Prevalence of antibodies to hepatitis B, hepatitis C, and HIV and risk factors in entrants to Irish prisons: a national cross sectional survey

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Abstract

Objectives To determine the prevalence of antibodies to hepatitis B core antigen, hepatitis C virus, and HIV in entrants to Irish prisons and to examine risk factors for infection.

Design Cross sectional, anonymous survey, with self completed risk factor questionnaire and oral fluid specimen for antibody testing.

Setting Five of seven committal prisons in the Republic of Ireland.

Participants 607 of the 718 consecutive prison entrants from 6 April to 1 May 1999.

Main outcome measures Prevalence of antibodies to hepatitis B core antigen, hepatitis C virus, and HIV in prison entrants, and self reported risk factor status.

Results Prevalence of antibodies to hepatitis B core antigen was 37/596 (6%; 95% confidence interval 4% to 9%), to hepatitis C virus was 130/596 (22%; 19% to 25%), and to HIV was 12/596 (2%; 1% to 4%). A third of the respondents had never previously been in prison; these had the lowest prevalence of antibodies to hepatitis B core antigen (4/197, 2%), to hepatitis C (6/197, 3%), and to HIV (0/197). In total 29% of respondents (173/593) reported ever injecting drugs, but only 7% (14/197) of those entering prison for the first time reported doing so compared with 40% (157/394) of those previously in prison. Use of injected drugs was the most important predictor of antibodies to hepatitis B core antigen and hepatitis C virus.

Conclusions Use of injected drugs and infection with hepatitis C virus are endemic in Irish prisons. A third of prison entrants were committed to prison for the first time. Only a small number of first time entrants were infected with one or more of the viruses. These findings confirm the need for increased infection control and harm reduction measures in Irish prisons.

Introduction

A national census survey in 1998 reported that 43% of prisoners in the Republic of Ireland had ever injected drugs and that the overall prevalence of antibodies to hepatitis B core antigen was 9%, to hepatitis C virus was 37%, and to HIV was 2%.[1] In injecting drug users the prevalence of antibodies to hepatitis B core antigen was 19%, to hepatitis C virus was 81%, and to HIV was 4%.

In April 1999 the first national survey of prison entrants in the Republic of Ireland was undertaken to determine the prevalence of antibodies to hepatitis B core antigen, hepatitis C virus, and HIV and to examine risk factors for infection. Before this survey, the burden of these infections among prisoners entering the Irish prison system was unknown.

Methods

In this survey we used similar methods to those we used in the recent national census survey.[1] Our study received ethical approval from the Federated Dublin Voluntary Hospitals Joint Research Ethics Committee.

Setting and participants

There are about 11 000 committals to seven prisons each year in the Republic of Ireland. We excluded two of these committal prisons from the survey because the numbers committed in preceding years were small (5% of annual committals).

We needed to recruit 534 participants in order to estimate the prevalence of antibodies to hepatitis C virus. There were 718 entrants to the five survey prisons during the survey period from 6 April to 1 May 1999; 85 individuals were released or transferred to another prison before they could be interviewed, and six individuals were unable to provide informed consent and were excluded, leaving 627 potential recruits.

Survey

Staff and prisoners were briefed in advance. We visited each prison daily and interviewed all those committed within the previous 48 hours. The list of entrants was obtained from the committal register maintained in each prison. The survey was anonymous and comprised a questionnaire and collection of an oral fluid sample.

Questionnaire—The self administered questionnaire, derived from questionnaires used in prison surveys in the United Kingdom[2–7] and Republic of Ireland,[1] took five minutes to complete (see appendix on bmj.com).

Oral fluid tests—Oral fluid samples were collected with a proprietary device (EpiScreen, Epitope, Oregon, USA). Details of testing procedures and estimated sensitivity and specificity were reported previously.[1]

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Table 1 Prevalence of hepatitis B core antibodies, hepatitis C antibodies, and HIV antibodies in 596 prisoners entering Irish prisons by use of injected drugs and prison history

		Hepatitis B core antibodies		Hepatitis C antibodies		HIV antibodies	
	Total No of prisoners	No (%; 95% CI) of prisoners	P value of difference*	No (%; 95% CI) of prisoners	P value of difference*	No (%; 95% CI) of prisoners	P value of difference*
Total sample:	596†	37† (6.2; 4.4 to 8.5)		130 (21.8; 18.6 to 25.4)		12‡ (2.0; 1.0 to 3.5)	
Previously spent time in prison	394	32 (8.1; 5.6 to 11.3)	<0.01	122 (31.0; 26.4 to 35.8)	<0.0001	11 (2.8; 1.4 to 4.9)	0.02
Never before spent time in prison	197	4 (2.0; 0.6 to 5.1)		6 (3.1; 1.1 to 6.5)		0 (0; 0 to 1.9)	
Injecting drug users:	173‡§	31 (17.9; 12.5 to 24.5)		124 (71.7; 64.3 to 78.3)		10 (5.8; 2.8 to 10.4)	
Previously spent time in prison	157	29 (18.5; 12.7 to 25.4)	0.3	117 (74.5; 67.0 to 81.1)	<0.01	10 (6.4; 3.1 to 11.4)	0.3
Never before spent time in prison	14	1 (7.1; 0.2 to 33.9)		5 (35.7; 12.8 to 64.9)		0 (0; 0 to 23.2)	
Never used injected drugs:	420‡¶	5 (1.2; 0.4 to 2.8)		6 (1.4; 0.5 to 3.1)		2§ (0.5; 0.1 to 1.7)	
Previously spent time in prison	236	2 (0.9; 0.1 to 3.1)	0.7	5 (2.1; 0.7 to 4.9)	0.2	1 (0.4; 0.0 to 2.3)	1.0
Never before spent time in prison	183	3 (1.6; 0.3 to 4.7)		1 (0.6; 0 to 3.0)		0 (0; 0 to 2.0)	

*Derived from χ^2 tests of association or Fisher's exact tests comparing prevalence in respondents previously in prison and prevalence in those never before in prison.
†Antibody prevalence estimated in 596 respondents with analysable oral fluid samples.
‡Three respondents with analysable samples (including one who tested positive for hepatitis B core antibodies) did not declare injector status.
§Two injectors did not provide information on time spent in prison.
¶One non-injector did not provide information on time spent in prison and also tested positive for HIV antibodies.

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Statistical analysis

We used Pearson χ^2 test and Fisher's exact test to compare proportions in independent groups of categorical data and the χ^2 test for trend to identify linear trends. We developed multiple logistic regression models to identify factors associated with positive test results.

Results

All five prisons participated, and 607 of the 627 available prisoners took part (97%). This represents 85% of the total population committed to these prisons during the survey period and 6% of the roughly 11 000 committals to Irish prisons each year.

Our analyses refer to the 596 participants who provided analysable oral fluid samples or, for use of injected drugs, the 593 respondents who also declared their injector status. Denominators vary because not all respondents answered all questions.

Respondent characteristics

The median age (range) of respondents was 23 years (15-73). The age distribution of respondents was similar to that of the total population entering the study prisons (P = 0.97). Forty one respondents (7%) were women. A third (197/591) had never previously been in prison.

Prevalence of viral antibodies

The overall prevalence of antibodies to hepatitis B core antigen was 6%, to hepatitis C virus 22%, and to HIV 2%. Prevalence was significantly lower in respondents who had never previously been in prison (table 1).

Twenty nine per cent of respondents (173/593) reported ever injecting drugs. Only 7% (14/197) of those entering prison for the first time had ever injected drugs compared with 40% (157/394) of those previously imprisoned (P < 0.0001). Among injecting drug users the overall prevalence of antibodies to hepatitis B core antigen was 18%, to hepatitis C virus 72%, and to HIV 6%. The prevalence of each of the three infections was lower in the injecting drug users not previously imprisoned (table 1).

For those who had never used injected drugs, the prevalence of each marker of infection was low (table 1). Three of the five non-injectors who tested positive for hepatitis B had been in prison before, as had five of the six non-injectors positive for hepatitis C. Two non-injectors tested positive for HIV, one of whom had previously been imprisoned.

The prevalence of each of the three infections was significantly higher in women than men (table 2). The

Table 2 Logistic regression models* to identify determinants of hepatitis B core antibodies, hepatitis C antibodies, and HIV antibodies in entrants to Irish prisons

	Total No of prisoners (n=596)†	No (%) of prisoners positive for antibodies	Odds ratio (95% CI)	P value‡
Hepatitis B core antibodies (n=37)				
Ever injected drugs:				
No	420	5 (1.2)	1	
Yes	173	31 (17.9)	15.9 (6.5 to 47.6)	<0.0001
Sex:				
Male	555	28 (5.1)	1	
Female	41	9 (22.0)	2.7 (1.1 to 6.5)	0.03
Hepatitis C antibodies (n=130)				
Ever injected drugs:				
No	420	6 (1.4)	1	
Yes	173	124 (71.7)	89.1 (37.4 to 255.3)	<0.0001
Sex:				
Male	555	107 (19.3)	1	
Female	41	23 (56.1)	7.3 (1.9 to 35.8)	<0.01
Months spent in prison in past 10 years:				
<3	261	13 (5.0)	1	
3-11	64	16 (25.0)	4.9 (1.5 to 17.4)	<0.01
12-36	107	38 (35.5)	5.2 (2.0 to 14.6)	<0.001
>36	87	53 (60.9)	14.2 (5.1 to 43.6)	<0.0001
Ever treated for sexually transmitted infection:				
No	546	101 (18.5)	1	
Yes	44	26 (59.1)	7.4 (1.9 to 33.7)	<0.01
HIV antibodies (n=12)				
Sex:				
Male	555	8 (1.4)	1	
Female	41	4 (9.8)	9.6 (2.3 to 37.4)	<0.001
Months spent in prison in past 10 years:				
<3	261	1 (0.4)	1	
3-11	64	2 (3.1)	8.4 (0.8 to 185.2)	0.09
12-36	107	2 (1.9)	4.9 (0.5 to 107.9)	0.2
>36	87	7 (8.1)	27.1 (4.5 to 521.2)	<0.01

*Initial models included age, sex, ever imprisoned, time spent in prison in past 10 years, tattooing, using injected drugs, smoking heroin, ever had sex with a man inside or outside prison, ever treated for a sexually transmitted infection, use of condoms during heterosexual intercourse, and ever been paid for sex. Significant factors were retained in the final model.
†Numbers may not add up to total because not all respondents answered all questions.
‡For whole model for hepatitis B, χ^2=59, P<0.0001; for hepatitis C, χ^2=353, P<0.0001; for HIV, χ^2=23.2, P<0.0001.

proportion of women prisoners reporting ever injecting drugs was also higher than in men (63% *v* 27%, P < 0.0001).

Reported injecting practices

Over 70% (120/167) of injecting drug users stated that they had injected drugs in the month before the survey; 85 reported injecting more than 20 times. Almost three quarters of injectors previously imprisoned (110/155) started injecting three or more years ago, compared with 36% (5/14) of injectors among new entrants (P < 0.01). Of the 156 injectors previously in prison, over half (85/156) reported sharing needles while incarcerated, although 35 of them stated they had not shared in the month before committal; almost a fifth (29/156) reported starting their injecting habit in prison.

Tattooing

Almost 60% of the respondents (352/596) reported having a tattoo. Injecting drug users were significantly more likely to have tattoos than non-injectors (137/172 (80%) *v* 215/420 (51%), P < 0.0001). The proportion of prison entrants with tattoos also increased with increasing time spent in prison in the 10 years before the survey (χ^2 test for trend = 76, P < 0.0001). Thus, only 41% (81/197) of those who had not spent any time in prison were tattooed, compared with 45% (29/64) of those who had spent between one day and three months, 74% (127/170) of those who had spent three months to five years, and 89% (77/87) of those who had spent more than three years in prison. Eighty seven respondents were tattooed in prison.

Sexually transmitted infections

Forty four respondents (8%) reported that they had been treated for a sexually transmitted infection. Most of these were injecting drug users (27/44, 61%).

Hepatitis B vaccination

Of the respondents who had been in prison before, 29% (112/393) had received at least one dose of hepatitis B vaccine. Of these, 82% (89/108) had undergone their vaccination in prison.

Logistic regression

We constructed logistic regression models to clarify the associations between prisoners' characteristics and reported risk behaviours and their likelihood of testing positive for the three viral antibodies. Four groups of variables were considered for inclusion in each model: demographic and sentence characteristics, drug use and injecting practices, sexual history, and tattooing. Significant factors were retained in the models.

Compared with men, women were almost three times more likely to test positive for hepatitis B core antibodies, seven times more likely to test positive for hepatitis C antibodies, and almost 10 times more likely to test positive for HIV antibodies (table 2). The most important predictor of hepatitis antibodies was a history of injecting drugs. Those who reported injecting drugs were 89 times more likely to have hepatitis C antibodies and 16 times more likely to have hepatitis B core antibodies than non-injectors. The likelihood of testing positive for hepatitis C antibodies increased with increasing time spent in prison in the preceding 10 years. Although inferences from the HIV regression model are limited by small numbers, those who had spent more than three of the preceding 10 years in prison were significantly more likely to test positive for HIV antibodies.

We constructed separate models for respondents with and without a history of injecting drugs (tables 3 and 4). Among injecting drug users, hepatitis B core antibodies were more common in older respondents (≥30 years old) and in those who reported having more than 10 sexual partners in the year before the survey, while hepatitis C antibodies were 3.5 times more likely in women and six times more likely in those who reported frequent current injecting or sharing needles in prison, and HIV antibodies were more common in older respondents and in those who shared needles in the month before imprisonment (table 3).

Table 3 Logistic regression models* to identify the determinants of hepatitis B core antibodies, hepatitis C antibodies, and HIV antibodies in injecting drug users entering Irish prisons

	Total No of prisoners (n=173)†	No (%) of prisoners positive for antibodies	Odds ratio (95% CI)	P value‡
Hepatitis B core antibodies (n=31)				
Age (years):				
< 30	143	21 (14.7)	1	
≥30	28	9 (32.1)	5.1 (1.7 to 15.3)	<0.01
Sex:				
Male	147	23 (15.7)	1	
Female	26	8 (30.8)	2.7 (0.8 to 8.3)	0.1
No of heterosexual partners in past year:				
1-2	103	17 (16.5)	1	
3-10	42	6 (14.3)	1.2 (0.4 to 3.8)	0.7
>10	10	4 (40.0)	6.0 (1.3 to 26.1)	0.02
None	12			
Hepatitis C antibodies (n=124)				
Sex:				
Male	147	101 (68.7)	1	
Female	26	46 (88.5)	3.5 (1.2 to 34.4)	0.05
No of times injected drugs in past month:				
0	47	24 (51.1)	1	
1-19	35	24 (68.6)	3.0 (1.0 to 9.4)	0.05
>19	85	72 (84.7)	6.3 (2.5 to 17.2)	<0.001
Shared needles in prison:				
No	94	59 (62.8)	1	
Yes	63	58 (92.1)	6.3 (2.3 to 20.3)	<0.001
First time in prison	14			
HIV antibodies (n=10)				
Age (years):				
<30	143	5 (3.5)	1	
≥30	28	5 (17.9)	8.0 (1.9 to 37.6)	<0.01
Sex:				
Male	147	6 (4.1)	1	
Female	26	4 (15.4)	3.6 (0.8 to 16.8)	0.1
Shared needles in month before imprisonment:				
No	118	3 (2.5)	1	
Yes	52	7 (13.5)	5.9 (1.4 to 31.5)	0.02

*Initial models included the variables age, sex, ever imprisoned, time spent in prison in preceding 10 years, tattooing, smoking heroin, length of time since first injection, started injecting in prison, sharing needles inside and outside prison, injecting frequency in prison, ever had sex with a man inside or outside prison, ever treated for a sexually transmitted infection, number of heterosexual partners, use of condoms during heterosexual intercourse, ever been paid for sex. Significant factors were retained in the final model.
†Numbers may not add up to total because not all respondents answered all questions.
‡For whole model for hepatitis B, χ^2=13.8, P<0.01; for hepatitis C, χ^2=36.6, P<0.0001; and for HIV, χ^2=16.8, P<0.001.

Table 4 Logistic regression model* to identify determinants of hepatitis C antibodies in non-users of injected drugs entering Irish prisons

	Total No of prisoners (n=420)†	No (%) of prisoners positive for antibodies	Odds ratio (95% CI)	P value‡
Hepatitis C antibodies (n=4)				
Tattooed outside prison	167	1 (0.6)	1	
Tattooed inside prison	46	3 (6.5)	11.6 (1.4 to 237.3)	0.04
No tattoo	205	0		

*Initial model included the variables age, sex, ever imprisoned, time spent in prison in past 10 years, tattooing, smoking heroin, ever had sex with a man inside or outside prison, ever treated for a sexually transmitted infection, number of heterosexual partners, use of condoms during heterosexual intercourse, and ever been paid for sex. Significant factors were retained in the final model.
†Numbers may not add up to total because not all respondents answered all questions.
‡For whole model for hepatitis C, χ^2=5.3, P=0.02.

No independent risk factors were identified for the five non-injectors who tested positive for hepatitis B core antibodies (two had no reported risk factors, two had tattoos, and one reported smoking heroin and having been treated for a sexually transmitted infection). Of the six non-injectors who tested positive for hepatitis C antibodies, five had spent time in prison and four had had a tattoo done in prison (table 4). The model indicated that non-injectors who were tattooed inside prison were more likely to test positive for this virus than those who had tattoos done outside prison. Only two non-injectors tested positive for HIV antibodies.

Discussion

This survey showed that, of the third of prison entrants being imprisoned for the first time, only 7% reported injecting drugs, compared with 40% of those who had been imprisoned previously. Bloodborne infections among drug injectors who had previously been in prison were higher than among injectors who had not previously been in prison.

Limitations of study

Conclusions from cross sectional surveys are limited. It is therefore not possible to deduce from this survey whether the higher infection rates in recidivist prisoners are because of their more chaotic drug use patterns (for example, a higher proportion of injectors previously imprisoned had started injecting more than three years earlier) or because of the previous exposure to prison. Increased risk associated with exposure to prison is probably because of the high risk injecting practices adopted in prison (such as sharing a small number of needles with a large and varied cohort of inmates) rather than spending time in prison in itself.

The validity of oral fluid assays is high except for the 80% sensitivity of the hepatitis C antibody test.[1] The prevalence of hepatitis C antibodies reported in this survey is therefore likely to be an underestimate of the true prevalence, which could be as high as 90% in injecting drug users entering Irish prisons. This is substantially higher than the prevalence reported in entrants to Australian prisons (64% and 66%).[8 9]

Comparison with other studies

This is the first time that the same methods have been used in both a national survey of prison inmates and a national committal survey, enabling direct comparisons. Although the overall prevalence of hepatitis antibodies was lower in prison entrants, the prevalence of these antibodies in entrants previously in prison was similar to that reported in the prison inmates, as was the prevalence in recidivist drug injectors.[1] In both surveys injecting drug use was by far the most important risk factor for hepatitis C, with injectors who reported sharing needles in prison or frequent current injecting being more likely to test positive. In both surveys about a fifth of injectors reported that they had started injecting in prison. Surveys in some Scottish prisons have reported similarly high initiation figures.[4 6 10]

The prevalence of hepatitis B core antibodies (18%) in drug injectors entering Irish prisons was lower than the 52% and 43% reported in drug injectors entering Australian prisons,[8 9] and also lower than in drug injectors entering French prisons (37%).[11] Ireland has a programme of proactive hepatitis B vaccination in prisons, and the vaccination coverage is higher than reported in UK prisons.[7] This may contribute to the lower than expected prevalence of hepatitis B in Irish prisoners. Offering the vaccine to all prisoners during committal procedures could further reduce the transmission of hepatitis B virus in Irish prisons.

Tattooing in prison was the only independent risk factor identified for the presence of hepatitis C antibodies in respondents who had never used injected drugs. Abildgaard and Peterslund reported the presence of hepatitis C antibodies in an individual with a tattoo but no other risk factors,[12] and Turnbull et al reported that 6% of prisoners interviewed had a tattoo done on their last occasion in prison and that half of these had shared tattooing equipment.[13] Taken together, these findings suggest that tattooing may be responsible for transmission of hepatitis C in prison. It may be advisable to include a question on tattooing in future studies of viral prevalence.

Conclusions

Research questions raised by this study are whether the high prevalence of bloodborne infections in recidivist prisoners derives from chaotic drug behaviour outside

What is already known on this topic

High rates of using injected drugs, initiation of use of injected drugs, and sharing injecting equipment occur in Irish prisons

Injecting drug users have high rates of infection with hepatitis B and C viruses, and hepatitis C is endemic in injecting drug users and in Irish prisoners

What this study adds

The prevalence of antibodies to hepatitis B core antigen, to hepatitis C, and to HIV in prison entrants who had previously been imprisoned was similar to that found in the recent national survey of Irish prisoners, but the prevalence of these antibodies was much lower in the third of prison entrants who had never previously been in prison

Tattooing in prison is an independent risk factor for hepatitis C infection in prisoners who have never used injected drugs

prison that leads to repeat imprisonment or from the risk behaviours adopted within prison; whether programmes of proactive hepatitis B vaccination in prisons will lower the prevalence of hepatitis B; and the role of tattooing in transmitting hepatitis C virus and whether provision of sterile tattoo kits would help reduce infection rates.

It is clear that both use of injected drugs and infection with hepatitis C virus are endemic in Irish prisons. Only a small number of the new entrants committed during the survey period were infected with one or more of the viruses. As imprisonment leads to high risk practices, this survey points to the need for increased infection control and harm reduction measures in Irish prisons.

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Competing interests: FB has contributed to policy development on prison health for the Labour Party (Ireland) and, until recently, was a part time prison medical officer. JB is a member of the National Drugs Strategy Team (Ireland).

1 Allwright S, Bradley F, Long J, Barry J, Thornton L, Parry J. Prevalence of antibodies to hepatitis B, hepatitis C and HIV and risk factors in Irish prisoners: results of a national cross sectional survey. *BMJ* 2000;321:78-82.
2 Bird AG, Gore SM, Jolliffe DW, Burns S. Anonymous HIV surveillance in Soughton Prison, Edinburgh. *AIDS* 1992;6:725-73.
3 Bird AG, Gore SM, Burns SM, Duggie JG. Study of infection with HIV and related risk factors in young offenders' institution. *BMJ* 1993;307:228-31.
4 Gore SM, Bird AG, Burns SM, Goldberg DJ, Ross AJ, Macgregor J. Drug injection and HIV prevalence in inmates of Glenochill prison. *BMJ* 1995;310:293-6.
5 Bird AG, Gore SM, Cameron S, Ross AJ, Goldberg DJ. Anonymous HIV surveillance with risk factor elicitation at Scotland's largest prison, Barlinnie. *AIDS* 1995;9:801-8.
6 Gore SM, Bird AG, Burns S, Ross AJ, Goldberg D. Anonymous HIV surveillance with risk-factors elicitation: at Perth (for men) and Cornton Vale (for women) Prisons in Scotland. *Int J STD AIDS* 1997;8:166-75.
7 Weild A, Gill O, Bennett D, Livingstone S, Parry J, Curran L. Prevalence of HIV, hepatitis B and hepatitis C antibodies in prisoners in England and Wales: a national survey. *Commun Dis Public Health* 2000;3:121-6.
8 Crofts N, Stewart T, Hearne P, Ping XY, Breschkin AM, Locarnini SA. Spread of bloodborne viruses among Australian prison entrants. *BMJ* 1995;310:285-8.
9 Butler TG, Dolan KA, Ferson MJ, McGuinness LM, Brown PR, Robertson PW. Hepatitis B and C in New South Wales Prisons: prevalence and risk factors. *Med J Aust* 1997;166:127-30.
10 Bird AG, Gore SM, Hutchinson SJ, Lewis SC, Cameron S, Burns S. Harm reduction measures and injecting inside prison versus mandatory drugs testing—results of a cross sectional anonymous questionnaire survey. *BMJ* 1997;315:21-4.
11 Rotily M, Vernay-Vaisse C, Bouliere M, Galinier-Pujol A, Rousseau S, Obadia Y. HBV and HIV screening, and hepatitis B immunization programme in the prison of Marseille, France. *Int J STD AIDS* 1997;8:735-59.
12 Abildgaard N, Peterslund NA. Hepatitis C virus transmitted by tattooing needle. *Lancet* 1991;338:460.
13 Turnbull PJ, Dolan KA, Stimson GV. *Prisons HIV and AIDS: risks and experiences in custodial care*. Horsham: AVERT, 1991.

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Commentary: efficient research gives direction on prisoners' and the wider public health—except in England and Wales

Sheila M Bird

Cost efficient, prison based medical research[1 2] has made an impact on enlightened prison services, such as in Scotland and Ireland, where short-course hepatitis B immunisation is offered. Long et al provide evidence of success: in the Republic of Ireland eight out of 10 recidivist prisoners who were vaccinated against hepatitis B had received their immunisation in prison. Clearly, community services have some catching up to do. Despite being limited to prisoners with longer sentences, hepatitis B immunisation in Irish prisons had reached a quarter of recidivists. Long et al suggest that offering it to all prisoners during committal procedures, as occurs in Scotland, could further reduce transmission of hepatitis B.

By contrast, the prison service in England and Wales has still failed to implement its strategy to provide hepatitis B immunisation for prisoners at risk of infection, despite research evidence of the need for it,[3] nor has it provided sterilisation tablets for inmates to clean needles and injecting equipment. By not condemning the prison service's procrastination on harm reduction,[4] the Department of Health condones this situation. Sir David Ramsbotham, the former chief inspector of prisons, had higher, fearless expectations for the treatment of prisoners[5] but was let go.

Long et al have successfully applied the same methods (unattributable saliva sample plus self completion questionnaire) to prison entrants as they had done recently to inmates in the same prisons[6]—a methodological first in prison based research into HIV infection and hepatitises related to injecting drugs. Notably, a third of prison entrants had never been in prison before; only 7% (14/197) of these first time entrants reported ever injecting drugs compared with 40% (157/394) of recidivist entrants, and 43% (509/1178) of prison inmates.[6]

The table shows the prevalence of prison inmates who had ever injected drugs among those who participated in nine first "willing anonymous salivary HIV/hepatitis C" (WASH-C) studies in Scotland: 26% (765/2895) of inmates had never been in prison before. The combined Scottish and Irish data point to

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Prevalence of prisoners who had ever injected drugs among inmates of Scottish prisons 1991-6 according to number of times imprisoned before. Values are percentages (numbers) of inmates

Inmates	Never in prison before	In prison once before	Other recidivists
Adult women	17 (10/58)	36 (5/14)	72 (43/60)
Adult men	8 (43/527)	15 (36/240)	43 (638/1492)
Male young offenders	10 (18/180)	17 (17/99)	28 (64/225)

a doubling of prevalence of injectors between first and subsequent incarceration, with a further doubling thereafter.

This is a critical observation operationally because prison services know how many times an inmate has been in prison before but not necessarily his or her history of injecting drugs. Since the proportion of inmates with a history of injecting rises steeply with the number of previous incarcerations, most injectors with rehabilitation needs will be found among those who have been inside two or more times before. Prevention initiatives, including how to avoid being initiated into injecting drugs, are best directed at those with most to gain—first and second time prisoners, especially young offenders.

For research, the high recidivism and low prevalence of injectors in first time prison entrants make prisons and young offenders institutions a cost efficient setting in which to monitor trends in recidivists' incidence of initiation into injecting of drugs (and incidence of hepatitis C among injectors). A suitable paired sample method has been devised,[7 8] and Long et al have shown that its application in the 48 hours after prisoners' committal to prison could work well. Questions such as what characterises new initiates into drug injecting could be answered. Monitoring the incidence of initiation into injecting of drugs and the context of initiation (in or out of prison) is key to any drugs strategy and for reducing the transmission of hepatitis C.

Long et al also showed that carriage of hepatitis C by non-injectors was linked to their having been tattooed in prison. To reduce that risk, tattooists should not use the same device on inmates who inject drugs and then on non-injectors, the use of sterilisation tablets should be promoted, and the booking of sterile equipment be considered with appropriate safeguards for staff and prisoners.

Surveys of people arrested by the police have not enjoyed the high volunteer rates that prisoner surveys do—nearer 40% than 80%.[9 10] If answers to common questions are similar across different settings in the criminal justice system (people under arrest, prison entrants and inmates), future studies could concentrate on the setting where answers are available most cost efficiently. It is time for surveys of prisoners to address wider issues (on drugs, morbidity, and acquisitive crime) than risk factors for bloodborne viruses. Time indeed for a wider epidemiological research programme on prisoners' health—a prudent investment with likely dividends for prisoners' and public health (provided, of course, that coercion is avoided, confidentiality is secured, methods are acceptable to prisoners, and they are informed of outcomes[11]).

Competing interests: I have published research on similar themes among Scottish prisoners and have a research interest in prisoners' health.

1 Bird AG, Gore SM, Hutchinson SJ, Lewis SC, Cameron S, Burns S for the European Commission Network on HIV infection and Hepatitis in prison. Harm reduction measures and injecting inside prison versus mandatory drugs tests: results of a cross sectional anonymous questionnaire survey. *BMJ* 1997;315:21-4.

2 Gore SM, Bird AG, Cameron SO, Hutchinson SJ, Burns SM, Goldberg DJ. Prevalence of hepatitis C carriage in Scottish prisons: willing anonymous salivary hepatitis C surveillance linked to self-reported risks. *Q J Med* 1999;92:25-32.

3 Weild AR, Gill ON, Bennett D, Livingstone SJM, Parry JV, Curran L. Prevalence of HIV, hepatitis B, and hepatitis C antibodies in prisoners in England and Wales: a national survey. *Commun Dis Public Health* 2000;3:121-6.

4 Department of Health and Expert Working Group. *Appendix G: application of guidance to the prison setting in hepatitis C—guidance for those working with drug users*. London: DoH, 2001:46-8.

5 HM Chief Inspector of Prisons (Sir David Ramsbotham). *Patient or prisoner?* London: Home Office, 1996.

6 Allwright S, Bradley F, Long J, Barry J, Thornton L, Parry JV. Prevalence of antibodies to hepatitis B, hepatitis C, and HIV and risk factors in Irish prisoners: results of a national cross sectional survey. *BMJ* 2000:321:78-82.

7 Gore SM, Bird AG, Burns SM. HIV epidemiology in prisons: anonymous voluntary HIV surveillance with risk factor elicitation. In: Liebling A, ed. *Deaths in custody. Caring for people at risk*. London: Whiting and Birch, 1996:114-42.

8 Bird SM, Rotily M, Bird AG (deceased). Inside methodologies: for counting blood-borne viruses and injector-inmates' behavioural risks, with results from European prisons. *Howard J Criminal Justice* (in press).

9 Bennett T. *Drugs and crime: the results of the second developmental stage of the NEW-ADAM programme. Home Office research study 205*. London: Home Office Research and Statistics Directorate, 2000.

10 McKeganey N, Connelly C, Knepil J, Norrie J, Reid L. *Interviewing and drug testing of arrestees in Scotland: a pilot of the arrestee drug abuse monitoring (ADAM) methodology*. Edinburgh: Central Research Unit, Scottish Executive, 2000.

11 Bird AG, Gore SM. Inside methodology: HIV surveillance in prisons. *AIDS* 1994;8:1345-6.