

The Australian Study of HIV and Injecting Drug Use. Part I: Prevalence for HIV, hepatitis B and hepatitis C among injecting drug users in four Australian cities

WENDY M. LOXLEY, MIKE PHILLIPS,
SUSAN J. CARRUTHERS & JUDE S. BEVAN

*National Centre for Research into the Prevention of Drug Abuse,
Curtin University of Technology, Perth, Australia*

Abstract

The objective of this study was to assess differences in HIV, hepatitis B and hepatitis C seroprevalence among injecting drug users (IDU) in four Australian cities. Eight hundred and seventh-two current IDU were recruited in approximately equal numbers from each of Adelaide, Melbourne, Perth and Sydney, and interviewed individually using a structured questionnaire. Fingerprick blood samples were taken from the majority of respondents, and tested for past exposure to the three viruses. HIV and hepatitis B and C raw seroprevalences were compared across cities, and comparisons were made of age-standardized seroprevalences for hepatitis B and C. Three percent of all respondents were HIV seropositive; 19% (23% age-standardized) were hepatitis B seropositive and 55% (60% age-standardized) were hepatitis C seropositive. There were general city differences and gender, sexual preference and treatment status group differences between the cities. Sydney respondents had the highest risk of infection for all three viruses in all comparisons. This was particularly striking for HIV among non-heterosexual men. Various explanations for the findings were considered, including city differences in demographic and drug use variables, underlying patterns of risk behaviour, and period/cohort effects. It was concluded that none of these explanations appeared to fit the pattern of findings, and that these probably represented true underlying differences in size of pools of infection. The reasons for this, however, cannot be ascertained from this study. [Loxley WM, Phillips M, Carruthers SJ, Bevan JS. The Australian Study of HIV and Injecting Drug Use. Part I: Prevalence for HIV, hepatitis B and hepatitis C among injecting drug users in four Australian cities. *Drug Alcohol Rev* 1997; 16: 207-214]

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Wendy Loxley BA Hons, MPsych, PhD, Senior Research Fellow, National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology, 1/14 Stone Street, South Perth, WA 6151, Australia; Mike Phillips BSc Hons, M Med Sci, Senior Lecturer, School of Public Health, Curtin University of Technology, GPO Box U1987, Perth, WA 6001, Australia; Susan J. Carruthers B App Sc, Grad Dip Diet, MPH, Doctoral Student, National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology, 1/14 Stone Street, South Perth, WA 6151, Australia; Jude S. Bevan, B App Sc, P Grad Dip Hlth Sc, Research Associate, National Centre for Research into the Prevention of Drug Abuse, Curtin University of Technology, 1/14 Stone Street, South Perth, WA 6151, Australia. Correspondence to Dr Wendy Loxley.

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Introduction

The risk of HIV infection among injecting drug users (IDU) has been the subject of many years of inquiry among Australian epidemiologists and social and behavioural scientists [1]. Together with numerous small cross-sectional studies designed to investigate specific populations or specific behaviours and a smaller number of intervention studies, there have been four major cross-sectional studies of the demographic characteristics, risk behaviour and HIV serostatus of injecting drug users in Australia [2-5] which have been complemented by a major longitudinal study [6]. The most recent of these cross-sectional studies is the Australian Study of HIV and Injecting Drug Use (ASHIDU) [5].

The ASHIDU was a cross-sectional, multi-city study which was designed to investigate the risks of blood-borne infections (BBI) in Australian injecting drug users (IDU). Data collected during 1994 from IDU in four Australian cities (Adelaide, Melbourne, Perth and Sydney) included knowledge, attitudes and behaviours relevant to acquiring or spreading infection as well as HIV, hepatitis C and hepatitis B antibody status. The aim of the project was to provide data to design strategies to reduce the transmission of BBI in IDU in Australia.

ASHIDU was the first Australian study to compare exposure to hepatitis B and C in a range of IDU across geographical locations. Its similarity in design to the earlier Australian National AIDS And Injecting Drug Use Study (ANAIDUS) [2,3] also makes it possible to compare HIV seropositivity in some cities across 6 years. In the 1989 ANAIDUS, HIV seroprevalence by dried blood spot testing was found to be 1.7% in Brisbane, 1.5% in Melbourne, 2.2% in Perth and 6.8% in Sydney [2].

It is known that HIV prevalence varies widely between cities, not only in Australia but in the United Kingdom and the United States [7-9]. In the first ASHIDU report, HIV seropositivity was found to be associated with gender and sexual orientation in men, and hepatitis B and C seropositivity were found to be associated with age, treatment status and duration of drug use [5]. The analyses reported in the present paper take account of these factors in reporting HIV, hepatitis B and hepatitis C seroprevalence among IDU in Adelaide, Melbourne, Perth and Sydney in 1994 [5]. This paper is the first in a series of two reporting ASHIDU data. Examination of risk factors is reported in Part II.

Method

The study group consisted of 872 respondents recruited in approximately equal numbers from each of the four cities. Quota sampling was used to ensure adequate proportions (at least 33% of the total sample) of women, young people, drug injectors who had never received treatment and those who lived in the outer suburbs of cities, because these IDUs are frequently under-represented in published research [1]. All respondents had injected within the previous 3 months.

Respondents were recruited by advertising, snowballing and networking. Start points included needle and syringe exchange schemes, drug treatment agencies, STD clinics, primary health care centres, youth work agencies, tertiary institutions, pharmacies and interviewer networks. Because of this method of recruiting, response rates could not be calculated. Each city employed variants of the general strategy that best suited their needs.

Ethical clearances were obtained from the relevant bodies in each city before data collection commenced. The instrument used in this study consisted of an administered questionnaire developed for the ASHIDU, and the Drug Use sub-scale of the HIV Risk-Taking Behaviour Scale [10].

A total of 832 (95%) blood samples were collected for anonymous testing for antibodies to HIV and hepatitis C and core antibodies to hepatitis B. All serological testing was carried out at the National Reference Laboratory, at Fairfield Hospital. Serological testing was conducted as follows.

Anti-HIV serology

Eluates were tested using Genetic Systems LAV EIA according to the manufacturers instructions for Dried Blood Spots. The NRL in-house Western Blot, modified for use in the immunetics miniblottedter, was used for confirmatory testing.

Anti-HCV serology

Eluates were tested using the Abbot 3rd generation anti-HCV EIA.

Anti-HBV serology

The two eluates from each blood spot were pooled to create a single sample. Eluates were tested using the Abbot anti-HBV core EIA.

Other details of serology are included in the technical report [5]. Serological results for hepatitis B core antibody (HBVcAb) and hepatitis C antibody (HCVAb) are presented as reactive rather than positive since there were no facilities for confirmatory testing.

Hepatitis B and C seroprevalences were age-standardized against the adult Australian population to allow for city comparisons which controlled for age. HIV seroprevalence was not age-standardized because small numbers of positive cases did not allow for direct standardization to be applied without an unacceptable inflation of the standard error and there was no prior evidence to suggest that HIV in drug injectors is related to age. Seroprevalences have been further divided by gender and, where appropriate, sexual orientation and treatment status. Confidence intervals were estimated for crude and age-standardized rates, and these intervals used to examine the statistical significance of differences in prevalence rates. Further significance testing is reported in Part II.

Results

Study group quotas

The composition of the total study group was consistent with the designated quotas of no fewer than one-third of women compared to men, younger compared to older and outer suburb compared to inner suburb respondents. However, fewer 'never received treatment' respondents were recruited (22% compared to the intended 33% or more).

Blood collection

Blood samples were collected from 832 (95.3%) respondents. Because the tests were carried out in the sequence HIV, hepatitis C, hepatitis B, insufficient blood in some samples meant that there were fewer hepatitis C tests (788) than HIV, and fewer hepatitis B tests (597) than hepatitis C. The number of tests conducted for men, women and transgender respondents can be seen in Table 1.

Description of the study group

The total study group consisted of 872 respondents: 213 from Adelaide, 220 from each of Melbourne and Perth and 219 from Sydney. Sixty-four percent were

men, 35% were women, and four respondents were transgender. Forty-seven percent of all respondents were receiving treatment for drug problems at the time of interview. ('Treatment' included methadone maintenance or withdrawal, detoxification, residential rehabilitation, out-patient treatment, treatment by GP, counselling and/or any other specifically drug-related programme other than self-help. Further details about treatment can be found in [11].) The mean age of respondents was 28.5 years (SD 7.4).

Almost 90% of men and 78% of the women described themselves as heterosexual. Sixty-seven percent were single. Over 70% had received some secondary education. Twenty-six percent were employed at the time of interview, and of these 41% were in full-time employment. Most respondents were born in Australia. Five percent described themselves as being of Aboriginal or Torres Strait Islander descent.

There were significant city differences in proportions of young respondents (under 25 years compared to over 25); those currently in treatment (compared to those not in treatment), heterosexual respondents; those who had completed secondary school (compared to those who did not complete secondary school) and those employed (compared to unemployed). There were no significant gender differences between the city study groups. Other significant differences were as follows. Melbourne and Perth respondents were younger than Adelaide and Sydney respondents. Sydney respondents were more likely to be receiving treatment than others. There were fewer heterosexual men in the Melbourne and Sydney than in the Adelaide and Perth groups and fewer heterosexual women in the Melbourne group than in other groups. Respondents in Melbourne and Adelaide were more likely to have completed secondary school than those in Perth and (particularly) Sydney. Melbourne respondents were more likely to be employed than those in other cities.

There was no overall gender difference in treatment status, but women in Sydney were more likely than women in other cities to be receiving treatment at the time of interview.

HIV seroprevalence

HIV prevalence rates and confidence intervals are shown in Table 2. The overall HIV seroprevalence was 3.1% with 3.9% among men, and 1.4% among women. Seroprevalence among Adelaide, Melbourne

Table 1. Number of tests carried out on respondent blood samples, by gender

Test	Men	Women	Transgender	Total
HIV	535	294	3	832
HCV	507	278	3	788
HBV	375	219	3	597

and Perth respondents was 1.9–2.0% and 6.6% in Sydney. There was no significant difference between those currently in- and not-in-treatment.

Although Sydney had the highest HIV seroprevalence in both genders, the difference between Sydney and the other cities was only significant among men. There were no significant differences between non-Sydney cities for either men or women and differences between men and women were only significant in Sydney.

Seroprevalence was strongly associated with male sexual orientation within cities. The overall seroprevalence for heterosexual men was 1.6% (CI 1.0, 2.2) and for homo/bisexual men 21.3% (CI 16.1, 26.5). The greater likelihood of homo/bisexual men to be HIV+ was particularly marked in Sydney (homo/bisexual: 37.5%; CI 25.4, 49.6; heterosexual: 3.7%; CI 1.9, 5.5). There were no significant city differences in seroprevalence among heterosexual men.

Hepatitis B seroprevalence

The overall age-standardized hepatitis B seroprevalence was 23.3% (Table 3). Table 3 shows that Melbourne respondents had the lowest, and Sydney respondents the highest age-standardized hepatitis B seroprevalence.

The overall hepatitis B seroprevalence among men

(22.5%; CI 20.8, 25.2) was not significantly different from that of women (22.7%; CI 20.1, 25.9). Gender differences within cities can be seen in Fig. 1. Fig. 1 shows that Sydney had the highest seroprevalence among both men and women. The differences between men and women were not significant in any city, but there were different patterns: women had higher seroprevalence than men in Sydney and Adelaide, similar seroprevalence to men in Melbourne, and lower seroprevalence than men in Perth.

Table 4 shows differences in hepatitis B by treatment status. Overall, 26.5% of those in-treatment and 22.7% of those not-in-treatment were seropositive. Seroprevalence for those currently in-treatment in Sydney was significantly higher than those in-treatment in Adelaide and Melbourne. There were no significant city differences among those not-in-treatment. Seroprevalence in all cities was higher among those in- than those not-in-treatment but this difference was only significant in Perth and Sydney.

Hepatitis C seroprevalence

Table 3 shows that the overall hepatitis C age-standardized seroprevalence was 60.2%. Seroprevalence in the Sydney group was significantly higher than that in the other cities, but the other

Table 2. HIV prevalences and confidence intervals, by city and by gender

City	Men	95% CI	Women	95% CI	Total	95% CI
Adelaide	2.4	1.0–3.8	1.3	0.0–2.6	2.0	1.0–3.0
Melbourne	3.2	1.6–4.8	0.0	NA	2.0	1.0–3.0
Perth	2.1	0.9–3.3	1.4	0.0–2.8	1.9	1.0–2.8
Sydney	8.0	5.7–10.3	2.8	0.8–4.8	6.6	4.9–8.3
National	3.9	3.1–4.7	1.4	0.7–2.1	3.1	2.5–3.7

Table 3. Age-standardized hepatitis C and B prevalences and confidence intervals, by city

City	HBV	95% CI	HCV	95% CI
Adelaide	20.8	17.9–23.7	52.2	48.8–55.8
Melbourne	18.6	15.4–21.8	62.0	58.6–65.4
Perth	21.3	16.9–25.7	57.1	53.5–60.7
Sydney	26.6	23.1–30.1	69.6	66.3–72.9
National	23.3	21.6–25.0	60.2	58.5–61.9

city groups were not significantly different from each other.

Gender-based seroprevalences can be seen in Table 5. Overall male seroprevalence was 59.4% and female seroprevalence 58.6%. There were different gender-based patterns of hepatitis C seroprevalence: in Sydney, Adelaide and Perth, men were more likely to be seropositive than women, while in Melbourne women were (slightly) more likely to be seropositive than men. Among men, seroprevalence in Sydney was significantly higher than in other

cities, while women in Melbourne and Sydney were significantly more likely to be seropositive than those in Adelaide and Perth. Differences between men and women were only significant in Perth.

There were significant national and between-city hepatitis C seroprevalence differences between those in- and not-in-treatment. Nationally, 68.3% (CI 65.9, 70.7) of those in treatment were seropositive compared to 50.4% (CI 47.9, 52.9) of those not-in-treatment. Treatment status differences within cities are shown in Fig. 2. Figure 2 shows that treatment

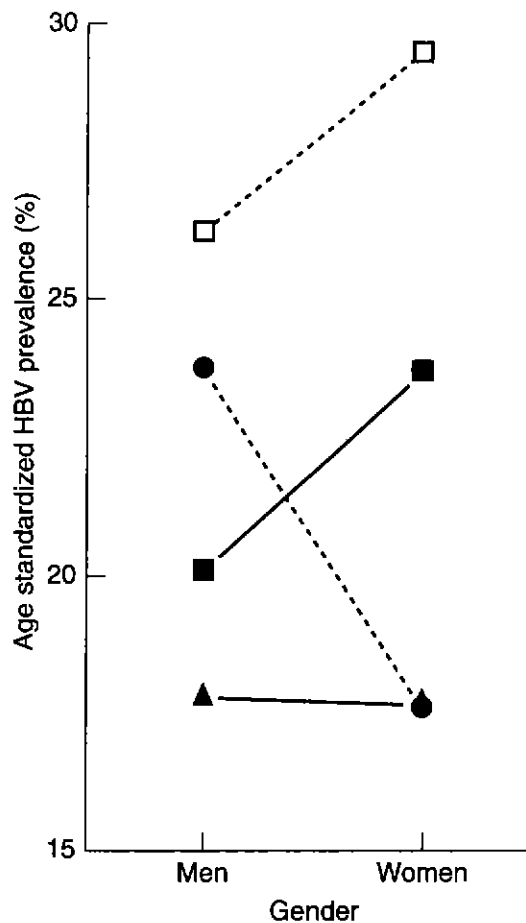


Fig. 1. Age-standardized hepatitis B prevalence, by city and by gender. ■, Adelaide; ▲, Melbourne; ●, Perth; □, Sydney.

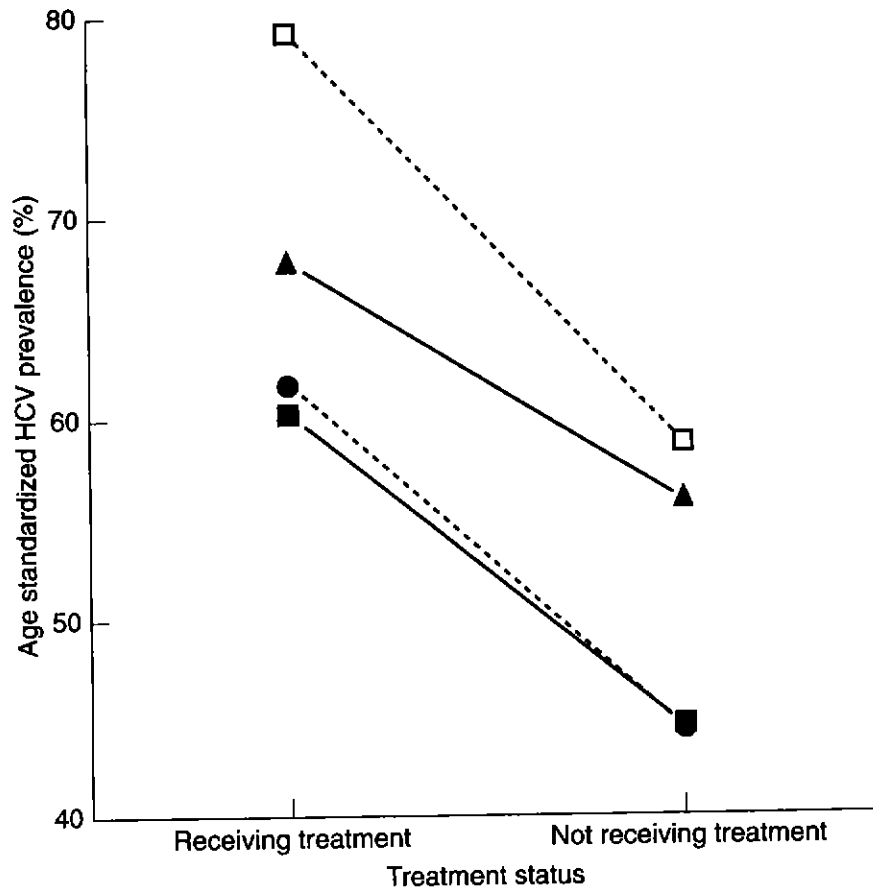


Fig. 2. Age-standardized hepatitis C prevalence, by city and by treatment status. ■, Adelaide; ▲, Melbourne; ●, Perth; □, Sydney.

of the serology tests was less than 100%, since confirmatory tests could not be carried out, there is no reason to suppose that this would vary between cities. Possible explanations for demonstrated differences between cities include differences in confounding variables, such as age, gender, sexual preference and/or treatment status; intrinsic differences in rates of risk behaviour; or period/cohort effects. These possibilities are considered below.

The first possibility is that underlying city differences in demographic and drug use variables account for much of the seroprevalence differences. There were city differences in respondents' age, treatment status and sexual orientation, but no gender differences, and other demographic differences (schooling and employment) may have been associated with treatment status differences.

Age was controlled in the hepatitis B and hepatitis C seroprevalence analyses because infection had earlier been found to be strongly associated with duration of injecting [5], which is obviously correlated with age. HIV, on the other hand, was not found to be associated with age or duration, so it seems unlikely that underlying age differences

would have affected the outcome of the HIV analysis.

Exposure to hepatitis C has been found to be related to treatment status among IDUs [6] and hepatitis B seropositivity was earlier found in this study to be associated with having ever been in treatment, particularly among older respondents [5]. The increased risk of hepatitis B and hepatitis C which was found among Sydney respondents was not, however, primarily related to the greater proportion of Sydney respondents being in treatment: hepatitis B and C seroprevalences were also higher in Sydney than in other cities among those who were not receiving treatment.

Hepatitis B and C seroprevalence gender differences were complex and similarity in gender distributions across the cities makes them more difficult to explain. The greater likelihood of Sydney women to have been in treatment may partly explain their higher hepatitis B and C rates, but the explanation does not hold for Sydney men who were no more likely to be in treatment than other men. Moreover, there are non-Sydney differences that are not easily explained and bear further investigation, particularly

Table 4. Age-standardized hepatitis B prevalences and confidence intervals, by city and by treatment

City	In-treatment	95% CI	Not-in-treatment	95% CI
Adelaide	22.7	18.5–26.9	17.9	14.1–26.9
Melbourne	20.1	15.2–25.0	16.5	12.3–20.7
Perth	26.5	18.6–34.4	11.1	6.9–15.3
Sydney	32.0	27.2–36.8	17.5	12.9–22.1
National	26.5	23.9–29.1	17.8	15.6–20.0

status seroprevalence patterns and rates were very similar in Adelaide and Perth. In-treatment respondents in Melbourne and Sydney were significantly more likely to be seropositive than those in-treatment in Adelaide or Perth, while among those not-in-treatment, Sydney respondents were significantly more likely to be seropositive than those in the other cities. Seroprevalence differences between those in- and not-in-treatment were significant in all cities.

Seroprevalences for those not-in-treatment were similar in Melbourne and Sydney, but respondents in-treatment in Sydney were more likely to have been exposed than those in-treatment in Melbourne, Adelaide and Perth.

Discussion

The patterns of exposure to HIV, hepatitis C and hepatitis B found in this study can be summarized as follows:

- (1) *HIV*. Those who were most likely to be HIV seropositive were non-heterosexual men, especially those living in Sydney.
- (2) *Hepatitis B*. While there were no major gender differences between cities patterns of

infection varied, with women in Adelaide and Sydney being more likely to be hepatitis B seropositive than men in the same cities, and Perth men being more likely to be hepatitis B seropositive than Perth women. Those receiving treatment were more likely to be hepatitis B seropositive if they lived in Sydney than in the other cities, and those not receiving treatment were more likely to be hepatitis B seropositive if they lived in Perth or Sydney than in Adelaide or Melbourne.

- (3) *Hepatitis C*. There were different patterns of gender-based seropositivity. Sydney men had higher hepatitis C seroprevalence than other men, and Sydney and Melbourne women had higher hepatitis C seroprevalence than other women. Across the cities, those receiving treatment were more likely to be hepatitis C seropositive than those not receiving treatment, but Sydney respondents in both treatment and non-treatment groups were more likely to be hepatitis C seropositive than in all other cities.

The essential question of this paper is whether the underlying seroprevalence for all three viruses among IDU was the same in all cities. While the specificity

Table 5. Age-standardized hepatitis C prevalences and confidence intervals, by city and by gender

City	Men	95% CI	Women	95% CI
Adelaide	54.4	50.0–58.8	51.3	45.5–57.1
Melbourne	61.1	56.7–65.5	63.3	57.8–68.8
Perth	56.4	52.0–60.8	44.1	37.5–50.7
Sydney	73.1	69.2–77.0	68.4	62.8–74.0
National	59.4	57.2–61.6	58.6	55.6–61.6

the influence of sexual preference on hepatitis B and hepatitis C seroprevalence among female IDU in Melbourne.

HIV seroprevalence was clearly related to self-reported sexual identity among men. There were more non-heterosexual men among the Sydney group and it seems likely that some of the between-city HIV differences, particularly the very high rate among Sydney men, was related to this.

The discussion of between-city differences in demographic and drug use variables thus suggests that although such differences existed they were unlikely to have accounted for all the between-city variation in seroprevalences. This issue is explored further using multivariate analysis in Part II.

The second possibility is that there were underlying city differences in rates of risk behaviour (needle-sharing or unsafe sex) which can account for differences in seroprevalences. There were no evidence in the preliminary analysis that any such differences existed [5]. However, past behaviour is clearly implicated in seroprevalence and that was not examined in this study, so the possibility awaits further investigation.

Finally, the possibility exists that there were period/cohort effects such that the pattern of seroprevalence was the same in all four cities, but lags in the timing of the epidemic in different cities accounted for apparent differences when cross-sectional data were gathered. While this remains a distinct possibility for HIV, particularly in terms of Sydney where the epidemic was first observed in Australia, it seems unlikely to have been influential for hepatitis B and C, which have both been in the community for at least 20 years [12].

Clearly, some of these questions can not be answered with the data from this study. It can be said, however, that analyses such as these are useful in that they reveal that national figures can mask major differences between geographically distinct areas. From this evidence, it appears likely that there is a larger pool of infection of all three viruses among IDUs in Sydney than in the other cities although, for HIV, only among non-heterosexual male IDUs. The implication of these data are that, given the differences in seroprevalence across the country, prevention and health education programmes need to be tailored to the local environment as well as developed nationally.

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