

# AIDS in Mexico: lessons learned and implications for developing countries

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## Introduction

Although anecdotal evidence suggests that HIV infections in Mexico were occurring in 1981, the first cases of AIDS in Mexico were documented in 1983. Since then, approximately 50 000 cases of AIDS have been reported nationwide and it is estimated that there are approximately 150 000 HIV-infected persons living in Mexico [1,2]. While it could be argued that there is some underreporting of AIDS in Mexico [2,3], the epidemic is still significantly less intense than that to the north (USA) or south (Central American countries, e.g. Honduras). One possible explanation for this is that, unlike in the countries surrounding it, the epidemic in Mexico has remained 'nuclear', primarily affecting men who have sex with men in urban areas of the country such as Mexico City, Guadalajara, Monterrey and Tijuana [4]. This relative containment of the epidemic is by no means accidental but rather the end result of many prevention efforts conducted by the government as well as by community-based organizations.

The national response to AIDS in Mexico was early and strong, beginning shortly after the first cases were

reported in 1983. HIV testing began the first year the test was available (1985) and in February of 1986 the National Committee for AIDS Prevention (CONASIDA) was founded. In 1988 a Presidential Decree transformed CONASIDA from a committee to a 'National Council', thus giving it a multisectorial composition that went beyond the scope of individual health sector response. While early national-level attention toward containing the epidemic has benefited the population at large, it is clear that prevention efforts of the Mexican government have been most successful in two areas: in the control of transfusion-transmitted HIV and in preventing infections among female commercial sex workers.

Because HIV infection through blood and blood products represents only a small proportion of all cases of HIV/AIDS worldwide it has not received the attention this means of transmission merits [5]. Not only is it the most efficient way in which HIV can be transmitted, but transmission via blood and blood products is also the route most amenable to government control. As a result, devoting attention and resources to insuring the safety of the blood supply represents a unique opportunity and a cost-effective

**This article represents the first in a series of Editorial Reviews that AIDS would like to publish on programs initiated in developing countries directed at controlling the HIV/AIDS epidemic.**

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intervention for public health authorities to dramatically change the course of HIV infection in a given country. The changing epidemiology of AIDS in Mexico provides compelling proof of this conclusion.

With the exception of patients with hemophilia, transfusion-transmitted HIV in developing countries primarily affects women – specifically women who receive blood for obstetric reasons [6]. Because of this observation, a country with a large proportion of infected women may overestimate the level of ‘heterosexual’ transmission, overlooking a hidden blood and blood products connection. For example, in 1986 there were 26 cases of AIDS in men for every one in women (26:1) in Mexico. Four years later, at the same time that the highest proportion of transfusion-transmitted cases were being reported nationwide, the number of infections among women had climbed so dramatically that the ratio dropped to five cases of AIDS in men for every one in women (5:1). Then, in 1999, the first year in which no transfusion-transmitted AIDS cases were reported in Mexico, the trend in male-to-female cases reversed direction (for the first time), with six cases of AIDS being reported in men for every one in women (6:1).

In many countries, infection of the blood supply is chiefly an economic phenomenon. For example, prior to 1987, selling one’s blood or plasma was such an attractive source of income for many impoverished Mexicans that commercial blood and plasma donors (who had, by definition, no inducement to know their HIV status prior to donation) formed a significant percentage of total blood suppliers. Thus, the control of transfusion-transmitted HIV in Mexico not only involved mandatory HIV testing but also banning the commercialization of blood and closing of commercial plasmapheresis centers. As noted above, this policy has all but eliminated HIV from the Mexican blood supply. Blood transmission of HIV in other countries continues to be a significant problem. Recent reports from China suggest that paid blood donors may be playing an important role in the spread of HIV there [7].

The impact of commercial sex on HIV transmission is well known and has long been considered a critical vector for the introduction of HIV infection into the general population [8,9]. As a result, interventions to limit the extent of HIV infection among commercial sex workers (CSW) are frequently viewed as a priority in many national prevention campaigns [10]. Perhaps the best-known of the successful interventions with CSW to date is the ‘100% condom use in brothels’ initiative in Thailand [11]. This initiative has led to a marked decrease in HIV incidence among Thai military recruits as well as to a decrease in the incidence of other sexually transmitted infections in that country. In contrast to Thailand and many other countries though,

HIV seroprevalence among female CSW in Mexico has remained low since the beginning of epidemiological investigation, with seroprevalence averaging below 1% in large, repetitive serosurveillance studies. This finding suggests that many of the early interventions targeting CSW in Mexico might have limited the impact of HIV in this group. Yet, it could also be argued that the nuclear epidemiology of HIV in Mexico described above has simply meant that female CSW in Mexico are at less risk of exposure to infection than CSW in other countries. If this observation is so, the low seroprevalence among Mexican CSW may not be credited to public health intervention but rather reflect lack of opportunity to be exposed to HIV.

In this article, we will review the major interventions conducted to date in Mexico as part of the National AIDS Prevention and Control Program. We will also review the available data published in journals or presented at the International AIDS Conferences for insights into Mexican HIV prevention successes and failures that may have implications for AIDS programs in other developing countries.

## **The control of HIV transmission through blood and blood products**

When the AIDS epidemic began in Mexico in the early 1980s there was no coordinated system of blood procurement and a large proportion of the blood available in the country was obtained from paid donors. In addition, an unknown number of commercial plasma collection centers throughout the nation also obtained their products from paid donors. Evidence now suggests that these centers frequently re-used contaminated equipment during blood collection resulting in the introduction of HIV to previously healthy donors. As a result, not only did the centers collect and distribute infected blood products, but they also acted as an efficient means for accelerating that process by transmitting HIV to previously uninfected repeat clients during the plasmapheresis process. Until recently, the impact of transfusion-transmitted HIV on the AIDS epidemic in Mexico had been quite significant. In only 4 years (1984–1988) blood and blood product transfusion associated AIDS in Mexico went from being unheard of to comprising over 10% of all cases.

Until 1987, paid blood and plasma donors provided approximately one-third of all blood products in Mexico [12]. Stereotypically, a paid donor would be a young man from a rural area who had migrated to one of the shanty towns that surround large cities like Mexico City, Guadalajara, Monterrey and Tijuana. He would be unemployed/underemployed, disenfran-

chised, and had no risk factors for HIV infection prior to his migration. After hearing about the opportunity from a friend or family member, he would become a regular customer at one of the local blood banks or plasmapheresis centers, being paid to donate as frequently as the individual center's policy allowed, perhaps as often as every 2 or 3 days. The more times he donated, the higher his risk became for becoming infected with HIV during the blood collection process. If he did become infected, he would almost certainly transmit that infection into the national blood supply – and to other donors at the same center as well – during his subsequent donations. Additionally, he might also transmit HIV to his wife or girlfriend during sex and, through them, to his children.

In May of 1986, when HIV testing of all blood donors became mandatory in Mexico, the full extent of the tragedy of HIV among paid donors first began to surface. In two separate but concurrent studies carried out between 1986 and 1987, a prevalence of 7% was found among 9100 paid donors [12] compared to a seroprevalence of only 0.67% among 319 153 persons who donated blood without remuneration [13]. Further evidence of the extreme health risk disparity faced by paid donors in Mexico at that time is evident when their seroprevalence is compared to that of related donors (0.12%) or volunteer donors (0.09%) [12,14].

When the data were analyzed retrospectively, the scope of the risk faced by paid donors became dramatically clear. For example, the prevalence among paid donors at one plasmapheresis center increased in 5 months, from 6% in June 1986 to 9.2% in October of the same year [14]. Furthermore, seroconversion was documented in 22.1% of these subjects during this period. A case-control study of this population revealed that a history of four or more donations per month (odds

ratio, 5.4; 95% confidence interval, 1.9–16.3) was associated with HIV infection. As described above, it is believed that donors were iatrogenically infected with HIV during the plasmapheresis process, probably as a result of improper infection control measures. The procedure included recycling of plasmapheresis equipment, reuse of needles or syringes, and even the injection of small amounts of infected plasma or blood. As the number of donations per month was as high as 12, it is feasible that once the infection was introduced into a specific blood or plasma bank, subsequent uninfected donors became infected at the blood or plasma facility at the time of donation.

In 1989, the first case of AIDS in a Mexican paid plasmapheresis donor was reported [15] and by 1990 the reporting of this high-risk group became mandatory in Mexico [16]. Thus a new 'risk group' was defined in Mexico and later adopted by the Panamerican Health Organization: the professional blood donor. However, paid donor is not routinely reported as a risk group in many epidemiological reports and thus it may not be recognized as an important contributor to the spread of HIV in a given country (see Fig. 1).

In May of 1987, as a consequence of poor compliance by blood and plasma banks with the 1986 law that mandated HIV screening of blood and blood products, the executive and legislative branches of the government approved a law prohibiting the sale of blood and blood products in Mexico [6,17]. This law was not without controversy and much opposition. Since Mexico lacked a culture of volunteer blood donation, ready sources of HIV testing, and an organized blood collection infrastructure, there was a major fear among public health officials that shutting down the blood and plasma industry would severely compromise the blood supply, prompting the emergence of a black market in blood and blood products. Because of this possibility, a two-

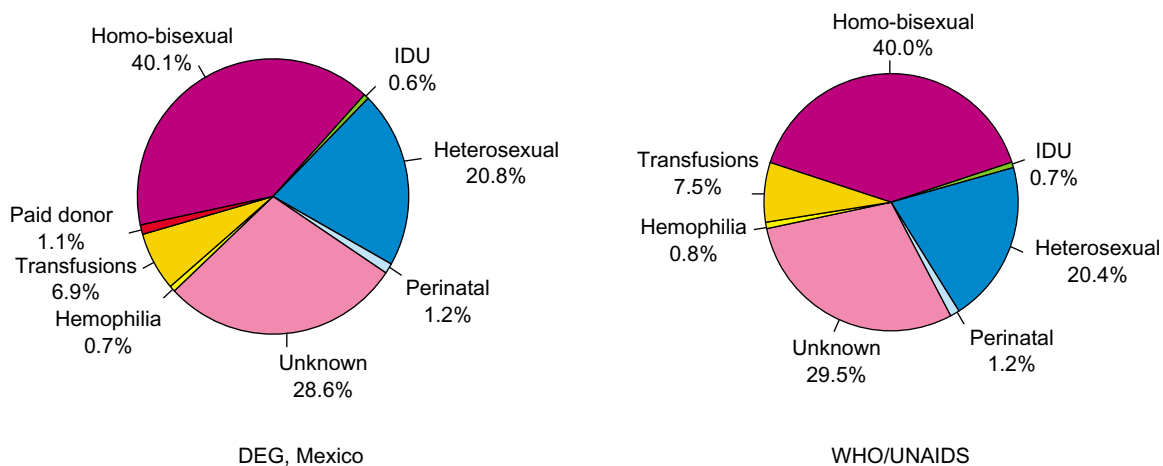


Fig. 1. AIDS cases in Mexico in 1997 by risk group. Mexico versus WHO/UNAIDS.

pronged response was quickly approved and implemented. Campaigns promoting volunteer blood donations were begun all over the country while, at the same time, the necessary laboratory infrastructure for HIV testing was established. Within 4 months, a network of 70 laboratories capable of screening donors for HIV was set up in the country's 32 states. In addition, blood collection and distribution centers were established in collaboration with the Mexican Red Cross. Table 1 summarizes the steps taken by Mexico for the control of transfusion-transmitted HIV.

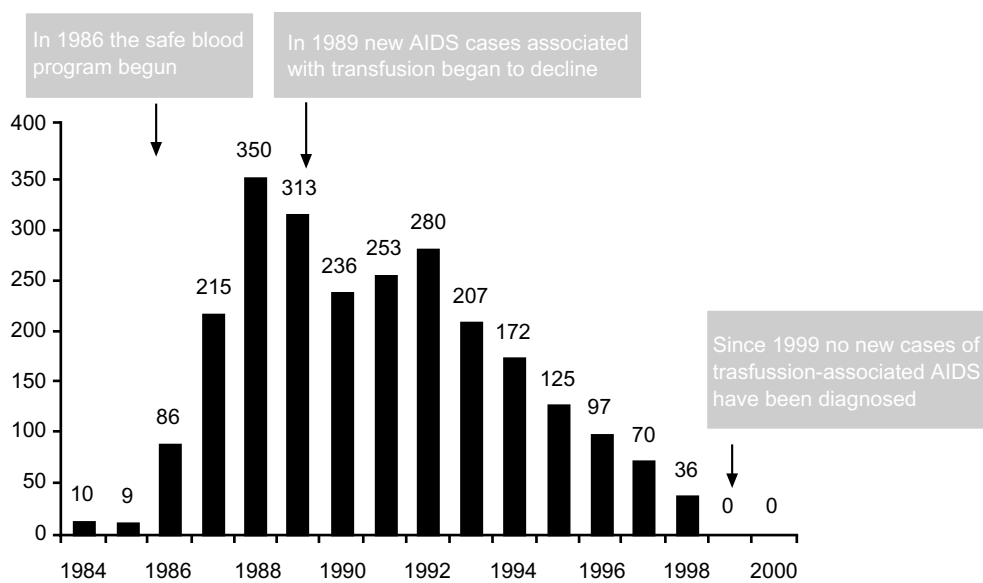
The implementation of the strategies described above has had dramatic consequences for public health in Mexico. Not only is the future health of the general public more assured – the number of transfusion-associated cases peaked within a year of the blood sale ban and no new cases of AIDS secondary to blood transfusion have been reported since 1999 (see Fig. 1) – but so is the future health of blood donors. After paid donors were banned in 1987 the HIV seroprevalence among donors decreased from 2.6% in 1986 to 0.7% in 1988 [6]. In 1989, HIV seroprevalence among blood donors in Mexico further decreased and has

remained low (below 0.08% in all years). For example, only 385 out of 1 099 755 blood units tested positive for HIV in 1999 (0.04% prevalence) and 377 out of 1 140 632 were HIV infected in 2000 (0.03% prevalence), (see Figs 2 and 3). As a result of the change in government policy, it is estimated that over 8000 transfusion-transmitted infections have been prevented.

This improvement is certainly a cause for relief but the true extent of the widespread damage caused by the paid donor system has yet to be calculated. Close to 400 cases of AIDS among paid donors were reported to the National AIDS Registry before this transmission of HIV was finally contained. This number of cases represents more than twice those reported among hemophiliacs in Mexico [17,18]. Close to 2500 cases of AIDS considered secondary to transfusion of HIV infected blood have been reported, and those account for only the primary infections [2,19,20]. As noted above, many of the paid donors, as well as the recipients of contaminated blood and blood products may have infected their sex partners (and subsequent children). This possibility is a key observation. Before the tragedy was contained, women in Mexico – parti-

**Table 1.** The Prevention of transfusion-transmitted HIV in Mexico.

1985	Voluntary screening of blood donors
May 1986	Mandatory screening of blood donors
May 1987	Use of paid donors as source of blood or plasma prohibited and plasmapheresis centers closed
July 1987	National HIV Laboratory Network established and volunteer donor program strengthen
1987–1993	State Blood Transfusion Centers established



**Fig. 2.** AIDS cases associated with blood transfusion in Mexico (through July 2000, by date of diagnosis).

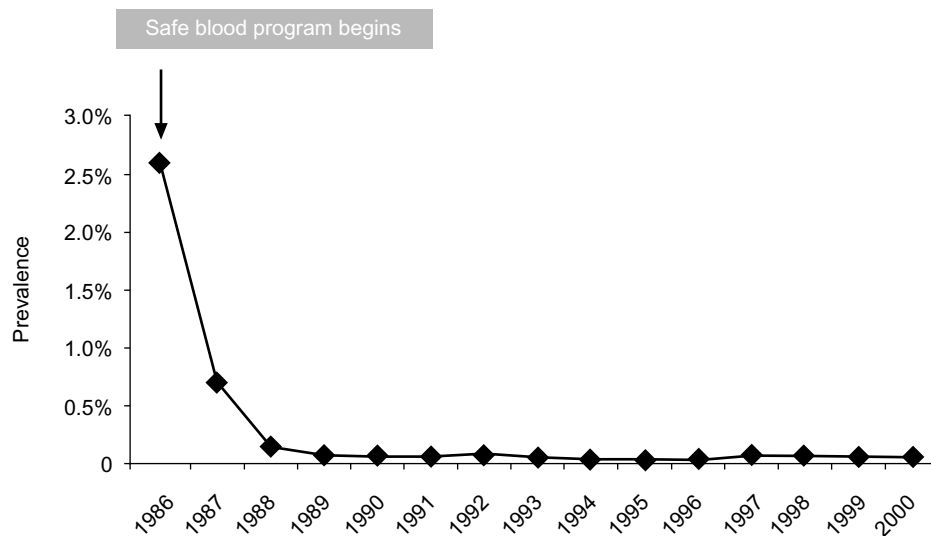


Fig. 3. HIV prevalence among blood donors, Mexico 1986–2000. From the National HIV Laboratory Network.

cularly poor women – were at risk from contaminated blood from not one but two sources. They were at risk directly, via obstetric-related blood transfusions and they were at risk indirectly from sexual partners who were professional donors and who were infected at the time of blood or plasma collection. We believe that it is this ‘double jeopardy’ that Mexican women faced that led to the rapid transition in male:female ratio of AIDS cases in the mid 1980s and the apparent ‘heterosexualization’ of the AIDS epidemic.

It is reasonable to suppose that without the now present safeguards placed on the blood supply in Mexico, this double jeopardy would have continued and the male:female ratio of infection would have continued to decrease until Mexico achieved a ‘pattern 2’ (primarily heterosexual) epidemic. Support for this assumption may be inferred by observing the rapid transition of the male:female case ratio in countries that continue to support a paid donor blood collection system. For example, in areas of India and China where epidemic HIV infection in paid donors has been noted, the epidemic has become overwhelmingly ‘heterosexual’ [21]. Support for this conclusion may also be found more concretely in the results of a study to determine the risk factors for HIV-infection among women in Mexico. Of 454 women who had an HIV test performed in 1992, multivariate analysis revealed that only a history of blood transfusion, low literacy and having sex with an HIV infected partner were associated with being HIV-infected [22].

In summary, the Mexican experience highlights the critical role that mandatory screening of all donors, prohibiting paid donations, and maintaining strict control of the plasma industry can have on the epidemiology of HIV/AIDS. Such simple control measures

undoubtedly require resources but, above all, require political will for their implementation.

### The prevention of HIV infection among female commercial sex workers

Commercial sex in Mexico takes place in the 32 federal states of Mexico under one of two legal frameworks: ‘abolitionist’ or ‘reglamentarist’ [23]. The abolitionist movement seeks to eliminate prostitution entirely by making its practice a misdemeanor. More commonly though, prostitution is allowed but controlled by legislation. The reglamentarist system restricts prostitutes’ activities to certain areas of the city or establishments and requires them to be licensed and have periodic health exams. Most of Mexico (except for the Federal District where Mexico City is located, and the States of Mexico, Puebla and Guanajuato) functions under a reglamentarist system. The public health threat posed by the reglamentarist system – specifically the requirement for periodic health exams – is the potential for corruption (a sex worker might have the opportunity to ‘buy’ a clean record) and the potential for a false sense of security on the part of CSW clients. This false sense of security, which may lead some clients to request or insist on sex without a condom, is not just a product of political corruption. Unfortunately even periodic health exams are not sufficient to protect clients from recently acquired HIV infection or sexually transmitted infections (STI).

There is continuing debate among public health experts about whether the abolitionist or reglamentarist legal framework provides a better system for preventing HIV infection among sex workers. Thailand’s experience,

however, would seem to suggest that strictly enforced rules and regulations governing both sex workers and their clients (such as 100% condom use in brothels) can be the cornerstone of a successful program of public health safety [11,24].

Commercial sex in Mexico City takes place under an abolitionist system that has been in place since 1940 when the practice of commercial sex was first banned in that city. In Mexico City, any individual who is found practicing commercial sex may be fined and arrested for 24–36 h [25]. Under this legislation the police are also permitted to detain women who are on the street simply because their personal appearance is considered ‘offensive to modesty and good custom’, even if there is no evidence that the women were actively engaging in prostitution. Nevertheless, patronizing the services of CSW is tolerated and excused, if not condoned. Clients are rarely arrested or prosecuted. This double standard is widely recognized. In 1985, the Mexico City Household Survey of young adult reproductive health found that 6% of men aged 15–24 years, reported having their first sexual intercourse with a CSW [26,27]. The proportion of men who have been clients of CSW during their lifetime is undoubtedly higher. Unfortunately this system keeps CSW in a marginal status and deprives them of health services and legal protection. This approach, in turn, fuels the corruption of police and other authorities who routinely extort bribes from CSW.

In 1986 an event took place involving CSW that, in retrospect, may have been pivotal in limiting the Mexican AIDS epidemic to its original, nuclear pattern. In that year, female CSW began appearing at National AIDS Council (CONASIDA) Counseling and Testing Centers to request HIV testing and risk reduction information. In coming forward voluntarily, these women provided an unprecedented opportunity for public health officials to gain access to an at-risk population that is officially invisible and traditionally suspicious of contact with the government. CONASIDA staff immediately began to work to forge links with these women and bring them into the public health planning process. Perhaps the most crucial system-level intervention that took place during this time was a negotiation between the Chief of Police in Mexico City and the Ministry of Health that allowed CONASIDA to conduct a variety of educational and structural interventions with sex workers without the harassment of the local police. In this way CONASIDA was able to develop substantive trust relationships with sex workers and their leaders without exposing them to official persecution.

Seroprevalence testing of early volunteers revealed that HIV incidence among female CSW in Mexico City was below 1% in the 1980s and has remained low since

then (0.3% among 1997 women tested for HIV in 1987–1998) [23,28]. This finding is in marked contrast to the prevalence of HIV among male CSW in Mexico (14%) or to the epidemic curve among male and female CSW in other countries. During the same time interval, for example, the HIV seroprevalence for sex workers in Thailand increased from 0.09% in 1988 to over 20% in 1990 [29]. A similar explosive rise of HIV among sex workers has been observed in India and Honduras [21].

Based on the seroprevalence of HIV found among CSW who are tested in a CONASIDA site, it is our hypothesis that while various factors described below may have fostered a low initial prevalence of HIV among female CSW in Mexico, the fact that HIV prevalence has remained low to this day could also be attributable to increased condom use [30–32]. Female CSW, like other women in Mexico, are likely to acquire HIV in one or more of four ways: through the transfusion of contaminated blood or blood products (e.g. during surgery or for obstetric reasons), through the use of contaminated needles (e.g. injection drug use), through iatrogenic infection at the time of blood or plasma donation (e.g. professional blood and/or plasma donor), or through unprotected sex with a person who is HIV infected. For the null hypothesis to be supported – that low HIV prevalence in female CSW is *not* primarily attributable to increased condom use – it would be necessary to provide convincing evidence that the avenues of transmission described above do not, in fact, pose a substantial risk for HIV infection to female CSW, although the result could indicate that other equal or greater means of protection exist than condoms against transmission from each of those avenues. In order to define what additional epidemiologic and sociological evidence should be collected in order to disprove the null hypothesis, researchers working at the Ministry of Health and CONASIDA delineated what was and was not known about the following transmission risks.

### **Transmission from contaminated blood or blood products**

As noted above, transfusion-transmitted HIV primarily affects women, specifically women who receive blood for obstetric reasons [6]. There was no evidence that female CSW in Mexico were at less risk of requiring blood transfusions than other women. Therefore, the low prevalence of HIV among female CSW was probably unrelated to a favorable transfusion-related risk differential.

### **Transmission from contaminated drug injecting equipment**

There was no question that HIV may be transmitted via contaminated needles either by drug injecting equipment or during medical procedures [33,34]. What

was in question was whether the low prevalence of injecting drug use among female CSW, (< 0.3% among those attending CONASIDA Counseling and Testing Centers in 1985–1986) was sufficient to account for the low prevalence of HIV among them as well. For instance, other countries with a low prevalence of injecting drug use among female CSW (e.g. India, Honduras) have seen the incidence of HIV rise dramatically in their female CSW populations [35]. So, while the low prevalence of injecting drug use among female CSW in Mexico [23,36] undoubtedly helped prevent the dissemination of HIV in this population, it did not appear to be more responsible than condom use for the continued low prevalence of HIV.

### Through iatrogenic infection at the time of blood or plasma donation

As has been described above professional blood and plasma donors became infected with HIV until this practice was banned in 1987. It was thus possible that women, especially CSW, could also have been professional donors and thus be at risk for HIV infection through this practice. However, > 86% of cases of AIDS among professional blood donors have been among men, which is explained by the fact that men were much more likely to be professional donors.

### Transmission from unprotected sex

There are at least three situations in which sexual activity in the absence of condoms may be consistent with a continued low prevalence of HIV among female CSW. These include an insufficient HIV seroprevalence in the general population to create a significant transmission risk; if the prevalence of HIV is not evenly spread throughout the population and infected clients do not patronize female CSW; and if the specific sexual practices engaged in by CSW do not promote HIV transmission.

In the first scenario, the low prevalence of HIV in the general population of Mexico in 1986 (approximately six per 10 000) meant that sex workers as a group faced little risk of exposure from their clients [25,26]. The problem with this explanation was that researchers had

found a high prevalence of bisexual behavior in many Latin American countries [37]. It was felt that additional sociological evidence would be required before a confident assertion could be made that bisexual males are less likely to patronize female CSW than male CSW and that, therefore, the risk for infection from this group was lower than for female CSW.

In the third scenario, it was conceivable that female CSW did not practice sexual behaviors considered to be of high risk with their clients so the presence or absence of condoms becomes a moot point. For the purposes of our discussion, 'HIV transmitting behaviors' include (in descending order of transmission risk): anal sex, vaginal sex, and oral sex. Again, sociological evidence would be required before a confident assertion could be made that female CSW in Mexico never or only infrequently engaged in HIV transmitting behaviors.

As a result of defining the gaps in knowledge, a major study was undertaken in 1992–1993 using direct observation, in-depth interviews, key informants and focus groups to construct a sample frame of commercial sex work sites located in the urban area of Mexico City [25,38]. This methodology allowed the identification of street points, bars and massage parlors where commercial sex occurred. From this conceptual framework, it was estimated that approximately 0.1% of the population of Mexico City were women engaged in commercial sex work (15 000/15 000 000).

A representative sample of these women were invited to participate in a study which included structured questionnaires defining sexual practices as well as testing for HIV, syphilis, hepatitis B, gonorrhoea and *Chlamydia*. The results of these studies demonstrated a low prevalence of STI among female sex workers and confirmed the previous studies which suggested that the HIV prevalence among these women was quite low (see Table 2) [28,39–41]. A significant association was also found between the risk of having an STI and the type of work site a woman used. Women working street sites have higher rates of STI. In addition, a

**Table 2.** HIV and STI prevalence among female commercial sex workers in Mexico. Adapted from reference [28].

Pathogen	Number tested	Seroprevalence (%)	95% CI
HIV	807	0.6	0.1–1.1
Hepatitis B virus			
HbcAb	776	3.0	1.7–4.1
HbsAg	778	0.3	0.0–0.6
<i>Neisseria gonorrhoeae</i>	326	3.7	1.6–5.7
<i>Chlamydia trachomatis</i>	294	11.1	7.5–14.6
<i>Treponema pallidum</i>	807	6.4	4.7–8.1
Herpes virus 2	757	65.1	61.6–68.4

CI, Confidence interval.

lower educational level and the number of years practicing commercial sex were associated with being seropositive for syphilis [42,43].

The results of the behavioral questionnaires were also of major interest. While nearly all women surveyed reported having vaginal intercourse with their clients, 97% reported never having anal sex and 89% reporting never having oral sex. In addition, 87% reported an increase in condom use since learning about AIDS. However, in contrast to their behavior with their clients, 85% reported 'never' using condoms with their lovers, concubines or husbands. In multivariate analysis, risk factors for unprotected sex with clients included a low educational level, street work, no current use of a contraceptive method, clients' refusal to use condoms, clients of lower socioeconomic level, and irregular use of STI clinical services [32].

Over the past several years subsequent studies conducted in Mexico City as well as in other cities throughout the country [44–46] have continued to show a low prevalence of HIV among female commercial sex workers (see Table 3). As noted above, this finding is in marked contrast to the HIV seroprevalence among sex workers in other developing nations.

In an effort to understand further same-gender sexual behavior and to define risk factors for HIV infection among men in Mexico, a series of additional studies have been conducted by our research group. These studies demonstrated that homosexual men seen at CONASIDA's Counseling and Testing Centers had a higher seroprevalence of HIV infection than bisexual men (34% versus 21%;  $P = 0.001$ ) [47] and that reported condom use was quite low, with only 5% reporting regular condom use [48]. As noted above, the practice of bisexuality has been reported to be common among Latin American men in general. According to a household probability survey of 8068 adult men conducted in 1992–1993, this practice appears to not be as prevalent in Mexico City in particular [49]. In that study 2.5% of men reported that they had practiced same-gender sex in their lifetime with 2.1% reporting bisexual and 0.4% exclusively homosexual behavior. The HIV prevalence estimate in this sample was 4% among homo/bisexual men and 0.09% among heterosexual men ( $P < 0.0001$ ) [49,50].

**Table 3.** HIV prevalence studies among female commercial sex workers in Mexico.

Year	1990 [46]	1993 [23]	1995 [18]
Place	20 cities in Mexico	Mexico city	Various cities
Number	3612	6425	20 320
Prevalence	0.4%	0.04%	0.7%

This study also suggested that while bisexual men might be equally likely to seek the services of male or female CSW when not in a steady relationship, concurrent bisexuality was an infrequent behavior compared to serial bisexuality. That is, only a minority of bisexual men were homosexually active while being in a steady heterosexual relationship. This finding implies that female CSW in Mexico City may have sex with men who are concurrently having sex with men (including male CSW) less frequently than was previously thought. This finding provides support for the assertion that while the population of clients seen by male and female CSW in Mexico City is not entirely segregated, they are sufficiently separated to lower the risk of HIV exposure to female CSW even in the absence of universal condom use among bisexual men [48].

This evidence strongly suggests that the high frequency of condom use reported by female sex workers, combined with the mitigating effect of sexual client segregation between male and female CSW is, in fact, responsible for the low rate of sexual transmission among female CSW in Mexico City. Additional support for this assertion may be drawn through inferences from the previously mentioned study among HIV positive women who were not sex workers [22]. Among these women, a history of sex with an infected man was an important risk factor for HIV and STI. Furthermore, a 1998 study of 495 female sex workers with an overall prevalence of human papillomavirus (HPV) infection of 48.9% found that younger age and failure to use condoms as a method of contraception were independently associated with HPV infection [51]. The authors suggest that sex workers who report using condoms for family planning are probably using them more regularly with both clients and regular sex partners. Unfortunately, we lack objective data to confirm the real frequency of condom use among female CSW in Mexico and self-reports regarding this issue may, in fact, be biased. Sex workers know that public health authorities strongly promote condom use and so may be reluctant to admit non-compliance, even to trusted CONASIDA staff [25].

In summary, the epidemiology of the AIDS epidemic in Mexico tantalizingly suggests that the use of condoms by female CSW may be a major reason why the HIV/AIDS epidemic in Mexico has remained nuclear. This finding provides a compelling reason for directing a portion of AIDS prevention resources towards female commercial sex workers and their clients. These two populations form a social network that is critically placed to facilitate or contain the dissemination of HIV infection in the general population. Ideally, strategies would be implemented to make sex work safer for both CSW and their clients. System level and structural interventions that incorporate the range of modifiable



determinants of high-risk behaviors should be implemented. In addition, these interventions should include all participants involved in the sex trade. As in Thailand, '100% condom use' campaigns should begin establishing a culture in which condom use with CSW is expected as the norm, not an option [11]. Simply placing legal prohibitions on the sex trade and instigating mandatory HIV testing in the absence of social support for using condoms have not proven to be useful preventive strategies for sex workers in Mexico or around the globe.

## **Other preventive interventions**

### **Prevention of HIV infection among men who have sex with men**

As described above, the AIDS epidemic in Mexico began and continues to be primarily an epidemic confined to gay and bisexual men. Through the end of 2000, 85.7% of the 47 617 cases of AIDS that had been reported in Mexico occurred in men. Among men in Mexico with sexually acquired HIV, 60% are classified as homosexual, 25% as bisexual and 15% as heterosexual. As discussed above, the percentage of true 'heterosexual' cases may also be over-reported as some of them may actually be occurring among men who have sex with men [47].

As early as 1986, a series of seroprevalence studies conducted among men who have sex with men in various Mexican cities reported seroprevalences as high as 25% for Mexico City [52,53]. In contrast, results of the 1987 National Seroepidemiological Survey suggested that the HIV seroprevalence among adult men in Mexico was 0.04% [26].

As a result of these and other studies [52,54] interventions were designed to increase condom use among men who have sex with men: small-group workshops to increase condom negotiation skills were implemented [55,56].

However, the interventions among men who have sex with men have thus far been limited and more resources should be directed to prevent HIV infection among them as they continue to be the population most heavily impacted.

### **Prevention of perinatal HIV infection**

Seroprevalence studies conducted among pregnant women as part of sentinel surveillance studies have been conducted in Mexico since 1988 following WHO/PAHO recommendations and guidelines. Between 1990 and 1999 a total of 12 068 pregnant women have been tested through this program and 11 have been found to be HIV infected (seroprevalence, 0.09%; 95%

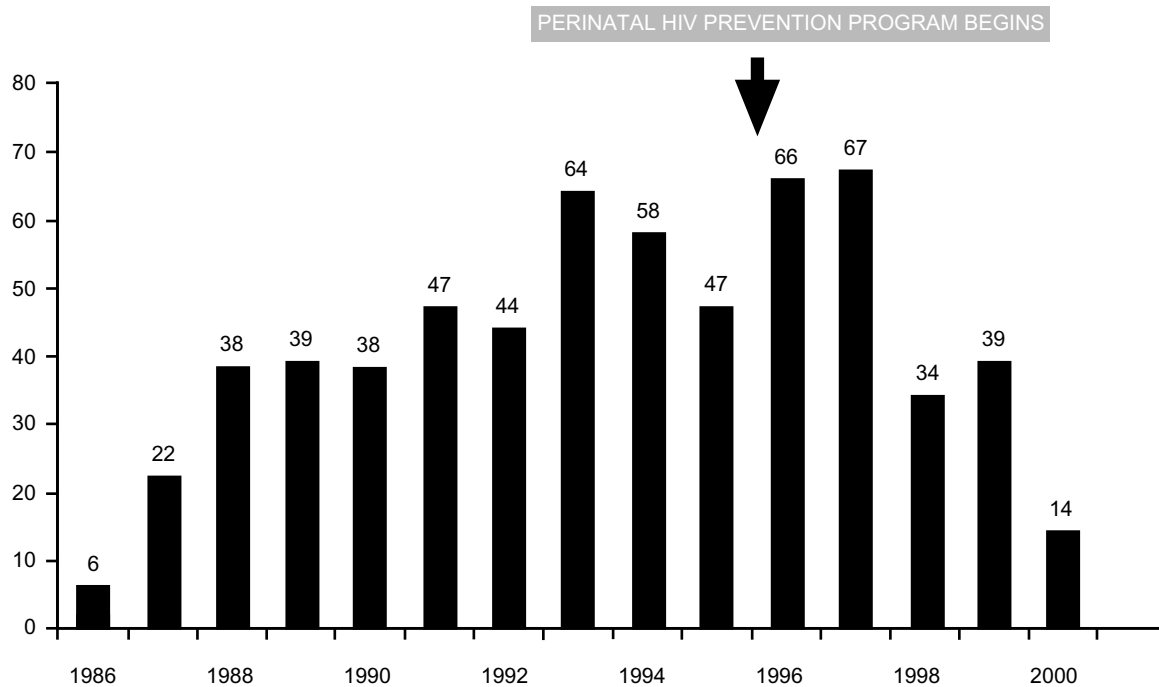
confidence interval, 0.04–0.15). Not only has seroprevalence remained low in this population, but no significant trends have been noted over time. However, even though the seroprevalence among childbearing women in Mexico is low (< 0.1%), the large absolute number of live births in Mexico (approximately 2.2 million annually) means that there is potentially a significant number of children at risk for being born infected. Given the seroprevalence estimates reported above, as many as 500 perinatally HIV-infected children could be born each year in Mexico.

In 1995 the Ministry of Health in Mexico began a program to reduce the number of perinatal HIV transmissions by offering free access to antiretroviral therapy for all HIV-infected pregnant women who wish to be treated. As a result of this program there has been a decrease in the number of HIV infected children who have been reported in Mexico (see Fig. 4). However, this program has only been partially successful, primarily because the low overall prevalence of HIV infection has made identification of HIV infected pregnant women difficult and many HIV infected women are not diagnosed [57]. This finding suggests that preventing perinatal HIV infection in a low prevalence country like Mexico must have the availability of HIV testing and the integration of HIV testing into routine prenatal care as its cornerstone. Only then can antiretroviral therapy be made available to HIV infected pregnant women who would otherwise remain unaware of the risk they carry. This strategy has already been used successfully the USA [58].

### **Antiretroviral therapy for HIV-infected persons**

Efforts to integrate treatment and care for people with HIV into the National AIDS Prevention Program started in 1992 with the publication of a CONASIDA guide for the 'Medical Care of Patients with HIV/AIDS'. This booklet was developed by a group of nationally recognized experts and all institutions that make up the Mexican health sector have approved it. This guide has been updated frequently as new knowledge was acquired and additional classes of antiretroviral drugs became available.

Mexico has also developed an expedited approval process for HIV/AIDS-related drugs. This program has successfully reduced the average approval time for new antiretrovirals from 4 years to no more than 2–4 weeks. Currently most antiretroviral drugs available in the USA are included in Mexico's Medical Pharmacopeia of the Health Sector. Inclusion of a drug in the Pharmacopeia makes it compulsory for hospitals and clinics supported by the Mexican Social Security administration to provide it free of charge to patients who are eligible to receive care under the Social Security system (IMSS). As a result, HIV infected



**Fig. 4.** Cases of AIDS due to mother to child transmission, Mexico 1986–2000. From SSA – General Directorate of Epidemiology. National Registry of AIDS cases.

persons who are eligible to receive medical care under IMSS have had access to antiretroviral therapy since 1994 [59]. Unfortunately, as of the end of 1997, more than half (55%) of the people living with AIDS in Mexico did not have access to Social Security [2], or, by extension, access to state subsidized antiretroviral care. In response to this long standing disparity in access, pilot projects to provide free antiretroviral therapy (zidovudine and, later, double nucleoside therapy) for those who could not receive it at the nation's Social Security Hospitals were initiated by CONASIDA as early as the end of 1992 [60]. However, these pilot projects failed to address the issue of access for the large majority of HIV-infected persons living in Mexico and were eventually discontinued.

The decision to discontinue these pilot projects in the face of the mounting need points to the crucial role that the economics of health care has always played in the HIV/AIDS epidemic in Mexico. The introduction of protease inhibitors to the AIDS prevention arsenal in 1996 created a sense of urgency among AIDS activists in Mexico who demanded a special budget for AIDS drugs from Congress [61]. However, the elevated cost of therapy made such a proposal prohibitively expensive. A study conducted in 1996 calculated that the annual cost of providing ambulatory care in Mexico to a person with HIV – if that care included triple combination therapy with a protease inhibitor – was \$10 197/person with 86% of the cost accounted for by

the antiretroviral drugs alone [62]. In 1996 it was estimated that providing highly active antiretroviral therapy to all eligible patients would have required \$69.2 million dollars or approximately 6.7% of the health care budget at that time [63].

In 1997, pressure from AIDS activists was successful in creating an AIDS drug fund called FONSIDA. The major goal of FONSIDA was to obtain funds via donations from government, the pharmaceutical industry, and private donors for the purchase and distribution of antiretroviral drugs to patients who did not have Social Security or other financial means. By 1998 FONSIDA was providing free treatment to 100% of patients aged < 18 years as well as to HIV infected women for the prevention of perinatal transmission before delivery and for continued HIV therapy for the mother after delivery. However, unfortunately, even though only 15% of persons living with HIV/AIDS could be covered by the funds available under FONSIDA, the program was still underutilized [64]. FONSIDA ceased operations in 2000 when a new Mexican administration decided to incorporate HIV/AIDS therapy into the budget of the Ministry of Health.

The availability of antiretroviral drugs in Mexico has steadily improved and preliminary data suggests that mortality has declined as a result of that practice [65]. AIDS associated mortality in Mexico among men aged 25–34 years has also decreased from 20.5 per 100 000

in 1996 to 16.7 per 100 000 in 1999 [66] and the length of HIV/AIDS-related hospital stays have diminished [65,67]. However, access is far from being ideal and additional resources are still needed if a universal treatment program similar to that in existence in Brazil is to be replicated in Mexico.

## New and emerging challenges

Two interrelated circumstances are likely to change the current epidemiology of HIV/AIDS in Mexico: migration and an increasing rural epidemic. Migration from Mexico to the USA is not a new phenomena but what is recent is the realization that as many as 25% of rural AIDS cases in Mexico are among migrants who have been in the USA in contrast to 6.1% of those in urban areas [68]. The first case of AIDS from a rural area of Mexico was reported in 1986 and while only 5% of AIDS cases can be considered 'rural' (reported from communities with fewer than 2500 inhabitants) such cases are epidemiologically distinct from those reported from urban centers. For example, 21.3% of rural cases are among women as compared to 14.4% of urban cases ( $P < 0.05$ ). Many of these women are wives or sex partners of temporary migrant workers who may be unaware of the high-risk sexual behavior of their partners [69]. Qualitative studies done in California suggest that Mexican migrant men place themselves at high risk for HIV infection [68]. Clearly, HIV infection should be considered a security concern for both the USA and Mexico and efforts should be undertaken on both sides of the border to prevent and limit the impact of HIV infection among migrants [70,71].

## Conclusions

The prevention of HIV infection requires a 'hit early and hit hard' approach [72] even more than the therapy. Only through decisive and coordinated interventions can the impact of HIV be limited in a population. Without a doubt, the most successful public health intervention that Mexico undertook early in the epidemic was the control of its blood supply through mandatory testing, prohibition of paid donations and the closure of plasmapheresis banks. As has been demonstrated in Mexico, similar actions could have a major impact in the HIV epidemic of many developing countries who are yet to make their blood supply safe [73–75]. The interventions among female CSW have also been quite successful and should be continued as this population is quite dynamic and is continuously incorporating new clients as well as sex workers. However, as it was previously mentioned and as has been demonstrated in Thailand, there should be

policy and structural level interventions that make condom use the law and the norm in commercial sex. As we reflect on the achievements and failures of HIV prevention in Mexico, it is clear that the rapid translation of research findings into policy played a major role in the success of the program. This close collaboration of researchers and policy makers in which evidence-based prevention programs are implemented should be the norm. However, as it has been noted from the experience with needle exchange in the USA, this is not always the case. The lesson is that science, and not politics, should dictate what HIV/AIDS Prevention Programs do.

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