Sentinel surveillance of HIV and hepatitis C virus in two urban emergency departments

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ABSTRACT

Objectives: This study was designed to determine the prevalence of HIV and hepatitis C virus (HCV) in a specific population, and to distinguish between known and previously unrecognized infections in the emergency department (ED) setting.

Methods: Consecutive patients aged 15 to 54 years who had presented to the EDs of 2 urban hospitals during a 6-week period were enrolled in a prospective cross-sectional study if a complete blood count had been obtained as part of their care. The study patients were initially cross-referenced against local databases of known HIV and HCV seropositive patients**.** After removal of all personal identifiers, the study patients' leftover blood was serotested for HIV and HCV, and seroprevalences were calculated. Univariate and multivariate analyses were performed to identify factors associated with HIV and HCV infection.

Results: Of 3057 individuals whose files were analyzed, 1457 (48%) were male and 7% (213) were Aboriginal. Overall, 302 patients (10%; 95% confidence interval [CI], 9%–11%) were seropositive for HCV and, of these, only 132 (44%) were previously known to be. HCV seropositivity was associated with Aboriginal status, age, male gender, hospital site and HIV infection (all $p < 0.001$). In contrast, 39 patients (1%; 95% CI, 1%–2%) were HIV seropositive. Of these, 32 (82%) were previously known to be HIV positive, and 27 (69%) were HCV seropositive. HIV seropositivity was only associated with HCV infection ($p < 0.001$).

Conclusions: The rate of previously undetected infections was relatively low for HIV but high for HCV. Emergency physicians in urban settings will frequently encounter patients not known to be HCV positive and not identified as such. These results emphasize the need for more effective preventive measures in the community and the importance of observing standard (universal) precautions in ED practice.

Key words: seroprevalence, HIV, hepatitis C, emergency department, surveillance

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RÉSUMÉ

Objectifs : La présente étude fut conçue dans le but de déterminer la prévalence des virus du VIH et de l'hépatite C (VHC) au sein d'une population spécifique et de faire la distinction entre des infections connues et non reconnues antérieurement dans le cadre du département d'urgence (DU).

Méthodes : Des patients consécutifs âgés entre 15 et 54 ans s'étant présentés au DU de deux hôpitaux urbains au cours d'une période de six semaines furent inclus dans une étude transversale prospective si une formule sanguine avait été obtenue dans le cadre de leurs soins. Les patients de l'étude furent tout d'abord soumis à un renvoi interne avec les banques de données locales sur les patients séropositifs pour le VIH et VHC connus. Après avoir retiré tous les identificateurs personnels, le reste du sang des patients de l'étude fut soumis à une épreuve de dépistage du VIH et du VHC, et les séroprévalences furent calculées. Des analyses multivariables et à une variable furent effectuées pour identifier les facteurs associés à l'infection par le VIH et le VHC.

Résultats : Parmi 3 057 individus dont les dossiers furent analysés, 1 457 (48 %) étaient de sexe masculin, et 7 % (213) étaient d'origine autochtone. Dans l'ensemble, 302 patients (10 %; intervalle de confiance [IC] 95 %, 9 %–11 %) étaient séropositifs pour le VHC et parmi ceux-ci, la séropositivité était déjà connue chez seulement 132 (44 %). La séropositivité pour le VHC était associée au statut autochtone, à l'âge, au sexe masculin, à l'emplacement de l'hôpital et à l'infection par le VIH ($p < 0{,}001$). En revanche, 39 patients (1 %; IC 95 %, 1 %–2 %) était séropositifs pour le VIH. Parmi ceux-ci, la séropositivité était déjà connue dans 32 (82 %) des cas et 27 (69 %) étaient séropositifs pour le VHC. La séropositivé pour le VIH était uniquement associée avec l'infection par le VHC ($p < 0{,}001$).

Conclusion : Le taux d'infections non décelées était relativement faible pour le VIH mais élevé pour le VHC. Les médecins d'urgence en milieu urbain rencontreront souvent des patients dont le statut séropositif pour le VHC est inconnu et non identifié. Les résultats de la présente étude font ressortir le besoin de mesures préventives plus efficaces au sein de la communauté et l'importance d'observer des précautions uniformisées (universelles) dans la pratiques au DU.

Background

A striking characteristic of the HIV epidemic has been the variation in epidemiology between countries, between communities within a region, and over time.[1] Local surveillance is critical to enable an effective response to the epidemic, with appropriate targeting of prevention and resources. Surveillance methods must be sensitive to changes in transmission patterns and the emergence of HIV infection in new population groups. Existing routine surveillance measures for HIV infection have many limitations, including the voluntary nature of the testing and the absence of ethnic information. Because HCV and HIV coinfections are common and their route of transmission is often similar, new approaches to surveillance should include both diseases.

HCV infection is a leading cause of hepatic failure, liver transplantation and liver-related death in North America.[2] HCV is also strongly associated with injection drug use (IDU) and can be considered a surrogate marker of IDU.[3,4] Finally, the risk of exposure to bloodborne pathogens is often high[5] among emergency department (ED) staff,[6,7] where intravenous access, emergency operative interventions, and other procedures are regularly performed on sick and injured patients, frequently under difficult circumstances.

Since the late 1980s, the demographics of HIV infection have changed in western Canada. For example, the city of Vancouver now has the highest documented incidence of HIV infection of any community in North America,[8] and HIV is becoming increasingly common in historically lower-risk areas. In the past, newly identified infections in northern Alberta were mainly attributable to gay or bisexual sex, whereas most are now attributable to IDU. An increasing proportion of newly diagnosed HIV-infected individuals are inner city residents — many with chronic psychiatric illness or Aboriginal status. Because these populations are less likely to receive coordinated primary and preventive medical care, standard community surveillance methods may not provide an accurate picture of HIV and HCV transmission trends. EDs are often the main source of medical contact for individuals with chaotic lifestyles and have been recognized as useful "sentinel" sites for HIV seroprevalence surveillance.[6,7,9] To identify individuals at high risk for HIV and HCV transmission who might not be reached in any other way, the EDs of Edmonton's 2 main hospitals were selected as sites for bloodborne pathogen surveillance.

Our objectives were to estimate HIV and HCV seroprevalence in 2 urban EDs, describe the demographics of those infected, and determine the proportion of patients

whose diagnosis was previously unknown. This information will enhance our understanding of evolving HIV and HCV epidemiology and help quantify the potential risk of occupational infection in an ED setting.

Methods

Setting

Edmonton, a city of 870 000 people (1996 Census data), has 6 acute care hospitals and provides tertiary referral services to patients from the northern half of Alberta. One group of infectious diseases physicians runs the HIV/HCV clinic in Edmonton and provides almost all HIV care in northern Alberta. The Northern Alberta Provincial Laboratory of Public Health performs all clinical HIV and HCV serological testing for northern Alberta, and antiretroviral drugs are provided at no cost to appropriate patients through a provincial government program. The 2 hospitals that participated in the present study are the 2 largest and highest acuity hospitals in the region (Table 1). At the time of the study, Hospital 1 was the major site of HIV care and Hospital 2 was an inner city community hospital without an organized HIV program.

Patient records

Consecutive patients aged 15–54 years (chosen because this age group exhibits high-risk behaviours for developing HIV/HCV) who presented to the ED of either hospital during a 6-week period in June and July of 1998 were eligible if a complete blood count (CBC) was obtained as part of their care. We excluded repeat samples from the same patient and samples with insufficient residual blood for analysis. Age (5-year categorical), gender, day of presentation, hospital site, and primary ED diagnosis category (medicine, surgery, trauma, obstetrics/gynecology, psychiatry) were extracted from the hospital computer record by the research coordinator. Specific injury mechanism (i.e., E codes [external cause of injury]) were recorded where applicable, and Aboriginal status was determined using 1 of 3 methods: 1) self-declaration, as recorded in a hospital database; 2) based on the presentation of a treaty status card (certification of Aboriginal status); or 3) from routine registration information. Data on other ethnic backgrounds were not systematically collected at the time of the study.

Database cross-referencing

Before unlinking and serologic testing, the research coordinator (L.M.) used patient name, gender and birthdate to cross-check all enrolled patients against a database of patients receiving care from the Division of Infectious Diseases, University of Alberta. Because viral load testing and antiretroviral drugs are only accessible through this group, the database contains most HIV-infected individuals receiving care in northern Alberta. The Northern Alberta Provincial Laboratory database was used to identify other known HIV and HCV cases. In addition to searching these clinical and laboratory databases, we reviewed the ED records of the study subjects to determine whether information about HCV or HIV status had been recorded in the chart.

Unlinking

All personal identifiers were removed from the study database, and only the following information was retained with each plasma sample: demographics, hospital site, ED admission category and outcome, Aboriginal status, prior knowledge of serology status from the laboratory and clinical databases, and disclosure of serology status in the ED.

Laboratory methods for anti-HIV and anti-HCV testing

Plasma samples were identified and marked with a unique study number. Serology testing was performed after permanent unlinking of the specimen from any personal identifiers. All samples, except those from patients previously known to be seropositive, were pooled in batches of 10 for anti-HIV screening and batches 5 for anti-HCV screening.

Table 1. Characteristics of the 2 study hospitals and their patient populations

Characteristic	Hospital 1	Hospital 2
No. of ED visits per year	61 206	87 282
No. of inpatient beds	566	517
No. of admissions per year (and % from ED)	23 447 (19)	28 196 (12)
Median household income, $*	52 336	32 032
Ethnic origin, %		
White	82	55
Aboriginal	2	11
Oriental	10	10
East Indian	3	1
Other Asian	1	12
Black	1	3
Other	1	8
< High school education, %	11	31
Total no. of patients aged 15–54 assessed in the ED during study period	6 777	10 289

*Based on a 1-mile radius around each hospital (1996 Statistics Canada Census data). ED = emergency department

Anti-HIV screening was performed using DETECT-HIV (BioChem ImmunoSystems, Inc., Montréal, Canada). Anti-HCV screening was performed using the UBI HCV EIA 4.0 (United Biomedical, Inc., Organon Teknika Inc., Boxstel, Netherlands). The sensitivity and specificity of pooled testing for anti-HIV and anti-HCV using these commercial kits has previously been studied, and their use has been validated.[8,10] All specimens in pools found to be non-reactive were reported as negative. Pools found to be reactive on screening were broken down, and individual samples re-screened. Samples reactive for anti-HIV on the initial screen were studied further using a second enzyme immunoassay (EIA), Abbott AXSYM HIVI/HIV2 (Abbott Laboratories Ltd., Abbott Park, Ill.) and a Western blot assay (BIORAD Novapath HIV-1 Immunoblot, BioRad Laboratories, Hercules, Calif.). Specimens were reported as negative, indeterminate or positive, based on the presence and intensity of specific bands on the Western blot according to standard criteria.[11] Indeterminate specimens were tested further using a "detuned" enzyme immunoassay used to detect early HIV-1 infection by the National HIV reference laboratory (Laboratory Centre for Disease Control, Ottawa, Canada).[12]

Samples reactive on initial anti-HCV screening were retested using a microparticle EIA, AXSYM, HCV 3.0 (Abbott Laboratories Ltd., Abbott Park, Ill.). This dual EIA algorithm, using specific optical density cut-off values above the manufacturer's suggested cut-off values for identification of positive samples, has been demonstrated to have high sensitivity and specificity relative to the immunoblot.[10] Samples demonstrating discrepant or low positive results in the dual EIA algorithm were tested by immunoblot (Liatek HCV 10, Organon Teknika Inc., Boxstel, Netherlands). Specimens were reported as negative, indeterminate, or positive for anti-HCV after proceeding through this algorithm.

Sample size

Based on an estimate of HIV seroprevalence of 1%, a sample of 1500 patients from each site would provide a level of precision of 0.5% with 95% confidence surrounding the estimate of seroprevalence.

Data analysis and statistics

Data were analyzed using SPSS-PC statistical software (SPSS, Inc.; Chicago). Categorical values are reported as counts and percentages (%), and compared using chi-squared statistics. Because of the number of statistical tests performed, a standard $p < 0.01$ was used to identify statistically significant secondary results. Independent variables that had adequate univariate correlation ($p < 0.10$) with HIV or HCV seropositivity were considered in logistic regression model development. All candidate variables were considered plausible factors. Backwards elimination, Wald statistics, and the likelihood ratio statistics were used to assess the fit of the model.

Ethics

This study protocol was approved by the Ethics Review Board of the University of Alberta. Previously published Canadian[13] and WHO[14] guidelines for anonymous unlinked serologic testing were followed in the design and implementation of the study. Extensive informal communications with representatives of the inner city and Aboriginal communities took place prior to study initiation in order to learn their concerns, particularly in regard to the potential for stigmatization due to reporting of the study results. Posters announcing and describing the study were displayed prominently in the 2 participating EDs during the study period. Each poster contained information concerning local sites for counselling and HIV testing. A mechanism was established whereby any patient who requested to be excluded from the study would have his or her specimen identified and discarded.

Results

Table 1 shows that, during the study period, 6777 patients aged 15 to 54 were assessed at Hospital 1 and 10 289 were assessed at Hospital 2 (total $n = 17\,066$). The study patients were less often injured (odds ratio [OR] 0.54, 95% confidence interval [CI] 49–59), less often male (OR 0.77, 95% CI 0.71–0.84) and generally younger ($p < 0.001$) than other patients seen in the 2 EDs over the same period.

Sample collection

Overall, 4424 samples were obtained and 3057 patients were eligible. Of these, 1367 samples were excluded: 499 (11%) because of insufficient remaining blood quantity, 212 (5%) because they were duplicate samples and 656 (15%) for a variety of reasons, including sample hemolysis, location, age or date exclusion criteria, and labelling error. No patient requested exclusion from the study.

Demographics

Table 2 shows that type of visit and patient characteristics (apart from ethnic origin) were similar between hospitals. Gender was proportionally represented (males: 48%), as were 10-year age groups; only 7% of subjects were identified as Aboriginal. Medical diagnoses accounted for 72%

of subjects, and injury was the reason for presentation in 21% of the cases. Weekend visits accounted for 41% of patients studied.

HIV prevalence

Initial testing identified 37 seropositive HIV patients. Two other samples demonstrated a Western blot banding pattern indicative of acute seroconversion. These samples were reactive in the sensitive EIA but non-reactive in the "detuned" assay, confirming that infection was likely to have been acquired within the previous 129 days.[12] These 2 patients were considered to be positive; therefore, a total of 39 ED attendees (1.3%, 95% CI 1%–2%) were considered HIV seropositive. Table 3 shows that 32 (82%) of the 39 seropositive cases were previously known. Based on chart review, 24 (75%) of 32 patients with known HIV infection informed health care workers of their HIV status while in the ED. One patient who self-identified as HIV-infected in the ED was, in fact, seronegative. In multivariable analyses, factors associated with HIV status were HCV status (OR 4.7, 95% CI 3.4–6.7) and non-injury presentation (OR for injury 0.41, 95% CI 0.20–0.87).

HIV/HCV interactions

Twenty-seven (69%) of identified HIV-seropositive patients were also HCV seropositive, including both acute seroconverters and 2 of the 5 not previously known to be HIV positive. When compared with HCV seronegative patients, those with evidence of both infections were younger ($p = 0.02$). However, among the HIV-infected, the HCV-seronegative and HCV-seropositive groups were similar in all other respects.

HCV prevalence

Table 4 shows that 302 subjects (9.8%, 95% CI 9%–11%) were seropositive for HCV, including 7.9% at Hospital 1 and 12.2% at Hospital 2 ($p < 0.0001$). Six samples were indeterminate, and these were considered negative in the analysis. Among self-identified Aboriginal patients, 72 (24%) were HCV seropositive.

Only 130 (43%) of HCV seropositive subjects were previously known to the laboratory and, of these, only 73 (24%) declared their status in the ED. Eleven patient charts described positive HCV status, yet these patients were seronegative on testing. We could not investigate

Table 2. Study subjects' characteristics and viral status

Characteristic	No. of patients (and %) Hospital 1 *n* = 1654	Hospital 2 *n* = 1403	Total no. (and %; 95% CI)
Male gender	842 (51)	615 (44)	1457 (48; 46–49)
Age, yr			
15–19	168 (10)	128 (9)	296 (10; 9–11)
20–24	200 (12)	190 (14)	390 (13; 12–14)
25–29	219 (13)	197 (14)	416 (14; 13–15)
30–34	214 (13)	198 (14)	412 (14; 13–15)
35–39	230 (14)	211 (15)	441 (14; 13–15)
40–44	236 (14)	178 (13)	414 (14; 13–15)
45–49	189 (11)	165 (12)	354 (12; 11–13)
50–54	198 (12)	136 (10)	334 (11; 10–12)
Aboriginal	58 (3.5)	155 (11)	213 (7; 6–8)
Weekend visit	685 (41)	567 (40)	1252 (41; 39–43)
Diagnosis category			
Medicine	1166 (71)	1027 (73)	2193 (72; 70–73)
Surgery	273 (17)	165 (12)	438 (14; 12–16)
Psychiatry	30 (2)	32 (2)	62 (2; 1–3)
Trauma	156 (9)	62 (4)	218 (7; 6–8)
Ob/Gyn	29 (2)	117 (8)	146 (5; 4–6)
E code (yes)	386 (23)	257 (18)	643 (21; 20–23)
Previously known HIV	19 (1)	13 (1)	32 (1; 1–2)
Previously known HCV	55 (2)	77 (5)	132 (4; 4–5)
HIV seropositive	22 (1.3)	17 (1.2)	39 (1.3; 1–2)
HCV seropositive	131 (7.9)	171 (12.2)	302 (9.9; 9–11)

CI = confidence interval; E code = external cause of injury; HCV = hepatitis C virus

this finding due to the unlinked nature of the study.

Multivariate modelling (Table 5) demonstrated that HCV was associated with age groups of 25–34, 35–44, 44+ known HIV seropositivity, Aboriginal status, male gender, injury and being a patient at Hospital 2.

Discussion

This is the first ED-based study of HIV/HCV seroprevalence in Canada. Our data showed that HIV seroprevalence was 1.3%, which is lower than reported in US centres.[5–7] As demonstrated in a prior ED study[6] most seropositive HIV patients had a previously documented diagnosis, and most patients disclosed their status on presentation. Conversely, HCV seroprevalence was nearly 10%, high for a population of patients not selected on the basis of HCV risk. Most of these infections had not been previously identified, and known HCV patients were less likely to disclose their condition. Thus, unsuspected HCV infection is common in our EDs and represents a potential reservoir for occupational bloodborne virus exposure.

Previous seroprevalence studies in northern Alberta have been limited to a sexually transmitted disease clinic population (HIV = 1.5%, HCV = 3.4%),[15] a small sample of needle-exchange users (HIV prevalence = 8%, but known seropositive individuals were believed to have excluded themselves),[16] and in a provincial antenatal testing program (0.03%, 1999–2000) (J.P.: unpublished data).

EDs often serve as the main source of primary care for people with chaotic lifestyles who may be at high risk for HIV infection. They are also the usual site of care for IDU-related problems such as drug overdose, trauma, injection-related abscesses, sepsis, pneumonia and other infectious diseases. The relatively high rate of both infections observed in this study supports the value of the ED as a sentinel surveillance site.

The proportion of HIV-infected patients who were not previously identified as seropositive in either the clinical or laboratory databases was less than 20% of all HIV seropositive patients identified. This suggests that health care providers have been reasonably successful in reaching this population, identifying people at risk and promoting HIV testing. Alternatively, it is possible that we were not entirely successful in reaching the population at highest

Table 3. Characteristics of HIV seropositive and seronegative study subjects

Characteristic	No. (and %) of subjects	
	HIV seropositive *n* = 39	HIV seronegative *n* = 3018
Male gender	26 (67)	1431 (47)
Age, yr		
15–24	3 (8)	683 (23)
25–34	16 (41)	811 (27)
35–44	16 (41)	838 (28)
45–54	4 (10)	683 (23)
Aboriginal	6 (15)	207 (7)
Seen at Hospital 2	17 (44)	1386 (46)
Weekend visit	14 (36)	1238 (41)
Diagnosis category		
Medicine	34 (87)	2159 (72)
Surgery	1 (3)	439 (15)
Psychiatry	1 (3)	61 (2)
Trauma	3 (8)	215 (7)
Ob/Gyn	0 (0)	146 (5)
E code (yes)	4 (10)	639 (21)
Prior HCV diagnosis	20 (51)	18 (1)
Prior HIV diagnosis	32 (86)*	0 (0)
Declared HCV or HIV status in ED	24 (75)†	60 (2)
HCV seropositive	27 (69)	275 (9)

*Denominator based on 37 patients who could have known their HIV status prior to the ED visit (see further explanation in Results, subsection "HIV prevalence").
†Denominator based on 32 known cases.

Table 4. Characteristics of HCV seropositive and seronegative study subjects

Characteristic	No. (and %) of subjects	
	HCV seropositive *n* = 302	HCV seronegative *n* = 2755
Male gender	179 (59)	1278 (47)
Age, yr		
15–24	16 (5)	670 (23)
25–34	92 (30)	736 (27)
35–44	131 (43)	724 (26)
45–54	63 (21)	625 (23)
Aboriginal	72 (24)	141 (5)
Seen at Hospital 2	171 (57)	1232 (45)
Weekend visit	123 (41)	1129 (41)
Diagnosis category		
Medicine	225 (74)	1968 (71)
Surgery	7 (2)	139 (5)
Psychiatry	32 (11)	186 (7)
Trauma	28 (9)	410 (15)
Ob/Gyn	10 (3)	52 (2)
E code (yes)	81 (27)	562 (33)
Prior HCV diagnosis	130 (43)	2 (1)
Prior HIV diagnosis	24 (8)	8 (<1)
Declared HCV or HIV status in ED	73 (24)	11 (<1)
HIV seropositive	27 (9)	12 (<1)

E code = external cause of injury; ED = emergency department

risk. Future studies in other high-risk sentinel sites (e.g., correctional institutions, needle exchange programs) should be considered in order to monitor the epidemic in these communities. Finally, the high prevalence of HCV among patients who test positive for HIV suggests the importance of IDU in the evolving HIV epidemic.

HCV prevalence in this ED sample was 10% — much higher than the 0.8% estimated for the general Canadian population[17] and the 1.8% reported in a large US sample.[18] In contrast to the patients who tested positive for HIV, most patients with HCV were not known locally, and it is likely that most were unaware of their infection. Moreover, many patients who could have known of their HCV status did not self-identify to health care workers. Finally, some patients were identified as HCV positive in the ED charts, but had negative HCV serology. This misapprehension involved a small number of patients and may represent an assumption among people in certain groups that they are likely to have HCV.

Our data raise concerns that HCV infection may be more common than previously recognized. These results have implications for future health care because they may herald increasing rates of liver disease. They also indicate that HCV infection remains substantially under-recognized by health care providers. Finally, since IDU is the major route of acquisition of HCV,[2] the proportion of the population using injection drugs could be larger than previously estimated.

Despite Aboriginal people representing about 6% of the population in our region, they have accounted for 25% to 33% of newly diagnosed cases of HIV in recent years.[19] In this study, the prevalence of HCV (34%) among identified Aboriginal people was higher than in the overall ED population, probably reflecting higher rates of IDU. Although the difference in HIV prevalence (2.8% v. 1.2%) between Aboriginal and non-Aboriginal ED attendees is small, the evidence for IDU behaviour is consistent with an increased present and future risk of HIV transmission.

Table 5. Multivariable modelling of factors associated with positive hepatitis C status

Factor	Adjusted OR (and 95% CI)
Age	
15–19	1.0 (–)
25–34	4.5 (2.6–7.9)
35–44	7.4 (4.4–12.7)
44+	4.6 (2.6–8.1)
Male gender	1.2 (1.1–1.4)
Seen at Hospital 2	1.2 (1.1–1.4)
Injury	1.3 (1.0–1.6)
Aboriginal	3.4 (2.7–4.4)
HIV seropositive	4.7 (3.3–6.9)

OR = odds ratio; CI = confidence interval

These findings indicate that there are high rates of bloodborne infections in patients presenting to the ED, and this increases the risk for ED staff, specifically when they are treating patients in whom there is an opportunity for blood exposure (e.g., drawing of blood, performance of procedures, trauma). Although some characteristics associated with HIV and HCV were identified, they do not provide criteria that reliably identify infected patients. These findings provide powerful support for the consistent implementation of standard (universal) precautions and for increased utilization of engineering controls and safer devices to prevent occupational exposures in the ED setting.

Limitations

Study entry required a clinical indication for CBC testing; therefore the study sample does not reflect the local population or overall ED population. Rather, it probably reflects a sicker subset that (based on the need for testing) poses a greater risk of blood and body fluid exposure to health care workers.

Second, the proportion of patients with previously documented HIV/HCV status could have been underestimated if subjects used an alias at previous testing or were tested at an anonymous testing site. However, positive results from anonymous testing are uncommon in this setting and are not likely to have had any impact on the findings.

Third, the identification of Aboriginal status was of uncertain reliability. Due to the system of identification, misclassification was likely in the direction of under-recognition of Aboriginal status. Further, our findings are more reflective of the urban, inner city Aboriginal population than of people living in more rural, traditional Aboriginal communities.

Strengths

The study has several strengths. The anonymous unlinked methodology avoids the bias associated with volunteer sampling,[20] and the use of local clinical and laboratory databases provided a unique opportunity to distinguish between previously known and unknown HIV infections. Correlating HCV and HIV results provided insight into the role of IDU in those with HIV infection. Finally, the serologic testing employed well-validated methodology while reducing testing costs through pooling of specimens.

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