

# Prevalence of HIV, hepatitis B, and hepatitis C antibodies in prisoners in England and Wales: a national survey

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**Summary:** *Prisoners in eight of the 135 prisons in England and Wales were surveyed in 1997 and 1998 to study the prevalence of and risk factors for transmission of bloodborne viruses in prison. Subjects voluntarily completed a risk factor questionnaire and provided oral fluid specimens for unlinked anonymous testing for the presence of antibodies to HIV, hepatitis C virus (HCV), and the core antigen of hepatitis B virus (HBc).*

*Almost 8% (4778) of the total of 60561 prisoners were eligible and four fifths (3942) of those eligible took part. Among all those tested (3930) 0.4% (14) were positive for anti-HIV, 8% (308) for anti-HBc, and 7% (293) for anti-HCV (the anti-HBc and anti-HCV prevalences were not adjusted for assay sensitivities of 82% and 80%, respectively). Twenty-four per cent (777/3176) of adult prisoners reported ever having injected drugs, 30% of whom (224/747) reported having injected in prison. Three quarters of those who injected in prison (167/224) shared needles or syringes. Among adult injecting drug users, 0.5% (4/775) had anti-HIV, 31% (240/775) anti-HCV, and 20% (158/775) anti-HBc. The presence of anti-HCV and anti-HBc was associated with injecting inside prison and number of previous times in prison.*

*The results suggest that hepatitis viruses are probably being transmitted in prisons through sharing non-sterile injecting equipment and that a risk of HIV transmission exists. Harm minimisation measures for the 6% of prisoners who continue to inject while in prison should be strengthened.*

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**Key words:**  
bloodborne pathogens  
needle exchange programmes  
needle sharing  
prisoners  
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sex behaviour

## Introduction

In many western countries prisoners have a higher prevalence of antibodies to HIV, hepatitis B (HBV), and

hepatitis C (HCV) viruses than the general population<sup>1-6</sup>, and injecting drug use is their most commonly reported risk factor<sup>2-5</sup>. The raised prevalence of antibodies to these viruses in prisoners reflects the intensity of transmission of these viruses through injecting drug use in different countries. Outside prison the prevalence of HIV infection in injecting drug users (IDUs) in England and Wales is low (3.3% in London and 0.4% outside London, data for 1997 and 1998 combined<sup>7</sup>). The prevalence of antibody to hepatitis B core (anti-HBc) in this group in 1997 and 1998 was around 21%<sup>7</sup>, and that of anti-HCV in 1998 was 35%<sup>7</sup>, but prevalences as high as 59% to 67% have been reported among IDUs accessing medical services<sup>8-10</sup>.

The frequency with which bloodborne viral infections are transmitted in British prisons is unknown. Recognition of transmission events is difficult because those at greatest risk may be imprisoned frequently and for short periods, the infections have long incubation periods, and primary infections are usually asymptomatic. Outbreaks of

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HIV and HBV infection due to unsafe injecting in prison have occurred in Scotland<sup>11,12</sup>, but no prison-related outbreaks of HCV infection have been documented.

We undertook a national survey to study the risk factors for transmission of bloodborne viruses in prisons in England and Wales by measuring the prevalence of anti-HIV, anti-HBc, and anti-HCV antibodies and the frequency of risk behaviours among the prisoners before and during imprisonment.

## Methods

Eight prisons were selected from a total of 135 in England and Wales – six for adult male inmates (a local prison; a maximum security prison; two closed training prisons; and two open training prisons); one for females; and one for male young offenders (under 21 years). London continues to be the focus of the HIV epidemic,<sup>7</sup> and half the prisons selected had a catchment area that included London. The prisons selected were not a representative sample of the whole prison population, but were selected to include various types of prison (92% of the prison population were accommodated in similar prisons (Home Office, unpublished data, 1998).

Fieldwork in each prison took one to three days, between February 1997 and January 1998. All prisoners in the prison at the time of the survey were eligible for inclusion. The only exclusions were prisoners who could not physically be reached (because of legal visits, social visits, or court appearances) and those from whom consent could not be sought because of serious mental or physical illness.

Prisoners were surveyed mostly in groups of 10 to 40, depending upon how many were available at the time. After a five minute briefing and demonstration, consenting prisoners completed a questionnaire on risk behaviours and, using the EpiScreen sample collection device (EpiTope Inc, Oregon, USA), provided an oral fluid specimen for antibody testing. As no personal identifiers were collected, and the oral fluid specimen and questionnaire were sealed in an opaque envelope by the prisoner, the survey was

unlinked and anonymous from the outset. Those who chose not to take part played no further part in the survey procedure and were characterised neither demographically nor for risk factors for the infections studied. This was to allay fears of any possible drug testing or security purpose of the study by ensuring that no one was coerced into taking part in any aspect of the study. Members of the survey team were available to help any inmate as required – for example, reading the questionnaire to those who could not read. No prison staff took part in the data collection.

Specimens were transported the same or next day to the laboratory, where they were refrigerated until processing. Testing began the next working day and took, on average, 10 days for each prison. Specimens were tested for anti-HIV using the Murex HIV 1+2 GACELISA (Abbott Diagnostics, Maidenhead), according to the manufacturer's instructions. Reactive specimens were investigated further using modified Clonesystems EIA<sup>®</sup> (Biostat Diagnostics, Stockport) and Western blot methods. Anti-HBc was sought using Murex HBc ICE<sup>®</sup> (Abbott Diagnostics, Maidenhead), and reactive specimens were also tested with an in-house radio immunoassay. Anti-HCV testing used a modified protocol for the Ortho HCV 3.0 eSAVE ELISA<sup>®</sup> (Amersham, Buckinghamshire), with positives confirmed using a modified Ortho HCV RIBA<sup>®</sup> 3.0.

If inconsistencies were found in responses from individual prisoners, data from the questionnaire section affected were discarded. Analysis was performed in GLIM 4 (update 8 for PC / DOS, 1992. Royal Statistical Society, London), STATA 6.0 for Windows (1984-99 Stata Corporation, Texas, USA), and SPSS for Windows (Rel. 9.0.0. 1998. SPSS Inc, Chicago, USA). Multivariable analyses used logistic regression. The significance of each explanatory variable's effects in these models was tested using likelihood ratio tests. The number of observations differs between tables because some participants did not answer all questions.

The study was approved by ethics committees of the Prison Service Directorate of Health Care and the PHLS.

**TABLE 1** Prevalence of anti-HIV, anti-HBc, and anti-HCV in prisoners: 1997-8

Prisoner group and sentence status	Total	Anti-HIV +ve		Anti-HBc +ve		Anti-HCV +ve	
		number	% (95% CI)	number	% (95% CI)	number	% (95% CI)
Adult male remand	358	3	0.8 (0.2-2.4)	54	15 (12-19)	70	20 (16-24)
Adult male convicted	2397	6	0.3 (0.1-0.5)	172	7.2 (6.2-8.3)	169	7.1 (6.1-8.1)
Female remand	200	2	1.0 (0.1-3.6)	24	12 (7.8-17)	22	11 (7.0-16)
Female convicted	200	2	1.0 (0.1-3.6)	25	13 (8.3-18)	22	11 (7.0-16)
Young offender remand	292	0	0 (0-1.3)	15	5.1 (2.9-8.3)	4	1.4 (0.4-3.5)
Young offender convicted	404	0	0 (0-0.9)	9	2.2 (1.0-4.2)	0	0 (0-0.9)

Ten adult males, one female, and one young offender, refused or were unable to provide a testable specimen and are not included in the table. Not all prisoners reported their sentence status. All adult male remand prisoners were from the one local prison sampled. Where the observed prevalence is zero, a one-sided 97.5% confidence interval is shown.

**TABLE 2 Drug injecting behaviours of prisoners while outside and inside prison**

Prisoner group	Ever injected drugs*		First injected inside prison	Ever injected inside prison (prison injectors)	Prison injectors who ever shared needles/ syringes inside prison
	Total		% (x/n) <sup>†</sup>	% (x/n) <sup>‡</sup>	% (x/n) <sup>‡</sup>
Adult male	24	(660/2769)	6 (36/631)	31 (195/636)	75 (147/195)
Female	29	(117/407)	3 (3/110)	26 (29/110)	69 (20/29)
Young offender	4	(30/714)	3 (1/30)	20 (6/30)	50 (3/6)

\* Ever injected drugs is a history of ever having injected, inside or outside prison.

<sup>†</sup> Percentages calculated among IDUs who answered the question.

<sup>‡</sup> Percentages calculated among IDUs who reported injecting inside prison.

## Results

Survey prisons had a total eligible population of 4778, which was 8% of the prison population of England and Wales on the last day of June 1997 (7% of the males, 19% of the females, and 13% of the male young offenders). The participation rate (83%; 3942/4778) varied little between prisons.

The prevalence of anti-HIV was 0.3% (9/2807; 95% confidence interval (CI) 0.1-0.6) among adult males, 1% (5/410; CI 0.4-2.8) among females, and zero (0/713; CI 0-0.5) among young offenders. The prevalence of anti-HBc was 8% (229/2807; CI 7.2-9.2) among adult males, 12% (50/410; CI 9.2-16) among females, and 4% (29/713; CI 2.7-5.8) among young offenders. The prevalence of anti-HCV was 9% (243/2807; CI 7.6-9.8) among adult males, 11% (46/410; CI 8.3-15) among females, and 0.6% (4/713; CI 0.2-1.4) among young offenders. For all three infections, adult male and young offender prisoners on remand had higher prevalences than those convicted (apart from HIV among young offenders, in whom no infections were found). The prevalences of the three infections were the same for females whether they were on remand or convicted (table 1).

Three of the nine anti-HIV positive adult males also had anti-HBc and none was positive for anti-HCV. One of the five anti-HIV positive females had anti-HCV and none had anti-HBc. Among the inmates who reported never having injected drugs (non-IDUs) who were anti-HBc positive, 11% (10/95) of adult males and 4% (1/23) of females had anti-HCV. Among the IDUs who were anti-HBc positive, 53% (70/131) of adult males and 52% (14/27) of females had antibodies to HCV.

Twenty-four per cent (660/2769) of adult males, 29% (117/407) of females, and 4% (30/714) of young offenders reported ever having injected drugs. Seven per cent of adult males (195/2745) and females (29/400) and 0.8% (6/714) of young offenders reported injecting inside prison. Nearly a third of adult males who had ever injected drugs had done so in prison, and three quarters of those who injected in prison reported sharing needles or syringes while inside (table 2).

Ninety-two per cent of prisoners (3537/3835) reported sexual activity before their current imprisonment and many had had two or more opposite sex partners (table 3). Sex with at least one male partner in the 12 months before the current imprisonment was reported by 3% (86/2468) of adult males and 1% (5/604) of young offenders. Three per cent of adult males (92/2652) and 0.4% of male young offenders (3/670) had ever had anal sex inside prison. Having spent three or more months in an African country since the age of 16 years was reported by 5% (154/2817) of adult males, 6% (25/411) of females, and 6% (42/714) of young offenders.

Eighty-two per cent (200/243) of anti-HCV positive adult male prisoners reported having injected drugs. Thirty per cent (200/659) of the adult male IDUs had anti-HCV as had 2% (43/2103) of non-IDUs (table 4). Of the females positive for anti-HCV, 89% (40/45) reported ever having injected drugs. The prevalence of anti-HCV was 34% (40/116) among female IDUs and 2% (5/290) among non-IDUs. Twenty per cent (131/659) of adult male IDUs had anti-HBc, compared with 5% (95/2103) of non-IDUs (table 4). Among female IDUs, 23% (27/116) were anti-HBc positive,

**TABLE 3 Sexual risk factors among prisoners**

Prisoner group	12 months before this imprisonment		Ever		
	2 or more same sex partners* % (x/n)	2 or more opposite sex partners % (x/n)	been paid for sex <sup>†</sup> % (x/n)	had STD % (x/n)	had sex inside prison <sup>‡</sup> % (x/n)
Adult male	2.6 (63/2468)	63 (1721/2719)	5.3 (138/2612)	15 (385/2649)	3.5 (92/2652)
Female	–	33 (131/400)	15 (57/388)	17 (68/390)	10 (40/395)
Young offender	0.7 (4/604)	83 (575/696)	4.0 (27/670)	7.8 (52/665)	0.4 (3/670)

\* 'Same sex partners' question not asked of the women.

<sup>†</sup> 'Been paid for sex' refers to exchanges of money, goods, or drugs for any type of sex throughout the life of the respondent.

<sup>‡</sup> For men, 'sex inside prison' refers specifically to anal sex; for women, to any form of sex.

TABLE 4 Prevalence of anti-HIV, anti-HBc, and anti-HCV in prisoners by risk category

Prisoner group	Risk factor	Total	Anti-HIV +ve number (%)	Anti-HBc +ve number (%)	Anti-HCV +ve number (%)
Adult male	IDU	659	3 (0.5)	131 (20)	200 (30)
	MSM	63	4 (6.3)	9 (14)	1 (1.6)
	Africa	126	0 (0)	14 (11)	1 (0.8)
	Other	1709	2 (0.1)	64 (3.7)	34 (2.0)
	Incomplete information	250	0 (0)	11 (4.4)	7 (2.8)
Female	IDU	116	1 (0.9)	27 (23)	40 (34)
	Africa	21	2 (9.5)	6 (29)	0 (0)
	Other	269	2 (0.7)	17 (6.3)	5 (1.9)
	Incomplete information	4	0 (0)	0 (0)	1 (25)
Young offender	IDU	30	0 (0)	2 (6.7)	0 (0)
	MSM	5	0 (0)	0 (0)	0 (0)
	Africa	41	0 (0)	12 (29)	0 (0)
	Other	540	0 (0)	13 (2.4)	3 (0.6)
	Incomplete information	97	0 (0)	2 (2.1)	1 (1.0)

Ten adult males, one female, and one young offender, refused or were unable to provide a testable specimen and are not included in the table. Risk categories are mutually exclusive and are ranked according to observed prevalence overall, from IDU to other.

MSM – men who have had sex with male partner(s) in the 12 months before incarceration and have never injected drugs.

Africa – spent 3 or more months in Africa since the age of 16 years and never injected drugs and, if male, not had sex with male partner(s) in the 12 months before incarceration.

Other – outside the above categories, this will include those reporting 'unsafe sex' and those with lower risk.

Incomplete information – no risks declared, but not all risk questions answered.

compared with 8% (23/290) of non-IDUs.

The prevalence of anti-HCV in adult male IDUs rose from 18% (29/158) in those who were within five years of their first injection to 47% (49/105) in those who first injected 16 or more years ago. At each interval up to 15 years since first injection the prevalence of anti-HCV in IDUs who had injected inside prison was higher than in those who had not (figure). A similar pattern was observed up to 10 years since first injection for anti-HBc (figure).

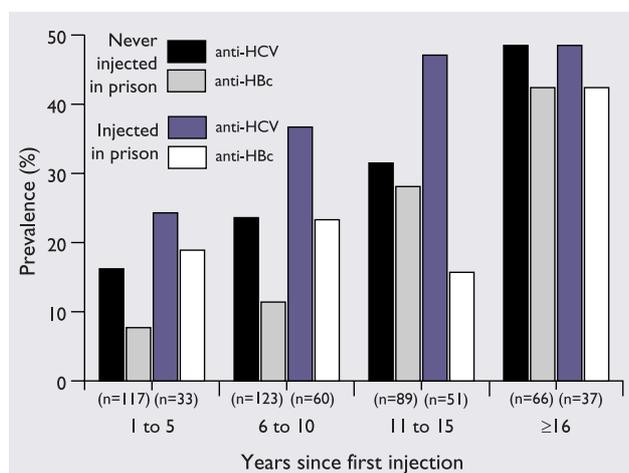
Logistic regression modelling of the prevalences in the largest group of IDUs, adult males, showed anti-HCV and anti-HBc to be significantly associated with the number of previous times in prison and ever having injected in prison, but not with the time spent in prison. Interactions were considered before arriving at the simplest adequate model. The final

multivariable model included age, time since starting to inject, injecting in the month before being imprisoned, prison type, number of previous incarcerations, and ever having injected inside prison (table 5). When tested using the likelihood ratio, number of previous times in prison was significantly associated with anti-HCV ( $p=0.0008$ ) and anti-HBc ( $p=0.003$ ), as was having injected inside prison (anti-HCV  $p = 0.0057$ ; anti-HBc  $p = 0.0144$ ).

Five prisoners serving their first sentence, all of whom had been in prison for over three years, reported starting to inject after being imprisoned. One was anti-HCV positive.

Fourteen per cent of adult male IDUs (82/608), 31% (36/116) of female IDUs, but no young offenders had begun courses of vaccination for HBV. Fifty-six per cent (389/689) of IDUs overall reported having received treatment or help in relation to their drug use, including 54% (303/560) of males, 75% (76/101) of females, and 36% (10/28) of young offender IDUs.

FIGURE Prevalence of anti-HCV and anti-HBc by years since first injection among IDUs who reported injecting or not injecting in prison



## Discussion

The potential for the transmission of bloodborne viruses in prisons in England and Wales is considerable. Our survey has shown that around a quarter of adult male prisoners have injected drugs, and that a third of those who have injected drugs have also injected in prison. Three quarters of those who have injected in prison have shared needles or syringes when injecting in prison.

At the mid-point of the survey the total prison population was 60 561 and 8% were sampled. The prevalence of antibody to hepatitis B and C increased with age and adult male open prisons were sampled more than local prisons, so when extrapolating from our results to the whole prison population an

**TABLE 5 Results of logistic regression model of factors affecting anti-HCV and anti-HBc prevalence among adult male IDUs**

Variable	n	anti-HCV				anti-HBc			
		% anti-HCV	Adjusted odds ratio	95% confidence interval	P value	% anti-HBc	Adjusted odds ratio	95% confidence interval	P value
<b>Age (years)</b>									
21-25	153	19.0	1	–	–	11.8	1	–	–
26-30	186	32.3	1.65	0.95-2.87	0.078	14.0	1.03	0.51-2.09	0.935
31-35	125	40.8	2.38	1.25-4.50	0.008	32.0	3.24	2.53-6.85	0.002
36-40	36	36.1	1.97	0.79-4.92	0.147	41.7	6.11	2.21-16.8	<0.001
41+	36	50.0	3.89	1.57-9.64	0.003	44.4	8.21	2.97-22.7	<0.001
<b>Time since 1<sup>st</sup> injection (years)</b>									
0-5	134	20.9	1	–	–	12.7	1	–	–
6-10	178	27.5	1.19	0.68-2.08	0.546	15.7	1.05	0.53-2.10	0.888
11+	224	42.0	1.58	0.88-2.81	0.123	31.3	1.39	0.69-2.80	0.355
<b>Injected in month before prison</b>									
No	196	26.5	1	–	–	15.3	1	–	–
Yes	340	35.0	1.33	0.86-2.07	0.197	25.0	1.90	1.12-3.24	0.018
<b>Ever injected inside prison</b>									
No	373	28.2	1	–	–	19.3	1	–	–
Yes	163	40.5	1.89	1.20-2.98	0.006	26.4	1.95	1.14-3.34	0.014
<b>Number of previous times in prison</b>									
0-4	304	26.3	1	–	–	17.1	1	–	–
5-9	148	31.1	1.13	0.71-1.80	0.593	19.6	1.00	0.58-1.74	0.994
10+	84	53.6	2.72	1.61-4.62	<0.001	40.5	2.63	1.46-4.72	0.001
<b>Prison type</b>									
Closed training category B	123	26.0	1	–	–	13.8	1	–	–
Closed training maximum security	52	36.5	1.52	0.72-3.21	0.267	19.2	1.32	0.51-3.38	0.567
Closed training category C	91	27.5	1.11	0.58-2.15	0.747	20.9	1.68	0.75-3.74	0.203
Local prison (closed)	242	36.0	1.88	1.09-3.23	0.023	26.9	3.04	1.52-6.09	0.002
Open training category D	28	28.6	1.08	0.41-2.88	0.877	14.3	0.89	0.25-3.18	0.856

Prison types included in order to adjust for variation between prisons

allowance must be made for a bias towards older prisoners and those serving longer sentences. On the other hand, relatively few remand prisoners, the group with the largest proportion of IDUs, were surveyed.

The sensitivity and specificity of the anti-HIV assay have been shown to exceed 99%<sup>13</sup>. For anti-HBc, the assay sensitivity was about 82%, and its specificity was over 99% (J Parry, personal communication). The specificity of the technique used to measure anti-HCV was over 99%, but the sensitivity of 80% was lower than desirable (Parry J, personal communication). The consistency observed between expected risks for HCV infection and anti-HCV prevalence, however, suggests that the laboratory method was adequate for the purposes of the survey. The anti-HCV assay was the same as used in a recent prisons survey in the Republic of Ireland, where about 80% of IDUs were found to be anti-HCV positive<sup>14</sup> – a result that could not have been obtained by an assay with a sensitivity of less than 80%, even if all of the IDUs tested were anti-HCV positive.

The prisoners with known risks were the ones most likely to have antibodies to bloodborne infections. Condoms should be made available to male prisoners because 3% of them had sex with another man within

prison and over 6% of homosexual men in prison were infected with HIV. The highest prevalence of HIV infection was in women who had spent three months or more in Africa since the age of 16, of whom two of 21 were infected. Only 0.5% (4/806) of IDU prisoners had HIV infection, which is consistent with the known prevalence in IDUs in England and Wales<sup>7</sup>.

The prevalence of anti-HCV (31%) in adult IDUs is high enough to make it likely that the virus is transmitted through injecting in prison. The prevalence of anti-HBc (20%) implies a 1% prevalence of HBsAg<sup>15</sup>, which makes it less likely but not impossible that this virus is transmitted in prison. Moreover, many IDUs who continued to inject in prison were still susceptible to infection with HCV and HBV. Despite a fresh hepatitis B vaccine initiative for prisoners in 1996<sup>16</sup>, only 15% of adult prisoners who injected drugs had received hepatitis B vaccine and 77% of the unvaccinated IDUs were still susceptible to hepatitis B infection.

After adjustment for other factors, there was a strong association between injecting inside prison and presence of anti-HCV and/or anti-HBc. IDUs who injected inside prison were anti-HCV positive earlier in their injecting careers. Whether the increased

prevalences of anti-HCV and anti-HBc in prisoners who had injected in prison were due to transmission in prison, or whether injecting in prison reflected greater risk taking overall and an increased rate at which infections were acquired outside prison, are questions which cannot be answered by this survey. Nevertheless, given the strength of the association, it is reasonable to assume that some of the hepatitis infections were acquired by injecting in prison. We cannot be certain how and where the infection was acquired, but one of the five prisoners who injected drugs for the first time in prison and who were in prison for the first time was anti-HCV positive.

Prevention efforts for IDUs both in the community and during imprisonment could be intensified, considering that 43% had never received treatment or help in relation to drug use. In the community, IDUs are provided with a range of services that aim to reduce the harm of their drug use and to assist abstinence in those who wish to quit. For those who continue to inject drugs, current UK policy promotes needle exchange schemes<sup>17</sup>. In the prisons of England and Wales, measures to reduce spread of bloodborne virus infections include health promotion<sup>18,19</sup>, vaccination against hepatitis B<sup>16</sup>, a range of options for coming off drugs<sup>20</sup>, and treatment with methadone for opiate withdrawal<sup>21</sup>. Distribution of bleach tablets to disinfect injecting equipment was piloted during 1998<sup>19</sup>, but no decision on the national implementation of this programme has yet been taken. Bleach is an intervention to be used if IDUs have no safer alternative; the once-only use of sterile needles and syringes is considered to be the most effective preventive measure<sup>22,23</sup>. The lack of needle exchange within prisons puts IDU prisoners at a disadvantage compared with IDUs in the community. Policies intended to minimise harm within prison, such as hepatitis B vaccination, could improve prisoners' health greatly.

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