

A systematic review of HIV testing among Canadian populations

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ABSTRACT

OBJECTIVE: Regular HIV testing and early detection leads to timely treatment. Appropriate treatment and care can prevent disease progression in the individual and prevent onwards transmission within the community. This review describes HIV testing coverage in populations disproportionately affected by HIV and in the general population in Canada.

METHODS: A search of published and grey literature on HIV testing uptake in Canada was conducted. Studies reporting quantitative data on testing practices (ever tested, recent testing, and regular testing), published in either English or French from 2008-2012, were included. Studies that involved testing for immigration or prenatal purposes, and post-intervention studies, were excluded. Included studies were assessed using a modified version of the Public Health Agency of Canada's Descriptive Study Critical Appraisal Tool. Pooled prevalence for percent ever tested was calculated for subpopulations and heterogeneity was estimated using the I^2 statistic.

SYNTHESIS: A total of 26 studies were included in the review. The highest rates of ever having been tested were among people who inject drugs (90.6%) and inmates (90.4%); followed by men who have sex with men (83.0%); Aboriginal peoples (55.5%); and the general population (32.8%). Limited information was available on regular and recent testing.

CONCLUSION: HIV testing can reduce the number of undiagnosed cases in Canada. Future research should focus on testing coverage in certain populations, and on the extent to which populations engage in regular testing.

KEY WORDS: HIV; Canada; testing; prevention

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

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In Canada, an estimated 71,300 people were living with human immunodeficiency virus (HIV) at the end of 2011. Approximately 25% (14,500-21,500) of prevalent cases were unaware of their HIV infection.¹ Those unaware of their HIV status are at greater risk of unintentionally transmitting the virus to others.¹

HIV screening is an important first step for early detection, treatment, and prevention. Early diagnosis and treatment improves the health outcomes of those infected by preventing the progression to AIDS.² Additional benefits include the prevention of onwards transmission as those who are aware of their status are less likely to engage in HIV-related risk behaviours.³ Previous studies have also demonstrated that achieving an undetectable viral load of under 40 copies/mL through the use of antiretroviral therapy (ART), in combination with other prevention measures such as consistent condom use, can greatly reduce the risk of transmission in heterosexual serodiscordant couples.⁴

International guidelines, including more recent guidelines within Canada, have moved towards incorporating HIV testing as a component of routine medical care.⁵⁻¹¹ The trend towards normalizing HIV testing has meant facilitating provider-initiated diagnosis and treatment, often replacing the recommendation for written consent with verbal consent and reducing the duration and complexity of pre- and post-test counselling. A key difference to previous guidelines is the move toward HIV testing for all sexually active individuals who have never received an HIV test.

Targeting affected populations who experience a high prevalence of HIV or engage in high-risk behaviours such as injection drug use or unprotected anal sex, remains an important testing strategy with the additional recommendations for these groups to be screened at least annually.⁵⁻¹¹ There are many benefits to knowing one's HIV status; however, stigma and discrimination continue to act as barriers to testing.⁶ Health care providers are encouraged to work with patients to overcome these sensitivities. To encourage uptake of these guidelines, it is important to identify which population would benefit most from further HIV testing promotion. The purposes of this review were to: 1) determine the HIV testing coverage in populations most affected and in the general population in Canada; 2) determine how the testing rates differ by population and by region of the country; and 3) describe the limitations and the gaps in the evidence on testing rates.

METHODS

A systematic review protocol was developed a priori, which specified the research questions, the literature search strategy, inclusion and exclusion criteria, and the analysis plan (i.e., data

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extraction, quality assessment, calculating the pooled prevalence and conducting a sensitivity analysis). This review was supported by the Public Health Agency of Canada.

Literature search strategy

A literature search was conducted to identify published and grey literature on HIV testing in Canada. The search was limited to English or French studies published between January 2008 and December 2012. This time frame was chosen to provide a current snapshot on testing practices in Canada.

Peer-reviewed articles were identified using the following databases: CAB Abstract, Embase, Global Health, Medline, PsycInfo, Social Policy and Practice; with the key words (“HIV” or “Human immunodeficiency”) and (“test” or “screen”) and (“Canada” or any Canadian provinces and territories, or large cities). In addition, a search of the grey literature was conducted, as follows: a search of the Canadian Electronic Library, using the key words “HIV” or “Human immunodeficiency” and “test” or “screen”; a hand search of abstracts from the Canadian Association for HIV Research (CAHR) and Ontario HIV Treatment Network (OHTN) conferences; a search for dissertations through the database Theses Canada; and an Internet search for reports on behavioural survey results and government reports. Authors of included conference abstracts were asked to provide a copy of any resulting report or published article, or if lacking those, a copy of the presentation or poster.

Study selection

A systematic approach was employed to identify, assess, and document studies that reported quantitative data on testing practices of a population. Two of the authors (SH, DP) screened all abstracts from the literature search, and resolved any disagreements on eligibility. The following checklist was used to determine the eligibility of the studies: provided quantitative data on testing practices of a population (e.g., recent testing, frequency or ever tested); published in 2008-2012 inclusive; Canadian study location; published in English or French. Studies that focused on prenatal testing, mandatory testing for immigration/refugee application purposes, or post-intervention studies were excluded as they represent specialized testing. Where the results from the same study were published in multiple articles, the most recent and comprehensive article or report was selected. Last, studies were not excluded based on standard quality criteria. Due to the challenges inherent with sampling marginalized populations, it was felt that excluding a study based on quality might result in the exclusion of too many studies with valuable information.

Data extraction

Two authors (SH, DP) independently extracted data from the citations into the following categories: study population, study location, sample size, study design, year of data collection, and testing status (ever tested, tested regularly, or tested recently). Data extraction tables were compared for discrepancies, which the two authors resolved by reviewing the original study. Outcome variables included testing rates categorized by proportion ever tested, proportion tested recently (as defined by the study), or tested regularly (as defined by the study).

Table 1. Characteristics of all included studies

Category	Subgroup	No. of studies
Population	Men who have sex with men (MSM)	6
	PWID and People who smoke crack	3
	Aboriginal peoples	3
	Inmates	2
	General population	2
Data collection method†	Other specific populations	10
	Interviewer-administered	11
	Self-administered	7
Sampling method	Interviewer- and self-administered	7
	Probability sampling	4
	Non-probability sampling	22
	Venue-based	14
Setting (venue-based sampling)	Respondent-driven sampling	1
	Other	7
	Multiple venues	11
	Single venue	3
	Sample size*	
Location of data collection‡	<250	7
	≥250	19
	National	4
	British Columbia	7
	Prairies	3
	Ontario	15
	Quebec	4
Atlantic Canada	2	
Data collection period	Northern Canada	1
	Not reported	1
	Before 2008	11
	2008 and later	11
	Other‡	1
	Not reported	4

* A sample size of 250 was chosen as this would have provided a sufficient sample size for most HIV testing rate studies (using a margin of error of 5%, 95% CI, population size of 1,000 – then the sample size needed for a prevalence of 30% is 245; 40% is 270; 50% is 278; 60% is 270; 70% is 245).

† The number of studies may not add to 26 as some studies that conducted surveys in multiple sites fall into 2 or more subgroups.

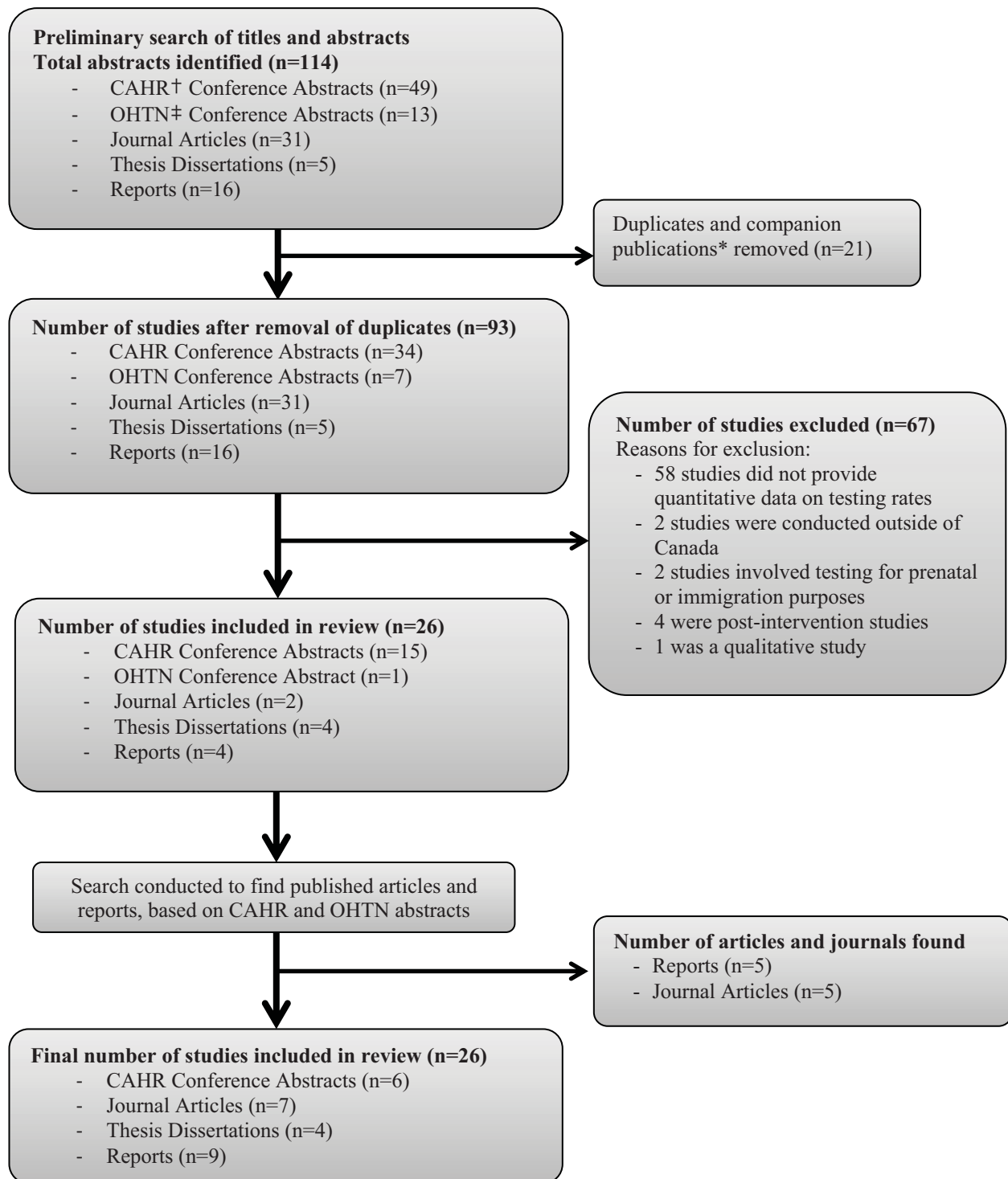
‡ One study collected data between 2003-2010.

Risk of bias in individual studies

Included citations were assessed for quality using a modified version of the Public Health Agency of Canada’s Descriptive Study Critical Appraisal Tool (in press).¹² Studies were given a score of 0, 1, or 2 for each of the following five criteria: representativeness, data collection methods, data collection instrument, ethical conduct, and statistical methods. Studies were also given a score of 0 or 1, depending on whether the authors made mention of receiving approval from a research ethics board. If no information was provided on a specific criterion, the criterion in question was conservatively given a 0. Studies were given a total score out of 9 and categorized as low (0-3); medium (4-6); and high (7-9) quality. If three or more criteria could not be scored, the studies were identified as having insufficient information and a total score was not calculated. The results from the quality assessment were used to complement the findings and to further discuss limitations with studies of testing rates in the Canadian population.

Pooled prevalence estimating methods

The pooled prevalence for “ever tested” was calculated for the following population subgroups: men who have sex with men (MSM), people who inject drugs (PWID), Aboriginal peoples, inmates, and the general population. The proportion of “ever tested” for individual studies was transformed using the variance-stabilizing double arcsine transformation. For final presentation, the pooled transformed proportion was back-transformed to a

Figure 1. Flow chart of systematic review process

* Duplicates and companion publications included reports and substudies that were part of a larger project. The most recent and comprehensive studies were included in the review.

[†] CAHR = Canadian Association for HIV Research.

[‡] OHTN = Ontario HIV Treatment Network.

proportion. The heterogeneity among the studies was estimated using the I^2 statistic, which describes the percentage of variation across studies that is due to heterogeneity rather than chance. Where the heterogeneity was low or moderate (<75%), the fixed effect method for combining the prevalence of “ever tested” was used. Where the heterogeneity was high ($\geq 75\%$), the random

effect method for combining different treatment effect sizes from heterogeneous studies was used.

Among population subgroups for which there were three or more studies, a sensitivity analysis was planned to examine the impact of methodological quality and sample size, by 1) excluding studies with a low quality rating (score 0-3) and studies with

insufficient information, and 2) excluding studies with <250 participants. Pooled prevalence and sensitivity analysis was calculated using MetaXL version 1.3.

RESULTS

After a preliminary search of titles and abstracts, a total of 114 abstracts were identified. Twenty-one studies were removed as they were duplicates. Sixty-seven more studies were excluded for not meeting the inclusion criteria. A final count of 26 studies was included in the analysis (Figure 1). All but one study relied on self-reported data for testing rates. Participants were mainly recruited through venue-based, non-probability sampling ($n=22$), and the majority of the studies took place in Ontario ($n=15$). Studies were categorized by population groups: MSM; PWID and people who smoke crack; Aboriginal peoples; inmates; general population; and other specific populations (Table 1). For a description of the included studies, please see Table 2.

MSM

Studies involving MSM accounted for 25% ($n=6$) of the studies. Given the considerable heterogeneity among the MSM studies ($I^2=96.9\%$), the random effect method was used to estimate the pooled prevalence of ever having been tested. There were five studies of MSM that included numerator and denominator information on the proportion who had “ever tested”; this yielded a pooled prevalence of 83.0% (95% CI 79.0-87.5).¹³⁻¹⁸ In a sensitivity analysis, the proportion who had ever tested differed by 1% when studies with small sample sizes (<250) were excluded from the analysis.

Only one report provided information on regular testing, with 44.0% of the total MSM population getting tested on an annual basis.¹⁸ With regards to recent testing, 63.1%-75.2% of total participants were tested in the previous two years and approximately 58.0%-59.3% were tested in the previous year (Table 3).¹³⁻¹⁷

PWID and people who smoke crack

Three studies (12%) examined PWID and people who smoke crack. In the study of people who smoke crack, the proportion who had ever been tested was 91.2%.¹⁹ This study was not included in the pooled prevalence as the numerator and denominator were not specified. Since there was no heterogeneity among the studies of PWID ($I^2=0\%$), the fixed effect method was used to estimate the pooled prevalence of ever having been tested. The pooled prevalence from the two studies of PWID was 90.6% (95% CI 89.9-91.3).^{20,21} This percentage of ever tested was the highest among all populations.

Information on regular testing or recent testing was only provided in the study of people who smoked crack. Twenty-six percent of those who smoked crack had received three or more tests in the previous two years and 44.6% received testing in the previous six months (Table 3).

Aboriginal peoples

Three studies (12%) among Aboriginal peoples were identified. Only one study specified that Aboriginal participants included First Nations, Inuits and Métis.²² Due to the high level of heterogeneity among the studies of Aboriginal peoples ($I^2=99.2\%$), the random effect method was used to estimate the

pooled prevalence of ever having been tested. The pooled prevalence was 55.5% (95% CI 34.7-75.5) from the three studies (Table 3).²²⁻²⁴ A sensitivity analysis was not conducted for this subgroup, as there were no studies assessed as being low quality or with sample sizes of less than 250.

Of the total number of Aboriginal youth sampled in one study, 43.4% were tested in the previous two years and a quarter of the participants reported having tested two or more times in the previous two years.²² Among the total number of Aboriginal youth who injected drugs, 31% had tested at least once a year.²³ Finally, 13.2% of Aboriginal people living off-reserve had an HIV test in the previous year (Table 3).²⁴

Inmates

Two studies measured testing rates in federal prison inmates (8%, $n=2$). A random effects method was used due to a high level of heterogeneity ($I^2=97.5\%$). The pooled prevalence of ever having been tested among inmates was 90.4% (95% CI 89.3-91.3) from the two studies.^{25,26} In federal prisons, all newly admitted inmates undergo a health assessment. Inmates are offered voluntary testing based on the results of the health assessment.²⁶ No information was provided for regular testing or recent testing for this group (Table 3).

General population

Based on the results of two studies of the general population, the pooled prevalence of people who had ever tested was 32.8% (95% CI 25.2-40.9).^{27,28} This pooled prevalence was calculated using a random effects method due to a high level of heterogeneity between the two studies ($I^2=96.7\%$). No information was provided on regular testing and recent testing practices within these two study reports (Table 3).

Other specific populations

There were 10 studies among other specific populations: transgender individuals, female sex workers, people from HIV-endemic countries, street youth, inner city residents (Downtown Eastside Vancouver), university students, young adults, female primary care patients, and Canadian snowbirds. Pooled prevalence was not calculated for this category due to the differences in the study populations. The percentage of people ever tested from this category ranged from 10.4%-75.0%, with the lowest rate among young sexually active students (10.4%) and the highest rate among individuals from HIV-endemic countries (75.0%).²⁹⁻³⁸ No information was provided on regular testing. Recent testing in the previous year was only reported in two studies. Out of the total number of survey respondents, 20% of transgender people reported testing in the previous year and 67.1% of female sex workers reported recent testing with no timeline indicated (Table 3).^{29,31}

DISCUSSION

Testing rates were highest among PWID, inmates, and MSM, at 91%, 90% and 83%, respectively. While there was limited information available on frequency of testing and recent testing, this review found 13%-59% of those in affected populations, specifically Aboriginal peoples, transgender individuals, street youth, and MSM, had tested in the previous year. A number of

Table 2. Description of included studies organized by population

Source	Population	Sample size	Setting	Sampling method	Survey method	Year of data collection	Location	Quality of study
MSM								
CRBC, 2011 ¹⁸	MSM	7910*	Not applicable	Non-probability sampling	Self-administered (online)	2010	Canada	Insufficient information
Husbands, 2009 ¹³	African, Caribbean, and Black MSM	168	Toronto Pride, community and social events at bath houses organized by Black men	Non-probability sampling (venue-based and word-of-mouth)	Self-administered (paper)	2007-2008	Toronto	Medium
Lambert, 2011 ¹⁴	MSM	1873	Bars, saunas, coffee shops, sports and recreational groups	Non-probability sampling (venue-based)	Self-administered (paper)	2008-2009	Montreal and Laval	Medium
Moore, 2012 ¹⁵	MSM	949	Bars, community events, business, community associations, bathhouses	Non-probability sampling (venue-based)	Self-administered (paper)	2008-2009	Vancouver	Medium
PHAC, 2011 ¹⁶	MSM	4793	Bars, events, associations, bathhouses, and other	Non-probability sampling (venue-based, respondent-driven sampling, and adapted time-location sampling)	Self-administered (paper)	2005 and 2007	Victoria, Winnipeg, Toronto, Ottawa, Montreal	Medium
Poon, 2011 ¹⁷	East/Southeast Asian MSM	222	Bathhouse and website (gay.com)	Non-probability sampling (venue-based)	Interviewer-administered (face-to-face)	2006-2007	Toronto	Medium
PWID and People who smoke crack								
Bennett, 2012 ²⁰	IDU	1158	Needle exchange programs	Non-probability sampling (venue-based)	Interviewer-administered (face-to-face)	2010-2012	Regina, Thunder Bay, Sudbury, Toronto, Kingston, Halifax	Medium
Leclerc, 2012 ²¹	IDU	12,205	SurvUDI Network – Needle exchange programs	Non-probability sampling	Interviewer-administered (face-to-face)	2003-2010	Ottawa, Estrie, Abitibi-Témiscamingue, Saguenay-Lac-St-Jean, Montérégie, Montreal, Quebec City, Outaouais, Mauricie et Centre-du-Québec, Réseau	Medium
White, 2012 ¹⁹	People who smoke crack	498†	Needle exchange programs	Non-probability sampling (venue-based)	Interviewer-administered (face-to-face)	2011	Toronto	Medium
Aboriginal peoples								
Mill, 2008 ²²	Aboriginal youth (First Nations, Inuit, or Métis)	413 surveys, 285 qualitative interviews	Aboriginal health and friendship centres and AIDS service organizations	Non-probability sampling (venue-based and network sampling)	Interviewer-administered (face-to-face) Self-administered (paper and online)	2004-2005	(Vancouver, Edmonton, Winnipeg, Ottawa, Toronto, Montreal, Halifax, Labrador, Inuvik)	Medium
Moniruzzaman, 2010 ²³	Aboriginal youth who inject drugs‡	605	Cedar Project – health care providers, street outreach, and word of mouth ⁵²	Non-probability sampling (venue-based and snowball)	Interviewer-administered (face-to-face)	2003-2005	Vancouver and Prince George	Medium
Orchard, 2010 ²⁴	Aboriginal people off-reserve‡	19,369	Not applicable	Probability sampling	Self-administered (paper)	2001	Canada	Insufficient information
Inmates								
Bonnycastle, 2011 ²⁵	Inmates	237	Penitentiary	Non-probability sampling	Self-administered (paper)	2002	Pacific region	Insufficient information
Zakaria, 2010 ²⁶	Inmates	3357	Penitentiaries	Probability sampling (stratified)	Self-administered (paper)	2007	Not specified	High ...suite/

Table 2. Description of included studies organized by population, suite

Source	Population	Sample size	Setting	Sampling method	Survey method	Year of data collection	Location	Quality of study
General population								
Calzavara, 2012 ²⁸	General population (Canadians 16 years of age and older)	2139	Not applicable	Probability sampling (online panel and random digit dialing)	Self-administered (online) Interviewer-administered (telephone)	2011	Canada	Insufficient information
EKOS, 2012 ²⁷	General population (Canadians 16 years of age and older)	2000	Not applicable	Probability sampling (random digit dialing and panel of randomly selected households)	Interviewer-administered (telephone)	2012	Provinces and territories	High
Other specific populations								
Bauer, 2012 ²⁹	Transgender	433	Not applicable	Non-probability sampling (Respondent-driven sampling)	Interviewer-administered (phone) Self-administered (paper and online)	2009-2010	Ontario	Low
Deering, 2012 ³¹	Female sex workers	435§	Bars, saunas, home, out-call, micro-brothels, massage parlours	Non-probability sampling (not specified)	Interviewer-administered (face-to-face)	2010	Vancouver	Insufficient information
Ghai, 2008 ³⁸	South Asian students	106	York University psychology course	Non-probability sampling	Self-administered (paper)	Not specified	Toronto	Low
Gray, 2008 ³²	People from African countries	456	Community and social events, public venues, and community organizations, community organization memberships and third-party lists	Non-probability (venue-based and snowball)	Interviewer-administered (face-to-face) Self-administered (paper)	2004 and 2006	Greater Toronto Area	Medium
Mairs, 2010 ³⁷	Canadian snowbirds	299	Pamphlets and posters placed in various locations in Florida and in Canada	Non-probability sampling	Interviewer-administered (face-to-face and telephone) Self-administered (online and paper)	2009-2010	Broward County (FL), Elmira, Kitchener, Cambridge, Oakville, Elliot Lake	Medium
Peterman, 2008 ³⁶	Female students	47	Three universities – On-campus student health clinic	Non-probability sampling	Self-administered (paper) Interviewer-administered (phone)	Not specified	London and Toronto	Low
Raffa, 2010 ³⁰	Inner city residents	2913	Community organizations, single-room occupancy hotels	Non-probability sampling (venue-based, word-of mouth)	Provincial database linkages	2003-2004	Vancouver	Medium
Schwandt, 2011 ³⁴	Female primary care patients (16-39 yrs)	104	Primary care centres	Non-probability sampling	Self-administered (paper)	Not specified	Toronto	Insufficient information
Vibert, 2010 ³³	Street youth	97	Youth shelters, drop-in centres, partnering community organizations, library, popular street hangouts	Non-probability sampling (venue-based)	Interviewer-administered (face-to-face)	2009	Hamilton	Medium
Wagner, 2008 ³⁵	Young sexually active adults	770	York University	Non-probability sampling	Self-administered	Not specified	Toronto	Insufficient information

Studies were classified as insufficient information when three or more criteria could not be scored.

* Community-Based Research Centre, Sex Now 2010 Survey – Total count of participants includes US participants (n=261).

† Sample includes both IDU and crack users (number of crack users not reported).

‡ These studies did not provide information on whether Aboriginal Peoples included First Nations, Inuit and/or Métis.

§ Sample only includes seronegative SWs.

Table 3. Pooled prevalence of testing rates categorized by population

Source	Population	Ever tested	Tested recently (defined)*	Tested regularly (defined)*
MSM				
CBRC, 2011 ^{18†}	MSM	79.0%	No data	44.0%† (≥annually)
Husbands, 2009 ¹³	Black MSM	88.2%	58.0% (past yr)	No data
Lambert, 2011 ¹⁴	MSM	No data	59.3% (past yr)	No data
Moore, 2012 ¹⁵	MSM	86.0%	68.0% (past 2 yrs)	No data
PHAC, 2011 ¹⁶	MSM	86.2%	75.2% (past 2 yrs)	No data
Poon, 2011 ¹⁷	East/Southeast Asian MSM	75.2%	63.1% (past 2 yrs)	No data
Pooled prevalence ($I^2=96.9\%$)		83.0% (95% CI 79.0-87.5%)		
PWID & People who smoke crack				
Bennett, 2012 ²⁰	IDU	91.0%	No data	No data
Leclerc, 2012 ²¹	IDU	90.5%	No data	No data
White, 2012 ^{19‡}	People who smoke crack	91.2%	44.6%† (past 6 months)	25.6%† (≥3 tests in past 2 yrs)
Pooled prevalence ($I^2=0$)		90.6% (95% CI 89.9-91.3%)		
Aboriginal peoples				
Mill, 2008 ²²	Aboriginal youth	50.8%	43.4% (past 2 yrs)	24.7% (2+ times in past 2 yrs)
Moniruzzaman, 2010 ²³	Aboriginal youth who inject drugs	73.0%	No data	31.0% (at least once per yr)
Orchard, 2010 ²⁴	Aboriginal people off-reserve	41.7%	13.2% (past yr)	No data
Pooled prevalence ($I^2=99.2\%$)		55.5% (95% CI 34.7-75.5%)		
Prisoners/Inmates				
Bonnycastle, 2011 ²⁵	Inmates	75.0%	No data	No data
Zakaria, 2010 ²⁶	Inmates – men	88.0%	No data	No data
	Inmates – women	98.0%	No data	No data
Pooled prevalence ($I^2=97.5\%$)		90.4% (95% CI 89.3-91.3%)		
General population				
Calzavara, 2012 ²⁸	General population (≥16 years old)	29.0%	No data	No data
EKOS, 2012 ²⁷	General population (≥16 years old)	37.0%	No data	No data
Pooled prevalence ($I^2=96.7\%$)		32.8% (95% CI 25.2-40.9%)		
Other specific populations				
Bauer, 2012 ²⁹	Transgender	53.0%	20.0% (past yr)	No data
Deering, 2012 ³¹	Female sex workers	No data	67.1% (“recently” not defined)	No data
Ghai, 2008 ³⁸	South Asian students	11.3%	No data	No data
Gray, 2008 ³²	People from African countries	75.0%	No data	No data
Mairs, 2010 ³⁷	Canadian snowbirds	17.7%	No data	No data
Peterman, 2008 ³⁶	Female students	31.9%	No data	No data
Raffa, 2010 ³⁰	Inner city residents	69.0%§	No data	No data
Schwandt, 2011 ³⁴	Female primary care patients (16-39 yrs)	56.0%	No data	No data
Vibert, 2010 ³³	Street youth	63.0%	52.9% (past yr)	No data
Wagner, 2008 ³⁵	Young sexually active adults	10.4%	No data	No data

* Denominator for recent and regular testing was calculated out of the total number of included participants for each study to facilitate comparability between studies (unless otherwise specified).

† Denominator was not specified for recent and regular testing.

‡ Percent ever tested was not included in pooled prevalence as the denominator and numerator were not specified.

§ Ever tested between 1991-2007.

|| Excludes testing for insurance, blood donation, research.

limitations and gaps were uncovered, including a lack of research on certain specific populations and a lack of information on testing frequency and recent testing.

Most studies relied on self-reported health behaviour information which is subject to social desirability response bias. Although attempts were made to reduce bias, social desirability bias cannot be ignored as 27% of studies did not provide information on whether they employed strategies to reduce bias. In addition, the difficulty inherent in sampling socially marginalized groups resulted in several of the studies employing venue-based, non-probability sampling. Venue-based sampling only reaches certain segments of the population who frequent the venues in question. Therefore, these results may not be generalizable to the populations studied. With the above two limitations in mind, the testing rates in this review may be overestimated in certain populations.

In Canada, the MSM exposure category comprised the largest proportion (47%) of estimated prevalent HIV cases in 2011.¹ Not surprisingly, several studies were conducted that described the

testing patterns within gay, bisexual, and other MSM.^{13-16,18} Among MSM in Canada, the high rates of ever having been tested (83%) are comparable to the rates in other resource-rich countries. For both the United States and Australia, the percentage of MSM ever tested was 90% and for Scotland, 80%.³⁹⁻⁴¹ These high testing rates may in part be due to the use of venue-based sampling in surveillance research. Recruiting participants from venues (bathhouses, bars, or community events) will capture more openly gay and bisexual identified men who are more likely to see HIV as a routine test.³⁹

Although the proportion of MSM who had ever tested was high, a lower proportion of MSM engaged in regular testing. In one study, only 44% tested on an annual basis.¹⁸ This suggests that this population may not be meeting the current recommendation for annual testing discussed in the several recent Canadian testing recommendations,⁶⁻⁸ which aligns with the recommendations made in other resource-rich countries.⁴¹ Common reasons for not testing include low perceived risk for infection, fear of testing positive, and fear of loss of

confidentiality.^{39,41} As current recommendations are designed to identify the undiagnosed population, efforts are needed to encourage regular HIV testing among this high-prevalence population. Addressing issues of stigma and discrimination around being HIV-positive, reducing the sexual exclusion of HIV-positive gay men, and improving access for MSM to supportive testing environments could increase the frequency of regular HIV testing.³⁹

People from HIV-endemic countries were estimated to comprise 15% of prevalent HIV infections in Canada in 2011.¹ However, only one study was identified in this review that provided information on testing rates.³² The results from this one study indicated that 75% of people from HIV-endemic countries had ever had an HIV test. The percentage of people from HIV-endemic countries living in Canada who had ever tested is higher than testing rates in migrants and ethnic minorities from the United States (31%-34%) and Europe (23%-60%).⁴² In Canada, the high percentage of people from HIV-endemic countries who had ever tested may have been due in part to the testing conducted during the immigration/refugee application process. Of the 75% who had ever been tested, 65% of participants had been tested as part of the immigration/refugee application process.³² Factors that can deter people from HIV-endemic countries from getting tested include fear of discrimination, language barriers, and unfamiliarity with the health care system in their new country.

PWID represent another population disproportionately affected by HIV in Canada, comprising 17% of the estimated prevalent infections in 2011.¹ This group of individuals had the highest rates of ever having been tested (91%), as well as recent and regular testing, with 45% of PWID tested in the previous 6 months and 26% tested three or more times in the previous two years. Our findings are consistent with the ever-tested rates in Australia and the United States of 88% and 89%, respectively.^{43,44} However, as previously mentioned, these rates may be artificially high since all three studies in this review included individuals recruited from prevention services.¹⁹⁻²¹ Those who frequent prevention services are more likely to have benefitted from venue-based testing or referrals to HIV testing and other health care services.

The percent of individuals ever tested was lower among other populations (i.e., transgender individuals, street youth, inner-city residents, Aboriginal peoples, university students etc.), ranging from 10% to 75%. The lower testing rates among Aboriginal peoples living off-reserve and Aboriginal youth (42%-51%) are a particular concern. At the end of 2011, Aboriginal peoples made up an estimated 9% of new infections in Canada while only making up 4% of Canada's population.^{1,45} These estimates demonstrate that Aboriginal peoples are disproportionately affected by HIV infection and thus at increased risk. The increased risk of HIV infection is influenced by high rates of incarceration, substance use, historic inequalities, poverty, social stigma surrounding testing, and low health literacy.⁴⁶ Those living on-reserve or in rural areas are less likely to get an HIV test compared to those living in urban settings,²⁴ which may be due to systemic barriers including concerns about confidentiality and access to testing.²² Injection drug use is the main exposure category for Aboriginal people

infected with HIV.⁴⁷ In the three studies included in this review, the highest rates of ever having been tested were among Aboriginal youth who inject drugs (73%), consistent with studies that have shown that individuals who engage in higher-risk activities are also more likely to get tested.^{23,48} Heterogeneity within populations can add complexity to measuring the optimal rates of HIV testing since not all individuals within a specific population engage in HIV-related risk behaviours to the same extent.

As expected, the rates of ever having been tested were the lowest among general population surveys and in surveys of some specific populations, such as older adults and younger adults, ranging from 10% to 37%.^{27,28,35-38} The results from this review corresponded well to other studies of populations with lower HIV incidence.^{5-11,49} This review suggests that greater efforts are needed to encourage health care providers to offer HIV and in educating the public about the benefits of HIV testing, through the use of targeted public health interventions. All testing initiatives should be guided by respect for autonomy, informed consent, privacy, and confidentiality. Normalizing HIV testing offers significant benefits such as reducing the number of undiagnosed infections in Canada, and reducing the stigma surrounding HIV and HIV screening.

One of the aims of this review was to look at geographic differences in HIV testing rates. Unfortunately, this was not possible, since the majority of the studies were conducted in metropolitan or urban settings within Ontario, British Columbia, and Quebec. This finding is to be expected since these provinces also have the highest reported HIV prevalence in Canada.⁵⁰ Residents in rural communities have to overcome barriers such as a real or perceived lack of confidentiality, travel distances to sites, and inadequate services.⁵¹ More research is needed into HIV testing in rural areas.

In addition, several other gaps in the literature were noted. It is helpful to develop and promote the use of standard HIV testing indicators across studies, to ensure comparability. Second, more research is needed to better understand testing in other populations, such as transgender individuals, sex workers, and people from HIV-endemic countries. Data on recent and regular testing were also found to be lacking. If reported, it was reported inconsistently, with different recall periods for recent testing and a lack of definition of what constitutes regular testing. Without information on recent and regular testing, an impact evaluation of HIV testing guidelines is difficult.

CONCLUSION

HIV testing is the first step within the treatment cascade. Despite the availability of free HIV testing, uptake of HIV testing is not optimal in the overall Canadian population. The results from this review indicate that MSM and PWID populations had the highest rates of having ever been tested and the general population had the lowest rate of having ever been tested. New approaches to testing, such as those that lead to the normalization of testing, rapid point-of-care testing and the provision of testing in less traditional settings (e.g., emergency rooms or community-based settings in "HIV hotspots") can improve the uptake of testing and reduce the large pool of undiagnosed HIV infections in Canada.

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RÉSUMÉ

OBJECTIF : Des tests réguliers de dépistage et une détection précoce du VIH entraînent un traitement en temps opportun. Des traitements et des soins appropriés peuvent éviter la progression de la maladie chez un individu et prévenir la retransmission du virus au sein d'une collectivité. Le présent examen décrit la couverture de dépistage du VIH au sein des populations disproportionnellement touchées par le VIH et au sein de la population générale du Canada.

MÉTHODES : Une recherche a été menée à l'échelle de la littérature grise et des documents publiés sur la prise de tests de dépistage du VIH au Canada. Des études signalant des données quantitatives sur des pratiques de dépistage (sujets ayant déjà passé un test, sujets testés récemment et sujets procédant à des tests réguliers), publiées en anglais ou en français de 2008 à 2012, ont été incluses dans la recherche. Les études portant sur le dépistage prénatal ou auprès des immigrants et les études menées après les interventions, elles, ont été exclues. Les études incluses ont été évaluées à l'aide d'une version modifiée de l'outil d'évaluation critique pour les études descriptives de l'Agence de la santé publique du Canada. La prévalence groupée pour le pourcentage de gens ayant déjà passé un test de dépistage a été calculée pour les sous-populations, et l'hétérogénéité a été estimée à l'aide de la statistique I^2 .

SYNTHÈSE : Au total, 26 études ont été incluses dans l'examen. Les utilisateurs de drogues injectables (90,6 %) et les détenus (90,4 %) avaient les taux les plus élevés de tests de dépistage. Ces groupes étaient suivis des hommes ayant des relations sexuelles avec d'autres hommes (83 %), des Autochtones (55,5 %) et de la population générale (32,8 %). Les renseignements accessibles sur les tests réguliers et les tests récents étaient limités.

CONCLUSION : Les tests de dépistage du VIH peuvent réduire le nombre de cas non diagnostiqués au Canada. Les prochaines recherches devraient insister sur la couverture du dépistage au sein de certaines populations et sur la mesure dans laquelle les populations procèdent à des tests réguliers.

MOTS CLÉS : VIH; Canada; dépistage; prévention