.00[a]
Age at first sex (yr)				
<18	1.8*** (1.3-2.7)	0.6** (0.4-0.9)	1.2 (0.6-2.4)	0.6 (0.3-1.4)
>18	1.00***	1.00[a]	1.00[a]	1.00[a]
Comprehensive knowledge of HIV[#]				
Yes	0.8 (0.5-1.3)	1.1 (0.6-2.0)	1.0 (0.5-2.3)	1.2 (0.6-2.8)
No	1.00[a]	1.00[a]	1.00[a]	1.00[a]
Risk perception[##]				
Yes	3.3*** (1.8-6.0)	0.7 (0.4-1.3)	0.6 (0.1-3.3)	1.2 (0.4-4.1)
No	1.00[a]	1.00[a]	1.00[a]	1.00[a]

P values *<0.05, **<0.01; ***<0.001

Truck drivers who were married at the time of interview were considered as currently married. Unmarried respondents included those who were never married, widowed or divorced at the time interview

[a]Reference category; [#]Those who gave correct response to all HIV related questions asked by the investigator were considered to have comprehensive knowledge of HIV; [##]Risk perception of HIV was defined as whether or not respondents feel to be at risk of getting infected with HIV/AIDS

perception of condoms as means of family planning and not as a measure to prevent STI and HIV. The inconsistent condom use among the married truck drivers put their wives at risk of getting infected from STI and HIV. The findings provide empirical evidences that long distance truck drivers are an important bridge group for transmission of HIV and STI from high-risk group of commercial sex workers to the low-risk general women.

Although the current study provides important insights to support better HIV prevention efforts

Table V. Percentage of married and unmarried long distance truck drivers by pick up areas of paid female partners, India, 2007

Pick up areas of paid female partners[#]	Married (N=428)	Unmarried (N=213)	Total (N=641)
At the time of traveling on road	87.5	79.6	85.8
Between offloading and reloading at transshipment location	44.4	39.1	8.4
Between trips while staying at home	6.9	20.9	3.1

Analysis was restricted to those who reported to have sex with paid female partner in past 12 months
[#]Multiple responses

for long distance truck drivers, the findings must be interpreted with consideration of some limitations. The respondents in the present study were long distance truck drivers. Hence, long distance truckers who work as helpers were excluded by the design making findings of this study to be applicable only for the drivers and not for the helpers. The data on sexual behaviour were based on self-reports, subject to recall and social desirability biases. Although efforts were made to reduce such biases by maintaining privacy during the interviewing and using a shorter-term recall period, presence of such biases cannot be denied which might have some effect on the results.

In conclusion, the results of this study suggest that the HIV prevention programme among long distance truck drivers needs to focus more on those who are unmarried. Concerted efforts are required for positive behaviour changes among long distance truck drivers. Some more efforts (*e.g.*, availability of condoms in high-risk settings, awareness among truckers about being at risk of acquiring STI and HIV, *etc.*) are required to make truckers motivated and able to use condom each time they have sex with non-regular partners. Further, married drivers should be made aware that they must use condom with non-regular partners to protect themselves as well as their spouses. The low percentage of truck drivers with comprehensive knowledge is also an area of immediate concern. Lastly, an area of future research among the married truck drivers could be to explore the sexual culture and risk behaviour of wives of these truckers. If separation from wife may stimulate risk-taking behaviour of truck drivers same is applicable to their wives too. Very little is known about this issue which is equally important to studying sexual behaviour of truck drivers.

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ORIGINAL RESEARCH

The association between adolescent entry into the trucking industry and risk of HIV among long-distance truck drivers in India

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Abstract: This study examines the relationship between entry into the trucking industry during adolescence and both sexually transmitted infections (STIs) and infection by the human immunodeficiency virus (HIV) among long-distance truck drivers in India. Data were sourced from a cross-sectional survey (sample size: 2066) undertaken in 2007 among long-distance truck drivers. The survey spread across major transshipment locations covering the bulk of India's transport volume along four routes. Participants were interviewed about sexual behaviors and were tested for HIV and STIs. The present authors constructed two synthetic cohorts based on the participants' duration of employment in the trucking industry: (1) low (duration $\leq$ 6 years) and (2) high experience (duration $\geq$ 7 years). Based on age at entry into the trucking industry, participants were termed as either adolescent (age at entry $<$ 18 complete years) or adult entrants (age at entry $\geq$ 18 complete years). In the low-experience cohort, the adolescent entrants were more likely than the adult entrants to have sex with paid female partners (42.6% versus 27.2%, respectively; adjusted odds ratio [OR]: 1.9; 95% confidence interval [CI]: 1.3–2.9) and to practice inconsistent condom use with such partners (69.1% versus 26.8%, respectively; adjusted OR: 5.3; 95% CI: 2.4–11.6). However, no significant differences were found in STI and HIV prevalence between the adolescent and the adult entrants in this cohort. In the high-experience cohort, the adolescent entrants were about two times more likely than the adult entrants to practice inconsistent condom use with paid female partners (38.5% versus 26.7%, respectively; adjusted OR: 1.7; 95% CI: 1.1–2.8) and to test positive for HIV (7.4% versus 4.0%, respectively; adjusted OR: 1.9; 95% CI: 1.2–3.1) and syphilis (5.7% versus 3.5%, respectively; adjusted OR: 1.8; 95% CI: 1.1–3.1). These results suggest the need for focused behavioral change programs in HIV prevention interventions for adolescent truckers in India and elsewhere.

Keywords: sexually transmitted infections, condom use, risky sexual behavior, truckers

Introduction

It is well documented that long-distance truck drivers and their helpers (collectively referred to as truckers) play an important role in the spread of sexually transmitted infections (STIs) and the human immunodeficiency virus (HIV) in many parts of the world, including India.[1–10] Recent evidence suggests that about one-quarter of the long-distance truck drivers in India have sex with female sex workers (FSWs),[7,11,12] constituting about 15%–20% of clients of FSWs,[8] and a substantial proportion have sexual relationships with casual unpaid female partners.[7,11] Studies conducted during 2007-2010 have shown that the rate of consistent condom use among truckers in India was low, at 58%–74% with FSWs and 18%–37% with casual unpaid female sex partners.[7,11,12] Several studies across the country have confirmed high HIV (2%–16%) and STI (3%–13%) prevalence among long-distance truckers.[9,12]

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Truckers constitute a heterogeneous population. Studies conducted in India indicate that current age, marital status, literacy, duration of employment in the trucking industry, duration of time spent away from home, alcohol consumption, and the specific routes on which the truckers usually travel correlate with different levels of risky sexual behavior and the corresponding prevalence of STIs and HIV among truckers.[9,11,12] However, an issue that has received less focus so far is the possible effect of the age at which truckers enter the trucking industry on their sexual behavior and STI/HIV status.

Although little is known about the sexual behavior of adolescent truckers in India, it has been observed that most of the long-distance truck drivers start working as helpers, with a substantial number entering the industry in their adolescence,[13] and some adolescent helpers in the past have reported visiting FSWs.[14] Considering that adolescents have a tendency to take greater risks than adults[15–17] and that behaviors established during adolescence may continue into later adolescence and early adulthood,[15,18,19] it may be argued that truck drivers who enter the trucking industry in adolescence may have higher vulnerability toward STIs and HIV infection than those who enter the industry as adults. Therefore, in this paper, the authors examine the effect of adolescent entry into the trucking industry on sexual behavior and STI/HIV status among long-distance truck drivers in India. Since longer duration of employment in the trucking industry correlates with a higher risk among truck drivers for contracting STIs and HIV,[9,11] this study also examines the effects of adolescent entry into the trucking industry on sexual behavior and STI/HIV status by duration of employment in the trucking industry.

Methods

Study settings and sampling

The authors used data from a cross-sectional behavioral and biological survey conducted in 2007 among long-distance truck drivers in India. Long-distance truck drivers were defined as truck drivers traveling to destinations over 800 km from their point of origin. The survey was undertaken at seven transshipment locations covering the bulk of India's transport volume along four routes: North-East, North-South, North-West, and South-East. Transshipment locations are places where transporters and brokers operate by linking truckers with individuals wanting to have goods transported; route categories are road corridors traveled by long-distance truck drivers.

A two-stage time-location cluster sampling approach was used to select respondents for the survey, covering 2066 long-distance truck drivers, a participation rate of 97%. Participation followed written informed consent, and all data were recorded in an anonymously linked manner using numerically coded cards. Behavioral data, including information about demographics, work, sexual partners, and condom use, were collected through face-to-face interviews, using a pretested, precoded questionnaire translated into local languages. Blood and urine samples were collected from all participating truckers. A blood sample (5 mL), obtained by antecubital venipuncture, was collected in a vacutainer, clotted for separation of serum, and stored at 2°C–8°C. A 30 mL urine sample was collected, from which 2 mL was stored in a urine specimen transport tube as per the protocol of the Aptima Combo 2® Assay (Gen-Probe Incorporated, San Diego, CA). Sera were tested for both HIV-1 and HIV-2 using the Microlisa HIV® kit (J Mitra & Co, Pvt Ltd, New Delhi, India) and the Genedia® HIV 1/2 ELISA 3.0 Kit (Green Cross Medical Science Corp, Chungbuk, Korea). Serologic tests for syphilis were performed using the Rapid Plasma Reagin Test Kit (Span Diagnostics Limited, Surat, India) and reactive serology was confirmed by *Treponema pallidum* hemagglutination assay (TPHA) (Syphagen TPHA Kit; Biokit, SA, Lliça d'Amunt, Spain). All cases with reactive rapid plasma reagin serology and TPHA positivity were considered positive for syphilis. To diagnose *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infections, urine samples were tested using the Transcription-Mediated Amplification Assay and the Dual Kinetic Assay (Gen-Probe Incorporated).

Ethical considerations

All relevant institutional review boards (Health Ministry Screening Committee, Government of India; Scientific Advisory Committee, National AIDS Research Institute; Protection of Human Subjects Committee, Family Health International; and Scientific Advisory Committee and Ethical Committee, National Institute of Medical Statistics) approved the study. As stated, participation followed written informed consent, and all data were recorded in an anonymously linked manner using numerically coded cards. Participants were given information on safe sex practices and HIV prevention and care facilities in the area. Numerically coded cards were provided to the participants for receiving test results and free treatment for syphilis at clinics being run under the Kavach HIV prevention program for truckers at major transshipment locations around India. More information about the survey methodology and salient findings can be found elsewhere.[10,20,21]

Measures

Sociodemographic and work-related characteristics

The sociodemographic and work-related characteristics of respondents included age (in completed years), literacy (defined as ability to read and write [yes/no]), marital status (currently married/not currently married), ownership of truck by respondent (yes/no), and route category (North-East, North-South, North-West, South-East).

Adolescent and adult entrants

The key independent variable in this study was the age at which respondents entered the trucking industry. Drivers who entered the industry before 18 complete years of age were termed adolescent entrants, while those who entered the industry at 18 complete years of age or older were termed adult entrants. The cutoff age of 18 years was chosen because it is the legal age of adulthood in India, when people are expected to be mature enough to be given important rights such as the right to vote[22] or the right to consume tobacco products.[23,24]

Duration of employment in the trucking industry

Two synthetic cohorts (termed low-experience and high-experience cohorts) were constructed based on the respondents' duration of employment in the trucking industry. The low-experience cohort comprised respondents who had worked as truckers for 6 years or less, while the high-experience cohort comprised those who had worked as truckers for 7 years or more. The cutoff point was selected to be 6 years because the difference in the average age at entry into the trucking industry for adolescent and adult entrants, as shown in the preliminary analysis of the data (see "Statistical analyses" section), was about 6 years.

Sexual behavior

Multiple indicators were used to measure the sexual behavior of respondents. These included age at first sexual intercourse; sexual partnerships with paid female partners, nonpaid female partners, and male or transgender partners; and inconsistent condom use with these partners. "Paid female partner" was defined as a woman to whom the respondent paid cash in exchange for sex. "Nonpaid female partner" was defined as a woman to whom the respondent was not married and to whom the respondent did not pay cash in exchange for sex. "Inconsistent condom use" was defined as failure to use a condom in every sexual encounter with a particular type of sexual partner for a minimum of the past 12 months. To assess inconsistent condom use, participants were asked, for each type of sexual partner, whether they used a condom in each sexual act and the time elapsed since they had been using condoms in every sexual act with the particular type of sexual partner. Using these questions, dummy variables for inconsistent condom use with the different types of sexual partners were computed.

Prevalence of STIs and HIV infection

A respondent was considered to have an STI if at least one of the following three STIs, for which prevalence was given, was found to be present: syphilis, *N. gonorrhoeae*, and *C. trachomatis*. A respondent was termed HIV positive if he tested positive for HIV-1, HIV-2, or both.

Statistical analyses

Appropriate sampling weights were used to account for differential probabilities of selection and for differential nonresponse rates across survey locations. Use of sampling weights provided unbiased estimates of the proportions, averages, and regression coefficients. Details regarding calculation of sampling weights are described elsewhere.[20] Cross-tabulations were used to examine the differences in background characteristics, sexual behavior, and STI and HIV prevalence between the adolescent and the adult entrants and between the low-experience and the high-experience cohorts. The chi-square test and the unpaired *t*-test were applied to test the significance of the differences in sociodemographic characteristics. To assess the effects of age at entry into and duration of employment in the trucking industry on sexual behavior and STI/HIV prevalence among truck drivers, separate multivariate logistic regression models were estimated with the following binary (yes/no) outcome variables: (1) whether had first sexual intercourse before the age of 18 years; (2) whether had sex with paid female partners in the past 12 months; (3) whether practiced inconsistent condom use with paid female partners in the past 12 months; (4) whether had sex with nonpaid female partners in the past 12 months; (5) whether practiced inconsistent condom use with nonpaid female partners in the past 12 months; (6) whether had sex with male or transgender partners in the past 12 months; (7) whether tested positive for HIV; (8) whether tested positive for syphilis; and (9) whether tested positive for any STI. All sociodemographic and work-related characteristics except for current age were controlled in the multivariate analyses to estimate adjusted odds ratios (ORs) and their 95% confidence intervals (CIs). The current age of the respondents was not included in the model so as to avoid problems of collinearity, as current age was determined by variables measuring

age at entry into and duration of employment in the trucking industry. Analyses were repeated and stratified by duration of employment in the trucking industry, because of its strong association with STI and HIV status among truck drivers. The statistical software Stata (v 11.1; StataCorp LP, College Station, TX) was used for analyses.

Results

Of the 2066 respondents covered in the survey, 555 (26.9%) were adolescent entrants and 1511 (73.1%) were adult entrants. A total of 705 (34.1%) participants belonged to the low-experience cohort, and 1361 (65.9%) belonged to the high-experience cohort. The low-experience and high-experience cohorts had 113 (16.0%) and 442 (32.5%) adolescent entrants, respectively (Table 1). Compared with adult entrants, a significantly lower proportion of adolescent entrants were currently married (75.7% versus 68.5%, respectively; $P = 0.01$) and owned a truck (16.9% versus 7.1%, respectively; $P = 0.01$). Compared with participants from the low-experience cohort, a significantly higher proportion of participants from the high-experience cohort were currently married (56.3% versus 82.9%, respectively; $P < 0.01$). Compared with participants from the high-experience cohort, a higher proportion of participants from the low-experience cohort were able to both read and write (84.7% versus 90.1%, respectively; $P = 0.01$) and owned a truck (12.5% versus 17.6%, respectively; $P = 0.02$).

Table 2 shows that adolescent entrants were about four times more likely than adult entrants to have experienced their first sexual intercourse before the age of 18 years (54.5% versus 25.5%, respectively; adjusted OR: 3.6; 95% CI: 2.9–4.4), about two times more likely than adult entrants to have practiced inconsistent condom use with paid female partners in the past 12 months (46.4% versus 26.8%, respectively; adjusted OR: 2.2; 95% CI: 1.5–3.2), about three times more likely than adult entrants to have had sex with male or transgender partners in the past 12 months (5.3% versus 1.9%, respectively; adjusted OR: 2.7; 95% CI: 1.6–4.7), and about two times more likely than adult entrants to test positive for HIV (6.0% versus 2.6%, respectively; adjusted OR: 2.4; 95% CI: 1.5–3.9) and syphilis (4.6% versus 2.7%, respectively; adjusted OR: 1.8; 95% CI: 1.1–3.0). Differences in sexual behaviors of participants between the low-experience and the high-experience cohorts in the past 12 months could not reach statistical significance. However, participants belonging to the high-experience cohort were more likely than those from the low-experience cohort to test positive for HIV (5.1% versus 0.4%, respectively; adjusted OR: 17.3; 95% CI: 5.1–58.4) and syphilis (4.2% versus 1.2%, respectively; adjusted OR: 3.5; 95% CI: 1.6–7.4).

Table 1 Sociodemographic and work-related characteristics of long-distance truck drivers by age at entry into and duration of employment in the trucking industry (India, 2007)

Sociodemographic and work-related characteristics	Age at entry into trucking industry			Duration of employment in trucking industry		
	Adolescent entrants[a] (n = 555)	Adult entrants[b] (n = 1511)	*P*-value	Low experience[c] (n = 705)	High experience[d] (n = 1361)	*P*-value
Mean current age [years (SD)]	29.0 (7.7)	31.8 (7.8)	<0.01	25.4 (4.9)	33.9 (7.5)	<0.01
Literacy[e] (%)	83.7	87.6	0.03	90.1	84.7	0.01
Currently married (%)	68.5	75.7	0.01	56.3	82.9	<0.01
Mean age at entry into trucking industry [years (SD)]	15.8 (1.4)	21.6 (4.0)	<0.01	21.2 (5.0)	19.5 (3.8)	<0.01
Mean duration of employment in trucking industry [years (SD)]	12.8 (7.2)	9.9 (6.6)	<0.01	4.2 (1.5)	14.2 (6.1)	<0.01
Ownership of truck (%)	7.1	16.9	0.01	17.6	12.5	0.02
Route category[f] (%)						
North-East	30.9	24.3	0.03	20.6	28.9	<0.01
North-South	25.2	25.9		24.7	26.3	
North-West	37.2	45.1		52.8	37.9	
South-East	6.6	4.7		1.95	6.85	
Age at entry into trucking industry						
Adolescent entrants	–	–		16.0	32.5	<0.01
Adult entrants	–	–		84.0	67.5	

Notes: [a]"Adolescent entrants" defined as age at entry into trucking industry <18 complete years; [b]"adult entrants" defined as age at entry into trucking industry ≥ 18 complete years; [c]"low experience" defined as duration of employment in trucking industry ≤6 years; [d]"high experience" defined as duration of employment in trucking industry ≥ 7 years; [e]"literacy" refers to the ability to both read and write; [f]"route category" refers to the road corridors on which the respondent usually travels; significance of difference in percentages across categories was tested using the chi-square test; significance of difference in average values was tested using the unpaired *t*-test.
Abbreviation: SD, standard deviation.

Table 2 Sexual behavior and prevalence of sexually transmitted infections (STIs) and human immunodeficiency virus (HIV) infection among long-distance truck drivers by age at entry into and duration of employment in the trucking industry (India, 2007)

Sexual behavior and STI/HIV prevalence	Age at entry into trucking industry			Duration of employment in trucking industry		
	Adolescent entrants[a] [% (N)]	Adult entrants[b] [% (N)]	Adjusted OR[c] (95% CI)	Low experience[d] [% (N)]	High experience[e] [% (N)]	Adjusted OR[c] (95% CI)
Age at first sexual intercourse < 18 years	54.5 (555)	25.5 (1511)	3.6 (2.9–4.4)	27.2 (705)	36.5 (1361)	1.5 (1.2–1.9)
Paid female partners (past 12 months)						
Had sex with	33.8 (555)	27.1 (1511)	1.3 (1.1–1.6)	29.7 (705)	28.4 (1361)	1.2 (1.0–1.5)
Inconsistent condom use with	46.4 (188)	26.8 (408)	2.2 (1.5–3.2)	36.5 (209)	30.9 (387)	0.7 (0.5–1.1)
Nonpaid female partners (past 12 months)						
Had sex with	21.3 (555)	20.0 (1511)	1.0 (0.8–1.3)	27.9 (705)	16.5 (1361)	0.8 (0.6–1.1)
Inconsistent condom use with	81.8 (118)	79.7 (302)	0.7 (0.4–1.2)	80.0 (195)	80.5 (225)	1.0 (0.6–2.1)
Male or transgender partners (past 12 months)						
Had sex with	5.3 (555)	1.9 (1511)	2.7 (1.6–4.7)	4.4 (705)	2.0 (1361)	0.9 (0.5–1.5)
Inconsistent condom use with	87.2 (29)	65.6 (29)	NE	75.6 (31)	77.6 (27)	NE
STI/HIV prevalence						
HIV	6.0 (555)	2.6 (1511)	2.4 (1.5–3.9)	0.4 (705)	5.1 (1361)	17.3 (5.1–58.4)
Syphilis	4.6 (555)	2.7 (1511)	1.8 (1.1–3.0)	1.2 (705)	4.2 (1361)	3.5 (1.6–7.4)
Neisseria gonorrhoeae	0.7 (555)	0.1 (1511)	NE	0.0 (705)	0.4 (1361)	NE
Chlamydia trachomatis	0.9 (555)	0.1 (1511)	NE	0.1 (705)	0.4 (1361)	NE
Any STI[g]	6.1 (555)	2.8 (1511)	2.3 (1.4–3.7)	1.3 (705)	4.9 (1361)	3.7 (1.8–7.5)

Notes: [a]"Adolescent entrants" defined as age at entry into the trucking industry < 18 complete years; [b]"adult entrants" defined as age at entry into the trucking industry ≥ 18 complete years; [c]ORs were adjusted for literacy (yes/no), marital status (currently married/not currently married), ownership of truck by respondent (yes/no), and route categories (North-East, North-South, North-West, South-East) by using multivariate logistic regression analyses; adult entrants were considered as reference category to examine the effects of age at entry into the trucking industry on outcomes. Low experience cohort was considered as reference category to examine the effect of duration of employment in the trucking industry on outcomes. [d]"low experience" defined as duration of employment in the trucking industry ≤ 6 years; [e]"high experience" defined as duration of employment in the trucking industry ≥ 7 years; multivariate logistic regression models were not estimated because of small cell frequencies; [g]"any STI" defined as presence of at least one of the three STIs syphilis, *N. gonorrhoeae*, and *C. trachomatis*.

Abbreviations: CI, confidence interval; NE, not estimable; OR, odds ratio.

Table 3 shows results from the duration-stratified analyses. Adolescent entrants were significantly more likely than adult entrants to have experienced their first sexual intercourse before the age of 18 years, both in the low-experience (46.3% versus 23.6%, respectively; adjusted OR: 2.8; 95% CI: 1.8–4.3) and the high-experience cohort (56.6% versus 26.8%, respectively; adjusted OR: 3.8; 95% CI: 3.0–4.9). In the low-experience cohort, the adolescent entrants were about twice as likely as the adult entrants to have had sex with paid female partners in the past 12 months (42.6% versus 27.2%, respectively; adjusted OR: 1.9; 95% CI: 1.3–2.9), about five times more likely than the adult entrants to practice inconsistent condom use in such relationships (69.1% versus 26.8%, respectively; adjusted OR: 5.3; 95% CI: 2.4–11.6), and about four times more likely than the adult entrants to have sex with male or transgender partners (17.7% versus 1.9%, respectively; adjusted OR: 3.8; 95% CI: 1.7–11.2). However, no significant differences were found in STI and HIV prevalence between the adolescent and the adult entrants in this cohort. In the high-experience cohort, the adolescent entrants were about two times more likely than the adult entrants to practice inconsistent condom use with paid female partners (38.5% versus 26.7%, respectively; adjusted OR: 1.7; 95% CI: 1.1–2.8) and to test positive for HIV (7.4% versus 4.0%, respectively; adjusted OR: 1.9; 95% CI: 1.2–3.1) and syphilis (5.7% versus 3.5%, respectively; adjusted OR: 1.8; 95% CI: 1.1–3.1).

Discussion

This study shows that long-distance truck drivers in India who enter the trucking industry during their adolescence are at significantly higher risk of contracting STIs and HIV than those who enter the industry as adults. The duration of employment in the trucking industry also exhibits significant association with higher STI and HIV prevalence, especially among the adolescent entrants. Adolescent entrants were more likely to experience sexual debut at an early age, exhibit high-risk sexual behavior, and exhibit higher STI and HIV prevalence than adult entrants. The differential in sexual behavior between the ado-

Table 3 Effect of age at entry into the trucking industry on sexual behavior and prevalence of sexually transmitted infections (STIs) and human immunodeficiency virus (HIV) infection among long-distance truck drivers stratified by duration of employment in the trucking industry (India, 2007)

Sexual behavior and STI/HIV prevalence	Low experience			High experience		
	Adolescent entrants[a] [% (N)]	Adult entrants[b] [% (N)]	Adjusted OR[c] (95% CI)	Adolescent entrants[d] [% (N)]	Adult entrants[e] [% (N)]	Adjusted OR[c] (95% CI)
Age at first sexual intercourse < 18 years	46.3 (113)	23.6 (592)	2.8 (1.8–4.3)	56.6 (442)	26.8 (919)	3.8 (3.0–4.9)
Paid female partners (past 12 months)						
Had sex with	42.6 (113)	27.2 (592)	1.9 (1.3–2.9)	31.5 (442)	26.9 (919)	1.1 (0.8–1.4)
Inconsistent condom use with	69.1 (48)	26.8 (161)	5.3 (2.4–11.6)	38.5 (139)	26.7 (247)	1.7 (1.1–2.8)
Nonpaid female partners (past 12 months)						
Had sex with	30.8 (113)	27.3 (592)	0.7 (0.3–1.5)	18.9 (442)	15.3 (919)	1.0 (0.6–1.7)
Inconsistent condom use with	87.6 (35)	78.4 (162)	1.3 (0.2–8.1)	79.4 (84)	81.2 (141)	1.1 (0.5–3.9)
Male or transgender partners (past 12 months)						
Had sex with	17.7 (113)	1.9 (592)	3.8 (1.7–11.2)	2.1 (442)	2.0 (919)	1.1 (0.5–3.1)
Inconsistent condom use with	94.2 (20)	41.6 (11)	NE	71.8 (9)	80.5 (18)	NE
STI/HIV prevalence						
HIV	0.7[f]	0.3[f]	NE	7.4[f]	4.0[f]	1.9 (1.2–3.1)
Syphilis	0.4[f]	1.3[f]	NE	5.7[f]	3.5[f]	1.8 (1.1–3.1)
Neisseria gonorrhoeae	0.0[f]	0.0[f]	NE	0.9[f]	0.2[f]	NE
Chlamydia trachomatis	0.7[f]	0.0[f]	NE	0.9[f]	0.1[f]	NE
Any STI[g]	1.1 (113)	1.3 (592)	1.3 (0.3–19.7)	7.4 (442)	3.8 (919)	2.1 (1.3–3.6)

Notes: [a]"Adolescent entrants" defined as age at entry into the trucking industry < 18 complete years; [b]"adult entrants" defined as age at entry into the trucking industry ≥ 18 complete years; [c]ORs were adjusted for literacy (yes/no), marital status (currently married/not currently married), ownership of truck by respondent (yes/no), and route categories (North-East, North-South, North-West, South-East) by using multivariate logistic regression analyses; adults entrants were considered as reference category; [d]"low experience" defined as duration of employment in the trucking industry ≤ 6 years; [e]"high experience" defined as duration of employment in the trucking industry ≥ 7 years; multivariate logistic regression models were not estimated because of small cell frequencies; [f]total in group not shown; [g]"any STI" defined as presence of at least one of the three STIs syphilis, *N. gonorrhoeae*, and *C. trachomatis*.

Abbreviations: CI, confidence interval; NE, not estimable; OR, odds ratio.

lescent and the adult entrants was particularly substantial in the low-experience cohort, whereas the differential in STI and HIV prevalence between the adolescent and the adult entrants could reach statistical significance in the high-experience cohort.

These findings are consistent with results from research in various other settings that determined early initiation of sexual intercourse was linked with HIV high-risk behavior[25–29] and was associated with longer periods of risk taking in later adolescence and early adulthood.[15–19] This evidence suggests that sexual debut at an early age may be one of the critical factors behind the differential in high-risk sexual behavior between adolescent and adult entrants in the low-experience cohort. The higher vulnerability of adolescent entrants compared with that of adult entrants may also be explained, at least partly, by the following two factors: first, adolescent boys who are believed to be "risk takers" – owing to a combination of physiological sexual urge, peer influences, and a need for experimentation[16,17] – are more likely to engage in riskier behaviors, including commercial sex and sexual relationships with male or transgender partners, if exposed to the environmental factors associated with the trucking industry, such as high mobility, easy access to FSWs, and interaction with men who are often away from their families (eg, senior drivers, other helpers, males working at roadside eating establishments, transgender people, and so forth); second, some of the senior drivers force adolescent helpers into "survival sex." The ability of helpers to resist and negotiate with the senior drivers is often limited, because in most cases they are appointed on contract by the drivers themselves.[30] Although this study did not collect specific information about coerced sexual activities between drivers and helpers, this could be an important area for future research and intervention.

The low STI and HIV prevalence observed in the low-experience cohort could be explained, at least to some extent, by several factors such as the overall declining trend in STI and HIV prevalence in India among high-risk groups

(including truckers, FSWs, and men who have sex with male or transgender partners),[11,31,32] implementation of high-intensity HIV prevention programs among high-risk groups during the past decade,[32,33] and the low infectivity of HIV through unprotected sexual contact in the absence of STIs.[34]

These findings are important because, to the best of the authors' knowledge, there has not been any study previously that has conducted a detailed examination of the effect of entry into the trucking industry during adolescence on the sexual behavior of long-distance truck drivers in India. A connection between age of entry into the trucking industry and sexual behavior of truckers in India has critical policy implications regarding HIV prevention programs. HIV prevention programs need to cover long-distance truckers during their initial years of working, when the truckers are most likely to initiate the risk-taking behaviors that in the long run result in the higher prevalence of STIs and HIV infection among truckers. Hence, concerted efforts may be required to sensitize and inform adolescent helpers about the risks and consequences of STIs and HIV infection. One possible intervention could be to convince transporters and brokers (the middlemen on whom long-distance truck drivers in India largely depend for their business) to recruit helpers themselves, rather than leaving recruitment primarily to the drivers, and sensitize them to this issue. This may provide some autonomy to helpers in order to avoid sexual relationships forced on them by senior drivers.

Although this study offers important findings, the results must be interpreted cautiously, by considering certain study limitations. The participants in the survey were adults working as long-distance truck drivers. Therefore, the findings are applicable to truckers who either started working as truck drivers or were promoted after working as helpers; the findings are not applicable to individuals who worked as helpers but were never promoted to truck drivers. Nonetheless, considering the high vulnerability of adolescent truckers to STIs and HIV, similar studies are needed among helpers to understand the effects of adolescent entry into the trucking industry on their sexual behavior and STI/HIV status. The behavioral measures used in this study were derived from self-reports, which are vulnerable to recall and social desirability bias. The HIV prevalence among the low-experience cohort was very low, which limited the choices for analysis of HIV data in this cohort.

Conclusion

In summary, the current study documents that long-distance truck drivers in India who enter the trucking industry during their adolescence are more likely than those who enter the industry as adults to display high-risk behavior and to have higher STI and HIV prevalence. These data highlight the need for HIV prevention programs to start focusing on adolescent truckers as early as possible during their initial years of working in order to maximize the effects of HIV prevention interventions. Losing adolescent truckers from the coverage of HIV prevention programs may be a lost opportunity in preventing truckers from contracting HIV.

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