

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

Jean Long, Shane Allwright, Joseph Barry, Sheilagh Reaper Reynolds, Lelia Thornton, Fiona Bradley, John V Parry



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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.

Why we carried out the study

The prevalence of antibodies to hepatitis B core antigen, hepatitis C virus, and HIV in prison inmates is high.¹ The burden of these infections among those entering the Irish prison system was unknown.

What were the main findings?

The overall prevalence of antibodies to hepatitis B core antigen was 6%, to hepatitis C virus 22%, and to HIV 2%. A third of prison entrants (197/591) had never previously been in prison. 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 ($P < 0.0001$). Bloodborne infections were more common among drug injectors who had previously been in prison than among injectors who had not previously been in prison.

How did we perform the study?

We used similar methods to those we used in the recent national census survey.¹ 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). Between 6 April and 1 May 1999 we visited each of the five prisons daily and interviewed all those committed within the previous 48 hours. The survey was anonymous and comprised a questionnaire, derived from questionnaires used in other prison surveys,¹⁻⁷ and collection of an oral fluid sample.¹

Our study received ethical approval from the Federated Dublin Voluntary Hospitals Joint Research Ethics Committee.

What were the detailed results?

Details of participants and prevalence of viral antibodies

During the survey period 607 of the 627 available entrants to the five survey prisons took part (97%). 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.

The median age (range) of respondents was 23 years (15-73). Forty one respondents (7%) were women. A third (197/591) had never previously been in prison. Prevalence of viral antibodies was signifi-

Department of Community Health and General Practice, Trinity College Centre for Health Sciences, Adelaide and Meath Hospital incorporating the National Children's Hospital, Tallaght, Dublin 24, Republic of Ireland

Jean Long
lecturer in international health and development

Shane Allwright
senior lecturer in epidemiology

Joseph Barry
senior lecturer in public health

Fiona Bradley
lecturer in general practice

Drugs/AIDS service, Northern Area Health Board, Phibsboro, Dublin 7, Republic of Ireland

Sheilagh Reaper Reynolds
education officer

Department of Public Health, Eastern Regional Health Authority, Dr Steevens' Hospital, Dublin 8, Republic of Ireland
Lelia Thornton
specialist in public health medicine

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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

	Total No of prisoners	Hepatitis B core antibodies		Hepatitis C antibodies		HIV antibodies	
		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.

Sexually Transmitted and Bloodborne Virus Laboratory, PHLS Central Public Health Laboratory, London NW9 5HT
John V Parry
deputy director

Correspondence to: S Allwright
sllwright@tcd.ie

cantly lower in respondents who had never previously been in prison (table 1).

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%. For those who had never used injected drugs, the prevalence of each marker of infection was low.

The prevalence of each of the three infections was significantly higher in women than men (table 2). The proportion of women prisoners reporting ever injecting drugs was also higher than in men (63% *v* 27%, $P < 0.0001$).

Injecting drug use, tattoos, treatment for sexually transmitted diseases, and hepatitis B vaccination

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. Of the 156 injectors previously in prison, over half (85/156) reported sharing needles while incarcerated; almost a fifth (29/156) reported starting their injecting habit in prison.

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%), $P < 0.0001$). Eighty seven respondents were tattooed in prison.

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%).

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.

Clarifying the association between risk behaviours and presence of viral antibodies

We developed multiple 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 (table 2). The most important predictor of hepatitis antibodies was a history of injecting drugs. 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.

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, $\chi^2=59$, $P < 0.0001$; for hepatitis C, $\chi^2=353$, $P < 0.0001$; for HIV, $\chi^2=23.2$, $P < 0.0001$.

What did other studies find?

Most important risk factor for hepatitis C is injecting drug use

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 (see full version of article on bmj.com). 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 8}

Prevalence of hepatitis B in drug injectors entering Irish prisons was lower than in other countries

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,^{9 10} 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 may cause hepatitis C

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 (see full version of article on bmj.com). 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.

What are the limitations of our 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

What is already known on this topic

High rates of using injected drugs, initiation of use of injected drugs, and sharing of 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

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%).^{9 10}

What are the implications for practice?

It is clear that both use of injected drugs and infection with hepatitis C virus are endemic in Irish prisons. 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).

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

Sheila M Bird

MRC Biostatistics
Unit, Cambridge
CB2 2SR
Sheila M Bird
senior statistician
sheila.bird@
mrc-bsu.cam.ac.uk

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 prisoners⁵ 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 prisons⁶—a methodological first in prison based research into HIV infection and hepatitis 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 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

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)

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 outcomes¹¹).

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

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Long term mortality of mothers and fathers after pre-eclampsia: population based cohort study

Henrik U Irgens, Lars Reisaeter, Lorentz M Irgens, Rolv T Lie

Abstract

Objective To assess whether mothers and fathers have a higher long term risk of death, particularly from cardiovascular disease and cancer, after the mother has had pre-eclampsia.

Design Population based cohort study of registry data.

Subjects Mothers and fathers of all 626 272 births that were the mothers' first deliveries, recorded in the Norwegian medical birth registry from 1967 to 1992. Parents were divided into two cohorts based on whether the mother had pre-eclampsia during the pregnancy. Subjects were also stratified by whether the birth was term or preterm, given that pre-eclampsia might be more severe in preterm pregnancies.

Main outcome measures Total mortality and mortality from cardiovascular causes, cancer, and stroke from 1967 to 1992, from data from the Norwegian registry of causes of death.

Results Women who had pre-eclampsia had a 1.2-fold higher long term risk of death (95% confidence interval 1.02 to 1.37) than women who did not have pre-eclampsia. The risk in women with pre-eclampsia and a preterm delivery was 2.71-fold higher (1.99 to 3.68) than in women who did not have pre-eclampsia and whose pregnancies went to term. In particular, the risk of death from cardiovascular causes among women with pre-eclampsia and a preterm delivery was 8.12-fold higher (4.31 to 15.33). However, these women had a 0.36-fold (not significant) decreased risk of cancer. The long term risk of death was no higher among the fathers of the

pre-eclamptic pregnancies than the fathers of pregnancies in which pre-eclampsia did not occur.

Conclusions Genetic factors that increase the risk of cardiovascular disease may also be linked to pre-eclampsia. A possible genetic contribution from fathers to the risk of pre-eclampsia was not reflected in increased risks of death from cardiovascular causes or cancer among fathers.

Introduction

Pre-eclampsia, which is characterised by hypertension and proteinuria, occurs in 3-5% of pregnancies.¹ The condition may be life threatening to the mother and the fetus if it is not properly managed, but it usually ends when the baby and placenta are delivered.²

The causes of pre-eclampsia are not well understood. A paradoxical preventive effect when the mother smokes has been established, even though the mechanism is unknown.³⁻⁴ Maternal and fetal genes, including paternal genes expressed in the fetus, probably also play a part.¹⁻⁵ A high risk of recurrence of pre-eclampsia in subsequent pregnancies supports the role of an inherited susceptibility in the maternal genes. In a previous study in Norwegian women we reported a 12-fold increase in the risk of pre-eclampsia in a second pregnancy when the woman had had pre-eclampsia in the first pregnancy.⁶ A strong association of risks between sisters (odds ratio 2.2) and an increased occurrence of pre-eclampsia in daughters of mothers who had pre-eclampsia are further evidence of maternal genes for susceptibility.⁶⁻⁷

Paternal genes transmitted to the fetus also seem to be involved in pre-eclampsia. Our earlier study found

Medical Birth Registry of Norway, Locus for Registry Based Epidemiology, Department of Public Health and Primary Health Care, University of Bergen, Haukeland Hospital, N5021 Bergen, Norway
Henrik U Irgens
medical student
Lars Reisaeter
medical student
Lorentz M Irgens
professor
Rolv T Lie
professor

Correspondence to: L M Irgens
lorentz.irgens@mfr.uib.no

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