

# Prevalence of HIV infection and acceptability of point-of-care testing in a Canadian inner-city emergency department

Rob Stenstrom, MD, PhD,<sup>1-4</sup> Daphne Ling, PhD,<sup>4,5</sup> Eric Grafstein, MD,<sup>1,2,4,6</sup> Rolando Barrios, MD, MPH,<sup>2,3,7,8</sup> Chris Sherlock, MBBS,<sup>9,10</sup> Reka Gustafson, MD, MPH,<sup>3,6</sup> Farzaneh Osati, PhD,<sup>2</sup> Iraj Poureslami, PhD,<sup>2</sup> Aslam Anis, PhD<sup>2-4,11</sup>

## ABSTRACT

**OBJECTIVES:** The objective of this study was to estimate the seroprevalence of HIV infection and the acceptability of point-of-care HIV testing in an inner-city Canadian emergency department.

**METHODS:** We conducted a prospective cohort study in an urban tertiary care emergency department between August 2009 and January 2011. Randomly selected patients were enrolled using probabilistic sampling based on patient volumes. Inclusion criteria were age 19–75 years and ability to provide informed consent. Patients who were intoxicated or in extremis were excluded. After informed consent and brief pre-test counselling, participants' HIV status was obtained using the INSTI HIV-1/HIV-2 Antibody Test. Participants completed a questionnaire on HIV risk behaviours and satisfaction with emergency department HIV testing. Participants with a positive result or those having other blood tests received confirmatory Western blot testing. HIV-positive participants were offered immediate referral to an HIV specialty clinic.

**RESULTS:** A total of 2,077 patients were approached, and 1,402 (67.5%) agreed to participate. Participants' mean age was 43.3 years, and 58.4% of participants were male. The HIV antibody seroprevalence based on the point-of-care test was 65/1,402 (4.6%; 95% confidence interval: 3.5%–5.8%). No new diagnoses of HIV were identified in our cohort. Patient satisfaction with point-of-care HIV testing was high (mean satisfaction score 9.6/10).

**CONCLUSION:** On the basis of a rapid, point-of-care HIV antibody test, the seroprevalence rate of HIV in an inner city emergency department was 4.6%. Point-of-care testing in the emergency department is acceptable, and patients' satisfaction with the testing procedure was high.

**KEY WORDS:** Diagnostic testing; emergency medicine; acceptability; HIV; point of care test

La traduction du résumé se trouve à la fin de l'article.

*Can J Public Health* 2016;107(3):e291–e295  
doi: 10.17269/CJPH.107.5318

Infection with human immunodeficiency virus (HIV) is a major public health concern. The Public Health Agency of Canada estimates that one out of five HIV infections remains undiagnosed.<sup>1</sup> In British Columbia (BC), approximately 11,700 individuals have been estimated to be infected with HIV, and over 2,000 individuals are HIV-positive but unaware of their status.<sup>1,2</sup> Timely diagnosis improves access to HIV treatment and lowers mortality.<sup>3</sup> The major focus of HIV prevention and control in Canada has been to promote the acceptance of risk-reducing behaviours through prevention counselling and to facilitate linkage to medical, prevention and other support services.<sup>1</sup> In BC, the provincial strategy of "Treatment as Prevention" has been implemented to better link HIV-positive individuals to antiretroviral therapy in order to reduce the population burden of HIV.<sup>4</sup>

Timely treatment of HIV-positive individuals improves their outcomes and has the potential to prevent further transmission of the virus.<sup>5</sup> Estimates of HIV prevalence in the Downtown Eastside of Vancouver have ranged from 20% to 30%, further highlighting the need for enhanced access to HIV testing in this area, where many people do not have primary care physicians.<sup>6</sup> For many residents who may be at high risk of HIV infection as a result of their risk-taking behaviours, the emergency department at

Saint Paul's Hospital is their only point of contact with the health care system. Thus, the emergency department is an ideal place for public health interventions.<sup>7</sup>

In 2006, the US Centers for Disease Control and Prevention (CDC) revised its guidelines to recommend routine opt-out HIV testing in all health care settings (where the expected prevalence is greater than 0.1%), including emergency departments, for earlier detection, treatment and linkage to care.<sup>8</sup> A drawback of

### Author Affiliations

1. Department of Emergency Medicine, University of British Columbia, Vancouver, BC
2. Providence Health Care, Vancouver, BC
3. School of Population and Public Health, University of British Columbia, Vancouver, BC
4. Centre for Health Evaluation and Outcome Sciences (CHÉOS), Vancouver, BC
5. Collaboration for Outcomes Research and Evaluation, Vancouver, BC
6. Vancouver Coastal Health, Vancouver, BC
7. Department of Infectious Diseases, University of British Columbia, Vancouver, BC
8. BC Centre for Excellence in HIV/AIDS, Vancouver, BC
9. Division of Medical Microbiology and Virology, Providence Health Care, Vancouver, BC
10. Pathology and Laboratory Medicine, University of British Columbia, Vancouver, BC
11. CIHR Canadian HIV Trials Network, Vancouver, BC

**Correspondence:** Dr. Rob Stenstrom, Department of Emergency Medicine, St. Paul's Hospital, 1081 Burrard Street, Vancouver, BC V6Z 1Y6, Tel: 604-806-8480, E-mail: robstenstrom@shaw.ca

**Funding:** The research was supported by a grant from the British Columbia Ministry of Health.

**Conflict of Interest:** None to declare.

## HIV PREVALENCE IN EMERGENCY DEPARTMENT

conventional HIV testing is the delay of days before the results are available, making routine screening a multi-visit approach. One study demonstrated that stepwise testing for HIV was associated with 31% of people with positive tests failing to return for the results.<sup>9</sup> Rapid point-of-care testing for HIV has considerable utility in the emergency department setting. These tests are as accurate as conventional methods (e.g., Western blot), with sensitivity and specificity reported to be >99%,<sup>10,11</sup> and provide results within minutes rather than days.<sup>7</sup> As a result, case-finding and prevention counselling can be completed in a single visit.

We conducted a prospective cohort study using a rapid point-of-care HIV test (INSTI™ HIV-1/HIV-2 Antibody Test; BioLytical Laboratories, Richmond, BC). Our objectives were to estimate the prevalence of HIV infection in an inner-city emergency department setting and evaluate the acceptability of point-of-care testing by assessing patient satisfaction with the testing procedure.

## METHODS

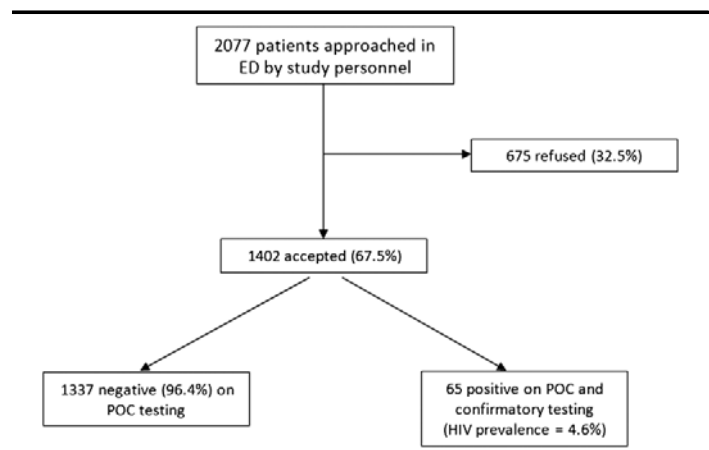
### Study sample

We conducted a prospective study from November 2009 to January 2011 to estimate the period prevalence of HIV infection among emergency department patients at Saint Paul's Hospital, an inner-city tertiary care hospital with over 70,000 patient visits per year and a high prevalence of patients with risk factors for HIV. Participants were randomly selected from all emergency department patients and recruited by research assistants who worked in pairs for eight-hour shifts. The shifts occurred from midnight to 0800, 0800–1600 and 1600 to 2400, seven days a week. Each shift was sampled in proportion to daily patient volumes. For example, historically 55% of patients arrive in the emergency department between the hours of 1600 and 2400; therefore, approximately 50%–60% of subjects were sampled from this time period. Similarly, 70% of patients are seen and treated on the “fast-track” section of our department and 30% on the acute side. The probabilistic sampling scheme reflected this distribution of patient volumes.

Potential subjects were recruited using an algorithm based on their arrival time in the emergency department. Two eligible patients were selected randomly using a random number generator for each one-hour arrival time period. If a potential subject was selected but refused, then another patient was chosen randomly. In the unlikely event that fewer than two eligible patients arrived in a given one-hour period, subjects were chosen from the preceding hour's arrival time. The inclusion criteria were patients between 19 and 75 years of age who were able to understand the consent form. All participants completed a consent form. Patients who were intoxicated, in extremis or critically ill, or had acute psychiatric illness were excluded. From our primary outcome of estimating HIV prevalence, we calculated that 1,250 subjects were required for a hypothesized prevalence of 3%, with a 95% confidence interval  $\pm 1\%$  around this estimate.

### Specimen collection

Blood specimens from a finger prick sample were obtained by trained research assistants who performed the INSTI™ HIV-1/HIV-2 Antibody Test. If patients did not want the confirmatory testing (which requires venipuncture) and would not otherwise



**Figure 1.** Patient flow of study sample recruited between August 2009 and January 2011 (ED, emergency department; POC, point-of-care)

undergo routine blood tests as part of their regular medical care, they would still be offered the point-of-care test. If the patient agreed to venipuncture, an emergency department laboratory phlebotomist took a second sample to be used for confirmatory testing, done using the standard HIV antibody (ELISA) and/or Western blot method of HIV detection for all positive point-of-care results. For negative test results, confirmatory testing was performed if the patient was undergoing routine blood testing. All participants received brief post-test counselling, including the explanation of the window period associated with HIV antibody testing and the need for follow-up testing, depending on their risk profile. Patients were asked to complete a questionnaire regarding HIV risk factors, perceived HIV status and satisfaction score with point-of-care testing (0–10 Likert scale).

### Patient management

The results of the point-of-care test were conveyed to the patient at the time of testing. Patients who tested positive were referred to the Immunodeficiency Clinic at the hospital within 24–72 hours for immediate clinical care, follow-up and counselling. If the patient had no contact information (e.g., homeless, shelter, no phone), transportation was arranged for follow-up. Patients with a negative point-of-care test result were contacted and informed of their confirmatory testing result within two weeks. Our study was approved by the Providence Health Care Institutional Review Board.

## RESULTS

A total of 2,077 patients were approached, and 1,402 (67.5%) agreed to be tested (Figure 1). The mean age of participants was 43.3 years (SD = 11.6) and of non-participants 43.7 years (SD = 9.9); 58% and 56% of participants and non-participants respectively were male.

Based on HIV point-of-care testing, the seroprevalence was 4.6% (65/1,402, 95% CI: 3.5%–5.8%). Confirmatory Western blot testing was performed for 185 participants (all positives and subjects having blood tests for other reasons). The sensitivity was 100% (65/65; 95% CI: 99.2%–100%) and specificity was 99.2% (119/120; 95% CI: 97.3%–100%) for the point-of-care test.

**Table 1.** Demographic characteristics and risk markers of patients who agreed to point-of-care testing ( $n = 1402$ ), stratified by HIV status

	HIV+ (N = 65)	HIV- (N = 1337)
Sex		
Male	57 (87.7)	765 (57.2)
Female	8 (12.3)	572 (42.8)
Age (mean)	48.4 years	41.9 years
CD4 count	396.8	NA
Risk markers		
MSM	32 (49.2)	79 (5.9)
IVDU	25 (38.4)	76 (5.6)
Transfusion	8 (12.3)	120 (9.0)

Note: MSM = men who have sex with men; IVDU = intravenous drug use.

All 65 patients who had positive Western blot tests were positive for the point-of-care test (sensitivity = 100%). The demographic characteristics of HIV positive and negative patients are presented in Table 1. The majority of the HIV-positive patients were male; the mean CD4 count of HIV-positive patients was 397. In terms of risk behaviours, nearly half of the HIV-positive patients identified themselves as men who have sex with men and almost 40% reported intravenous drug use.

Among the 65 HIV-positive subjects, there were no new diagnoses of HIV. Forty-five of 65 patients (69.2%) were receiving ongoing care for HIV. The remaining 20 were not currently linked to care for various reasons, such as failure to keep follow-up appointments or non-compliance with antiretroviral therapy. Of these subjects, 17/20 were linked to care after positive point-of-care testing and kept their initial immunodeficiency clinic appointment; the remaining 3 patients were lost to follow-up.

Patient satisfaction with point-of-care testing was high (mean score = 9.6/10; SD = 0.9). The vast majority of patients tested (1,391/1,402; 99.2%) felt that the emergency department was an appropriate place to institute point-of-care testing. The median amount of time required to perform each test was 7.2 minutes, including time for point-of-care test explanation, administration and interpretation (interquartile range = 4.7–10.1 minutes).

Of the emergency department patients who did not consent to study participation, 35.5% were not interested or did not give a reason (Figure 2). An additional 22% did not want to participate because they were feeling unwell. Of those who refused point-of-care testing, 13.6% reported that they already knew their HIV status. Finally, 12% of patients did not want to participate because they did not want additional testing, particularly if it required additional bloodwork or needles.

## DISCUSSION

Since 2006, on the recommendation of the CDC, several emergency departments in the US have adopted routine HIV screening. Conventional test results take several days, and concerns about patient acceptance have been raised. Technological advances in the diagnosis of HIV infection provide clinicians with greater opportunities to reduce transmission rates.<sup>7</sup>

Current Canadian guidelines for HIV testing propose that HIV testing be made a component of periodic routine medical care.<sup>12</sup> A significant portion of inner city inhabitants will have the

emergency department as their only point of contact with the health care system, making it the only opportunity for HIV testing in typically high-risk groups.

Despite national and provincial recommendations, Canadian emergency departments have not seen a widespread uptake of routine HIV testing using point-of-care or traditional laboratory testing. One other Canadian study has demonstrated the utility and feasibility of point-of-care HIV testing in the emergency department,<sup>13</sup> lending support to the concept of emergency department-based testing in this country.

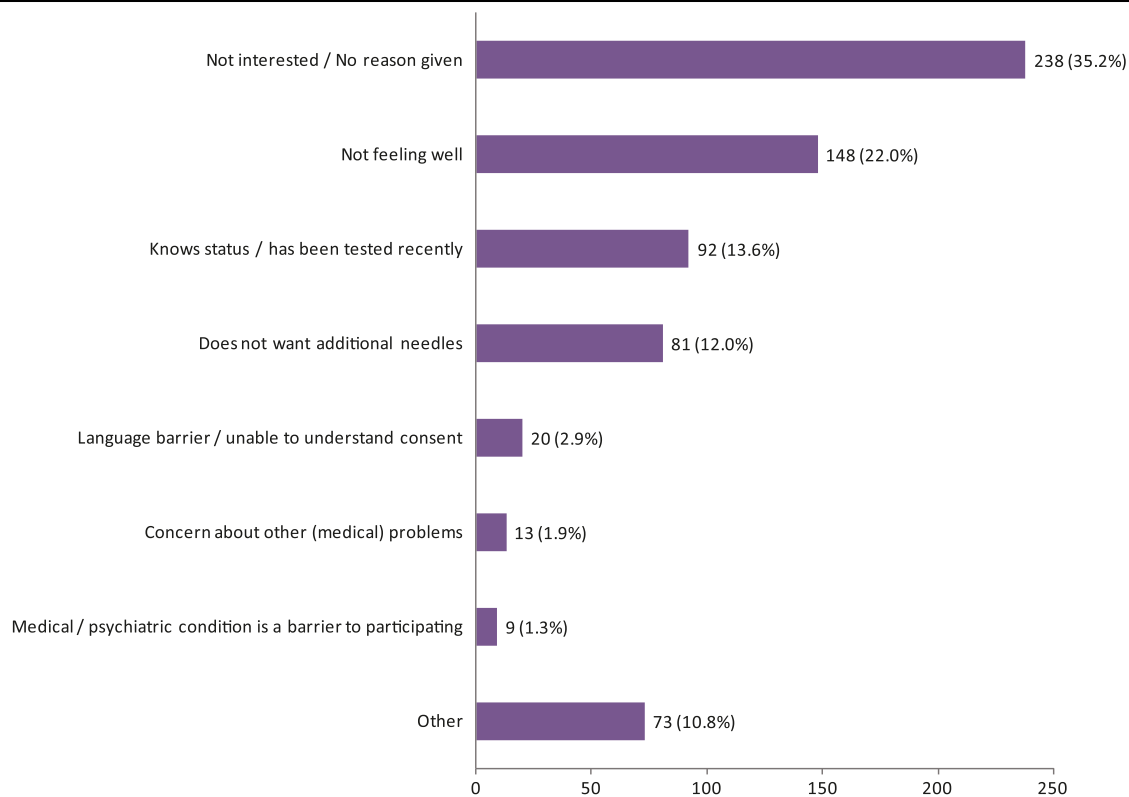
Our study provides useful information on the seroprevalence of HIV infection in an inner-city emergency department, as well as the utility and acceptability of point-of-care testing. It was feasible to undertake point-of-care testing in the emergency department, and it took under 10 minutes to perform. The HIV point-of-care test and counselling was administered by trained assistants, and therefore did not require the use of physician or nurse resources. Other research has demonstrated that this approach is cost-effective<sup>14</sup> and that screening does not adversely affect emergency department flow and length of stay.<sup>15</sup>

We observed a high level of patient satisfaction with the point-of-care testing procedure, and almost all patients felt that the emergency department was a suitable place to institute HIV testing. Concerns have been raised that the emergency department may not be the most appropriate setting to inform patients that they have tested positive for HIV. However, emergency department staff are frequently required to inform patients of serious diagnoses as part of their job. We provided rapid access to a specialty HIV clinic in the event of a positive test, and others have found that news about a positive test and counselling can be provided in a compassionate and empathetic fashion in the emergency department.<sup>16</sup>

Our prevalence rate of 4.6% was higher than anticipated and higher than that found in previous studies conducted in the emergency department of US and Canadian urban hospitals. One study from Boston that assessed a rapid oral HIV test in an emergency department setting also found an initial positivity rate of 4.6%, but the seroprevalence dropped to less than 1% after confirmation by conventional tests.<sup>17</sup> This study had a small sample of patients who were recruited within the context of a randomized clinical trial. A larger study from Washington DC also found a prevalence of <1% using the same oral HIV test as an opt-out routine screening test in the emergency department.<sup>18</sup> One other emergency department-based Canadian study<sup>13</sup> found a seroprevalence rate of 1.4%, and the authors suggest that their rate might have been higher if testing had been offered at night and on weekends, which our study did.

Our high prevalence rate is indicative of the inner-city location of our hospital and the high-risk behaviours of the population that we serve. One study demonstrated cost-effectiveness in screening patients for HIV in health care settings where the prevalence is greater than 1%.<sup>19</sup> While most of the patients with positive results in our study had been previously linked to care, 20 were not currently receiving antiretroviral therapy or regular immunodeficiency clinic appointments. Seventeen of these patients (85%) were re-linked to follow-up in this specialty clinic.

Our study has several limitations. Point-of-care tests were not performed for acutely ill patients, and there was a 33% refusal rate



**Figure 2.** Reasons given for refusal of HIV testing among patients approached in the emergency department (reasons in the Other category included time constraints or electing to remain unaware of HIV status)

among emergency department patients. This figure, however, is lower than the 40% that has been reported in studies that have used rapid HIV tests in urban-based emergency departments. Our prevalence rate could be even higher, as two studies using de-identified, discarded blood samples showed that positivity rates were several times higher in emergency department patients who declined versus those who accepted HIV testing.<sup>20,21</sup>

In conclusion, random HIV point-of-care testing in an inner city emergency department revealed a prevalence of 4.6%. Although we did not identify any new positives, 17/20 patients were re-linked to specific HIV care. Point-of-care HIV testing had a high acceptance rate and patient satisfaction level in this setting. Emergency department-based HIV testing is in keeping with the Canadian guidelines for routine testing in all health care settings. Point-of-care testing provides immediate results, which is particularly important for inner city patients who may be difficult to follow up. We recommend the adoption of this strategy, specifically in Canadian inner city emergency departments.

**REFERENCES**

- Public Health Agency of Canada. Summary: Estimates of HIV Incidence, Prevalence and Proportion Undiagnosed in Canada, 2014. Surveillance and Epidemiology Division, Professional Guidelines and Public Health Practice Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2015.
- Public Health Agency of Canada. HIV/AIDS Epi Updates Chapter 1: National HIV Prevalence and Incidence Estimates for 2011. Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2014.
- Chadborn TR, Delpuch VC, Sabin CA, Sinka K, Evans BG. The late diagnosis and consequent short-term mortality of HIV-infected heterosexuals (England

and Wales, 2000–2004). *AIDS* 2006;20(18):2371–79. PMID: 17117024. doi: 10.1097/QAD.0b013e32801138f7.

- Montaner JS. Treatment as prevention—a double hat-trick. *Lancet* 2011; 378(9787):208–9. PMID: 21763923. doi: 10.1016/S0140-6736(11)60821-0.
- Montaner JS, Hogg R, Wood E, Kerr T, Tyndall M, Levy AR, et al. The case for expanding access to highly active antiretroviral therapy to curb the growth of the HIV epidemic. *Lancet* 2006;368(9534):531–36. PMID: 16890841. doi: 10.1016/S0140-6736(06)69162-9.
- Fischer B, Rehm J, Blitz-Miller T. Injection drug use and preventive measures: A comparison of Canadian and western European jurisdictions over time. *CMAJ* 2000;162(12):1709–13. PMID: 10870504.
- Paul SM, Grimes-Dennis J, Burr CK, DiFerdinando GT. Rapid diagnostic testing for HIV. Clinical implications. *N J Med* 2003;100(9 Suppl):11–14; quiz 63–64. PMID: 14556597.
- Branson BM, Handsfield HH, Lampe MA, Janssen RS, Taylor AW, Lyss SB, et al. Centers for Disease Control and Prevention (CDC). Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR Recomm and Rep* 2006;55(RR-14): 1–17; quiz CE1-4. PMID: 16988643.
- Centers for Disease Control and Prevention (CDC). Advancing HIV Prevention: New strategies for a changing epidemic – United States, 2003. *MMWR Morb Mortal Wkly Rep* 2003;52:329–32. PMID: 12733863.
- Delaney KP, Branson BM, Uniyal A, Kerndt PR, Keenan PA, Jafa K, et al. Performance of an oral fluid rapid HIV-1/2 test: Experience from four CDC studies. *AIDS* 2006;20(12):1655–60. PMID: 16868447. doi: 10.1097/01.aids.0000238412.75324.82.
- Singh A, Lee B, Fenton J, Preiksaitis J. The INSTI HIV-1/HIV-2 antibody test: A review. *Expert Opin Med Diagn* 2013;7(3):299–308. PMID: 23480561. doi: 10.1517/17530059.2013.774370.
- Public Health Agency of Canada. *Human Immunodeficiency Virus HIV Screening and Testing Guide*. Public Health Agency of Canada, 2013.
- Becker M, Thompson L, Pindera C, Bridger N, Lopez C, Keynan Y, Bullard J, Van Casele P, Kasper K. Feasibility and success of HIV point-of-care testing in an emergency department in an urban Canadian setting. *Can J Infect Dis Med Microbiol* 2013;24(1):27–31. PMID: 24421789.
- Knapp H, Chan K. HIV Rapid testing in a VA emergency department setting: Cost analysis at 5 years. *Value Health* 2015;18(5):735–37. PMID: 26297102. doi: 10.1016/j.jval.2015.02.019.

15. Coeller N, Kuo I, Brown J. Nontargeted rapid human immunodeficiency virus screening provided by dedicated personnel does not adversely affect emergency department length of stay. *Acad Emerg Med* 2011;18:708–13. PMID: 21729185. doi: 10.1111/j.1553-2712.2011.01100.x.
16. Christopoulos KA, Massey AD, Lopez AM, Hare CB, Johnson MO, Pilcher CD, et al. Patient perspectives on the experience of being newly diagnosed with HIV in the emergency department/urgent care clinic of a public hospital. *PLoS One* 2013;8(8):e74199. PMID: 23991214. doi: 10.1371/journal.pone.0074199.
17. Walensky RP, Arbelaez C, Reichmann WM, Walls RM, Katz JN, Block BL, et al. Revising expectations from rapid HIV tests in the emergency department. *Ann Intern Med* 2008;149(3):153–60. PMID: 18678842. doi: 10.7326/0003-4819-149-3-200808050-00003.
18. Brown J, Shesser R, Simon G, Bahn M, Czarnogorski M, Kuo I, et al. Routine HIV screening in the emergency department using the new US Centers for Disease Control and Prevention Guidelines: Results from a high-prevalence area. *J Acquir Immune Defic Syndr* 2007;46(4):395–401. PMID: 18077831. doi: 10.1097/QAI.0b013e3181582d82.
19. Paltiel AD, Weinstein MC, Kimmel AD, Seage GR III, Losina E, Zhang H, et al. Expanded screening for HIV in the United States—an analysis of cost-effectiveness. *N Engl J Med* 2005;352(6):586–95. PMID: 15703423. doi: 10.1056/NEJMsa042088.
20. Lyss SB, Branson BM, Kroc KA, Couture EF, Newman DR, Weinstein RA. Detecting unsuspected HIV infection with a rapid whole-blood HIV test in an urban emergency department. *J Acquir Immune Defic Syndr* 2007;44(4):435–42. PMID: 17224850. doi: 10.1097/QAI.0b013e31802f83d0.
21. Czarnogorski M, Brown J, Lee V, Oben J, Kuo I, Stern R, et al. The prevalence of undiagnosed HIV infection in those who decline HIV screening in an urban emergency department. *AIDS Res Treat* 2011;879065. PMID: 21738860. doi: 10.1155/2011/879065.

Received: October 7, 2015  
Accepted: February 6, 2016

## RÉSUMÉ

**OBJECTIFS :** Cette étude visait à estimer la séroprévalence de l'infection à VIH et l'acceptabilité du dépistage du VIH aux points de service au service d'urgence d'un quartier central d'une ville canadienne.

**MÉTHODE :** Nous avons mené une étude prospective de cohortes au service d'urgence d'un hôpital de soins tertiaires en milieu urbain entre août 2009 et janvier 2011. Des patients sélectionnés au hasard ont été inscrits par échantillonnage probabiliste fondé sur les volumes de patients. Les critères d'inclusion étaient l'âge (19–75 ans) et la capacité de fournir un consentement éclairé. Les patients en état d'ébriété ou *in extremis* ont été exclus. Après avoir obtenu le consentement éclairé des patients et leur avoir donné un bref counseling pré-dépistage, nous avons obtenu leur état sérologique relativement au VIH à l'aide du test d'anticorps INSTI HIV-1/HIV-2. Les participants ont rempli un questionnaire sur les comportements présentant un risque pour le VIH et sur leur satisfaction à l'égard du dépistage du VIH au service d'urgence. Les participants ayant obtenu un résultat positif et ceux ayant eu d'autres analyses sanguines ont subi un test de transfert western pour confirmer les résultats. Les participants séropositifs pour le VIH se sont fait offrir un aiguillage immédiat vers une clinique de VIH spécialisée.

**RÉSULTATS :** Nous avons approché 2 077 patients, dont 1 402 (67,5 %) ont accepté de participer. L'âge moyen des participants était de 43,3 ans; 58,4 % des participants étaient des hommes. La séroprévalence des anticorps anti-VIH d'après le dépistage au point de service était de 65/1 402 (4,6 %; intervalle de confiance de 95 % : 3,5 %–5,8 %). Aucun nouveau diagnostic de VIH n'a été identifié dans notre cohorte. La satisfaction des patients à l'égard du dépistage du VIH au point de service était élevée (note de satisfaction moyenne de 9,6/10).

**CONCLUSION :** D'après un test de détection rapide des anticorps anti-VIH au point de service, le taux de séroprévalence du VIH au service d'urgence d'un quartier central d'une ville était de 4,6 %. Le dépistage au point de service dans un service d'urgence est acceptable, et la satisfaction des patients à l'égard de la procédure de dépistage était élevée.

**MOTS CLÉS :** tests diagnostiques; médecine d'urgence; acceptabilité; VIH; dépistage aux points de service