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CANADA COMMUNICABLE DISEASE REPORT

CURRENT TRAVEL RISKS

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RAPID COMMUNICATION

Illness in Canadian travellers and migrants from Brazil: CanTravNet surveillance data, 2013–2016

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Abstract

Background: In light of the 2016 summer Olympic games it is anticipated that Canadian practitioners will require information about common illnesses that may affect travellers returning from Brazil.

Objective: To identify the demographic and travel correlates of illness among recent Canadian travellers and migrants from Brazil attending a network of travel health clinics across Canada.

Methods: Data was analyzed on returned Canadian travellers and migrants presenting to a CanTravNet site for care of an illness between June 2013 and June 2016.

Results: During the study period, 7,707 ill travellers and migrants presented to a CanTravNet site and 89 (0.01%) acquired their illness in Brazil. Tourists were most well represented (n=45, 50.6%), followed by those travelling to "visit friends and relatives" (n=14, 15.7%). The median age was 37 years (range <1–78 years), 49 travellers were men (55.1%) and 40 were women (44.9%). Of the 40 women, 26 (65%) were of childbearing age. Nine percent (n=8) of travellers were diagnosed with arboviruses including dengue (n=6), chikungunya (n=1) and Zika virus (n=1), while another 14.6% (n=13) presented for care of non-specific viral syndrome (n=7), non-specific febrile illness (n=1), peripheral neuropathy (n=1) and non-specific rash (n=4), which are four syndromes that may be indicative of Zika virus infection. Ill returned travellers to Brazil were more likely to present for care of arboviral or Zika-like illness than other ill returned travellers to South America (23.6 per 100 travellers versus 10.5 per 100 travellers, respectively [p=0.0024]).

Interpretation: An epidemiologic approach to illness among returned Canadian travellers to Brazil can inform Canadian practitioners encountering both prospective and returned travellers to the Olympic games. Analysis showed that vector-borne illnesses such as dengue are common and even in this small group of travellers, both chikungunya and Zika virus were represented. It is extremely important to educate travellers about mosquito-avoidance measures in advance of travel to Brazil.

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Introduction

During the past three years, Zika virus and chikungunya have emerged in the Americas (1-3) and dengue continues to be transmitted at high rates throughout the Caribbean, Central America and South America (4). Brazil, in particular, has suffered severe health and economic consequences due to the emergence of these viruses in both urban and rural settings (5). High rates of Zika virus in the Pernambuco state of Brazil heralded the recognition of a devastating new congenital neurologic syndrome (6).

In light of the ongoing Zika crisis, much attention has been directed at the 2016 Olympic games in Rio de Janeiro, set to begin in August. Debate around the risks to athletes, their entourages and to Canadians from infectious diseases among travellers returning to Canada, has been fierce (7,8). There is a lack of information about the health conditions associated with travel to Brazil for Canadians. In order to fill this knowledge gap, the authors conducted a Canada-specific traveller-level surveillance summary of illness among returned Canadian travellers and migrants to Brazil who presented for care at CanTravNet sites over a three-year period.

Methods

Data source: Seven Canadian sites that practice post-travel medicine in large urban centres from five provinces (British Columbia, Alberta, Manitoba, Ontario and Quebec), belong to the GeoSentinel Global Surveillance Network and constitute a national surveillance group called CanTravNet (9). Demographic and travel-related data were collected using the data platform of the GeoSentinel Surveillance Network (10). The GeoSentinel data-collection protocol is reviewed cyclically by the institutional review board (IRB) officer at the National Center for Emerging and Zoonotic Infectious Diseases at the US Centers for Disease Control and Prevention and is classified as public health surveillance, not human-subjects research requiring submission to and approval from IRBs. Final diagnoses include specific etiologies (e.g., Zika virus) and syndromes (e.g., rash). All CanTravNet sites contribute microbiologically-confirmed data where available, based on the best available reference diagnostics.

Definitions and classifications: Seven travel purpose designations were used, including tourism, business, missionary/volunteer research/aid work, visiting friends and relatives (VFR), migration, education and planned medical care (9-11).

Inclusion criteria: Demographic, clinical and travel-related data on Canadians encountered after completion of their travel to Brazil and seen in any of six CanTravNet sites from June 1, 2013 to June 1, 2016 were extracted and analyzed. Only patients with probable or confirmed final diagnoses were included.

Analysis: Extracted data were managed in a Microsoft Access database. Travellers were organized by purpose of travel, demographics and travel metrics including pre-travel encounter and diagnoses. Women of childbearing age were defined as those between 15 and 49 years of age. Differences between groups of travellers were compared using Fisher's exact test. All statistical computations were performed using GraphPad Prism software (GraphPad Software Inc., La Jolla, CA).

Results

During the study period, 7,707 ill travellers and migrants presented to a CanTravNet site and of those, 89 (0.01%) acquired their illness in Brazil. Those travelling for tourism were the most well represented (n=45, 50.6%), followed by those travelling for VFR (n=14, 15.7%), business (n=13, 14.6%), migration (n=6, 6.7%), missionary/volunteer/aid work (n=6, 6.7%), education (n=3, 3.4%) or planned medical care (n=2, 2.2%). Median age was 37 years (range <1-78 years), 49 travellers were male (55.1%) and 40 were female (44.9%). Six travellers (6.7%) were under the age of 18 years. Top countries of birth were Canada (n=50, 56.2%) and Brazil (n=21, 23.6%). Median trip duration was 16 days (range 3-304 days). Almost one-third of travellers (n=28, 31.5%) had received a pre-travel consultation.

Almost 98% of ill returned travellers and migrants in this analysis were managed as outpatients (n=87). The most common presenting symptoms were dermatologic (n=43, 48.3%), followed by gastrointestinal (n=37, 41.6%) and fever (n=21, 23.6%). Cutaneous larva migrans (n=8, 9.0%), severe arthropod bites (n=8, 9.0%) and post-infectious irritable bowel syndrome (n=10, 11.2%) were the most common dermatologic and gastrointestinal diagnoses respectively (**Table 1**).

Table 1: Demographic characteristics of 89 returned travellers or migrants presenting to a CanTravNet site for care of an illness acquired in Brazil, 2013–2016[1]

Diagnosis	All travellers n=89		Short-duration travellers[2] (trip ≤2 weeks) n=26		Mid-duration travellers[2] (trip 2–4 weeks) n=24		Long-duration travellers[2] (trip ≥1 month) n=24	
	n	%	n	%	n	%	n	%
Systemic febrile illness								
Non-specific viral syndrome and mononucleosis-like illness	7	7.9	2	7.7	4	16.7	1	4.2
Dengue fever	6	6.7	0	0	3	12.5	3	12.5
Influenza and influenza-like illness	4	4.5	3	11.5	0	0	0	0
Upper respiratory tract infection	2	2.2	0	0	0	0	2	8.3
Enteric fever due to *Salmonella typhi*	1	1.1	0	0	1	4.2	0	0
Lobar pneumonia	1	1.1	1	3.8	0	0	0	0
Chikungunya fever	1	1.1	1	3.8	0	0	0	0
Zika virus	1	1.1	0	0	0	0	1	4.2
Zika-like syndrome[3]	13	14.6	2	7.7	6	25.0	3	12.5
Viral meningitis	1	1.1	0	0	1	4.2	0	0
Gastrointestinal illness								
Post-infectious irritable bowel syndrome	10	11.2	1	3.8	3	12.5	3	12.5
Strongyloidiasis	4	4.5	0	0	0	0	2	8.3
Acute diarrhea	3	3.4	2	7.7	0	0	1	4.2
Chronic diarrhea	2	2.2	0	0	0	0	1	4.2
Amoebiasis due to *Entamoeba histolytica*	2	2.2	1	3.8	0	0	1	4.2
Giardiasis	1	1.1	0	0	0	0	0	0
Shigellosis	1	1.1	1	3.8	0	0	0	0
Campylobacteriosis	1	1.1	1	3.8	0	0	0	0
Dermatologic illness								
Cutaneous larva migrans	8	9.0	2	7.7	4	16.7	2	8.3
Arthropod bite	8	9.0	4	15.4	3	12.5	1	4.2
Skin and soft-tissue infection[4]	6	6.7	2	7.7	1	4.2	2	8.3
Rash, unknown etiology	4	4.5	0	0	2	8.3	1	4.2
Animal Bite[5]	2	2.2	1	3.8	0	0	1	4.2
Cutaneous leishmaniasis	2	2.2	0	0	0	0	1	4.2

Abbreviations: n, number

[1] The total cohort of travellers consisted of 7,707 travellers between June 1, 2013 and June 1, 2016

[2] Includes those who acquired their illness on a trip to Brazil within the year prior to presentation (n=74). Excludes those travelling for migration (n=6) and those who acquired their illness on a trip to Brazil >1 year prior to presentation (n=9)

[3] Includes viral syndrome, non-specific rash, non-specific febrile syndrome and peripheral neuropathy. Excludes confirmed Zika virus

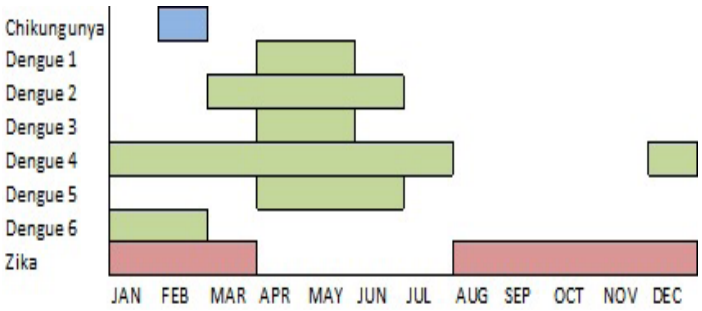
[4] Includes impetigo, ecthyma, paronychia, folliculitis, erysipelas, furunculosis, carbunculosis and cellulitis

[5] Includes monkey and dog bites

Presumably fecal-orally acquired illnesses such as typhoid fever, acute diarrhea, amoebiasis, giardiasis, campylobacteriosis and shigellosis occurred in 10% (n=9) of ill returned travellers. Respiratory illnesses, including influenza, influenza-like illness, lobar pneumonia and upper respiratory tract infections, occurred in 7.9% (n=7) of ill returned travellers.

Febrile conditions including arboviral infections occurred in nine percent (n=8) of travellers, who were diagnosed with either dengue (n=6), chikungunya (n=1), or Zika virus (n=1). All eight travellers (100%) with chikunguyna, dengue or Zika had itineraries entailing travel to Brazil during the months of January to June, while only two of these eight travellers (25%) travelled to Brazil during the months of July to December (**Figure 1**). Non-specific viral syndrome (n=7), non-specific rash (n=4), non-specific febrile syndrome (n=1) and peripheral neuropathy (n=1), four syndromes possibly indicative of Zika virus infection, were also well represented (Table 1).

Figure 1: Eight cases of arboviral infection from Brazil by month of travel, CanTravNet 2013-2016



Note: Most cases of arboviral infection were acquired December to June rather than June to September, when the 2016 Olympics will be held

Of 40 female travellers to Brazil, 26 (65%) were of childbearing age. Just over one-third of women of childbearing age had undergone pre-travel consultation (n=9, 34.6%). Rates of arboviral infection among women of childbearing age appeared to be similar to those in other travellers: 2/26 (7.7%) versus 6/63 (9.5%), respectively (p=1.00). Rates of non-specific rash, however, appeared to be greater in women of childbearing age than in other travellers: 3/26 (11.5%) versus 1/63 (1.6%), respectively, though this difference was not significant (p=0.07). Women of childbearing age appeared to be more likely to receive a diagnosis that could be compatible with a Zika-like illness, including peripheral neuropathy, viral syndrome, non-specific febrile syndrome and rash, compared to other travellers: 6/26 (23.1%) versus 7/63 (11.1%), respectively, though this difference was not significant (p=0.189).

Compared to other ill returned travellers and migrants to South America (n=401), those who acquired illness in Brazil were more likely to be diagnosed with dengue, chikungunya, or Zika: 8/89 (9.0%) versus 13/401 (3.2%) (p=0.0362) (**Table 2**). In addition, ill returned travellers to Brazil were more likely than other ill travellers to South America to acquire a Zika-like illness: 13/89 (14.6%) versus 29/401 (7.2%) (p=0.0347) (Table 2).

Table 2: Arboviral and arboviral-like illnesses among ill returned travellers and migrants from Brazil (n=89) **and other South American countries** (n=401) **presenting to a CanTravNet site, 2013-2016**

Diagnosis or diagnostic bundle	Ill returned travellers and migrants from Brazil (n=89)		Ill returned travellers and migrants from other countries of South America (n=401)		*P*-value
	n	Number per 100 travellers	n	Number per 100 travellers	
A. Arboviral infection (Dengue, CHK or Zika virus)[1]	8	9	13	3.2	p=0.0362
B. Zika-like illness[2]	13	14.6	29	7.2	p=0.0347
Total A + B	21	23.6	42	10.5	p=0.0024

Abbreviations: n, number; CHK, Chikungunya
[1] Laboratory confirmed diagnosis
[2] Clinical diagnosis that includes non-specific viral syndrome; non-specific febrile illness, non-specific rash and peripheral neuropathy

Discussion

This analysis of surveillance data elucidates travel and demographic details for a subset of ill returned Canadian travellers and migrants who acquired their disease in Brazil this can inform Canadian practitioners encountering prospective and returned travellers to the 2016 Olympic games. These data highlight the recent and ongoing emergence of arboviral infections such as dengue, chikungunya and Zika in travellers to the Americas and the high rate of arthropod bite acquisition in travellers to Brazil.

Vector-borne viral disease occurred in 9% of ill travellers to Brazil and arthropod bites in another 10%

Vector-borne diseases, including dengue, chikungunya and Zika, were well represented among this group of ill travellers to Brazil and such illnesses appeared to have been associated predominantly with travel during the months of January to June, rather than the latter of half of the year during which time the Olympic games will be held. Compared to ill returned travellers and migrants to other countries of South America, those who travelled to Brazil were two- to three-times more likely to acquire arboviral or Zika-like illness. Due to a lack of vaccine availability or chemoprophylaxis at this time, prevention of arboviruses such as dengue, chikungunya and Zika rests on the use of mosquito avoidances measures such as screened accommodations, insecticide-treated clothing and DEET- or picaridin-based insect repellants (12,13). Sexual transmission of Zika virus can be reduced through use of condoms and abstinence (6,14).

Zika-like illness occurred in nearly 15% of ill travellers to Brazil

Phylogenetic studies have convincingly dated the introduction of Zika virus to Brazil in 2013 (15), however, specific Zika virus diagnostic testing has only recently become available (14). A full 15% of ill travellers to Brazil in this analysis received a diagnosis that could signal the presence of Zika virus, including non-specific viral or febrile syndrome, non-specific rash and peripheral neuropathy. Those presenting early in the study

period prior to recognition of Zika transmission in the Americas would not have been tested for Zika virus. In addition, due to the prolonged turnaround time for Zika testing (14), many of those travellers with a recent Zika-like diagnosis may receive confirmatory Zika test results in the future. Of more concern is the finding of a Zika-like syndrome in almost one-quarter of women of childbearing age. Given the frequency and severity of the newly recognized congenital Zika syndrome (6,14), women who are pregnant are advised to avoid travel to the Olympics (14,16) and those planning to conceive should consider deferring travel (14).

Limitations

Analysis of CanTravNet data has several limitations (9). This analysis pertains only to the sample of ill returned travellers who presented to a CanTravNet site following travel to Brazil, thus, our conclusions may lack generalizability to other Canadian travellers and to those visiting other countries. The appearance of over-representation of arboviral and Zika-like illness among women of childbearing age may simply reflect referral bias following the emergence of Zika in the Americas. Our database may under-represent those who acquired short-duration illnesses on long-duration travel as these individuals may have convalesced while abroad and did not seek care upon return. Our data cannot estimate incidence rates or destination-specific numerical risks for particular diagnoses (17). As the Winnipeg site was new to CanTravNet in 2016, returning travellers to Manitoba are not represented. Data on pre-travel medical consultation was missing for 31.5% of ill returned travellers. Finally, due to the nature of our network, pediatric cases are under-represented, thus, our data may not be generalizable to the travelling pediatric population in Canada.

Conclusion

CanTravNet surveillance data can be used to better inform health professionals preparing prospective travellers to Brazil and the post-travel diagnostic approach to ill travellers and migrants returning to Canada from Brazil. These data underscore the emergent nature of both chikungunya and Zika in travellers to Brazil and reiterate that dengue continues to be a commonly travel-acquired arboviral infection in those with South American itineraries. The frequency of both arboviral infection and severe arthropod bites among this group of travellers to Brazil highlights the need for aggressive precautions against mosquito bites particularly during the daytime. Reinforcement of the range and type of mosquito avoidance measures available to travellers to Brazil should figure prominently into pre-travel discussions.

Contributions

AKB conceived the study, contributed to study design, data collection, analysis and interpretation, and was primarily responsible for writing the manuscript. JG contributed to study conception, data interpretation, critical appraisal and revision of the manuscript. JV contributed to data collection, analysis and interpretation, and to critical appraisal and revision of the manuscript. ML, CY, AEM, JH, WG, SK and KCK contributed to data collection and interpretation and to critical appraisal and revision of the manuscript. DOF and PJP contributed to data interpretation and critical appraisal and revision of the manuscript. All authors take responsibility for the integrity of the manuscript.

Conflict of interest

None.

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Interim Canadian recommendations for the use of a fractional dose of yellow fever vaccine during a vaccine shortage

Yellow Fever Working Group[1] on behalf of the Committee to Advise on Tropical Medicine and Travel (CATMAT)

Summary

This statement outlines interim recommendations intended for use during yellow fever vaccine shortages only. The recommendations differ from the standard recommendations for yellow fever vaccination in the *Canadian Immunization Guide* and in the Committee to Advise on Tropical Medicine and Travel (CATMAT) Statement for Travellers and Yellow Fever.

Affiliation

[1] **Note:** Members of the Yellow Fever Working Group are listed in the Acknowledgements section

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Introduction

Yellow fever vaccine shortages pose a challenge. Travel clinics may be allotted a small fraction of the number of vaccines typically ordered, or in some cases, travel clinics will not have access to the yellow fever vaccine until a new supply of the vaccine is available. There is currently only one licensed marketer of the vaccine in Canada.

In 2016, there have been calls for the use of a fractional dose of yellow fever vaccine to address a global yellow fever vaccine shortage, a measure which would allow for immunization of a greater number of people during the vaccine shortage (1-3). This suggestion is primarily based on three studies which have shown that doses in the range of 1/10 to 1/5 of the usual 0.5 ml subcutaneous dose are protective based on laboratory criteria.

On 17 June 2016, the World Health Organization (WHO) released a statement that the WHO Strategic Advisory Group of Experts (SAGE) on Immunization found that the use of a fifth of a standard vaccine dose (0.1 ml instead of 0.5 ml) would provide protection against yellow fever for at least 12 months based on a review of existing evidence (4). The WHO states that the fractional dose of yellow fever vaccine can be considered a safe and effective approach to control an urban outbreak in case of vaccine shortages.

CATMAT formed a working group to review the evidence and make interim recommendations on the use and documentation of fractional doses of yellow fever vaccine in Canada intended for use during yellow fever vaccine shortages only. Each member was a volunteer, and none declared a relevant conflict of interest. The recommendations differ from the standard recommendations for yellow fever vaccination in the *Canadian Immunization Guide* (5) and in the Committee to Advise on Tropical Medicine and Travel (CATMAT) Statement for Travellers and Yellow Fever (6).

Methods

A literature search for evidence related to the immunogenicity of a fractional dose of yellow fever vaccine was conducted. Evidence was retrieved by performing searches in electronic databases (Ovid MEDLINE, Embase, Global Health and Scopus). The search spanned the initial date for each database until June 2016 and 49 results were identified. Titles and abstracts of these results were reviewed and selected for inclusion based on relevancy to the research question.

Results

In 2008, Roukens et al studied the effect of a one-fifth dose of yellow fever vaccine administered intradermally. All subjects developed titres of neutralizing antibody considered to be protective (7). The average subject age was 27 years with a wide adult age range (18 to 70 years).

In 2013, Martins et al studied seroconversion and viremia responses to the use of full dose and five different dilutions of the usual human dose of 17-DD yellow fever vaccine administered subcutaneously (8). There was little difference in immune response down to a dilution of 1:50.

In a 2014 extension of the Martins study (using the same patient data and collected blood), Campi-Azevedo studied serum biomarkers of cellular immunity responses using fractional doses (9). There was evidence of protection at dilutions down to 1:50. However, consistent findings of equivalency to a full dose

across all markers of immunity (serology, viremia and cellular immunity) were found down to a 1:10 dilution. In the Martins and Campi-Azevedo investigations, all subjects were healthy young males with an average age of 19 years.

Although the results of these studies are encouraging, this constitutes a limited evidence base. Further research is needed to determine the effectiveness of fractional doses, especially in young children.

Recommendations

Under normal circumstances, a recommendation for use of fractional dose of yellow fever vaccine would not be made for travellers. However, some travellers going to yellow fever endemic or epidemic regions may not have access to a full dose of yellow fever vaccine, and as such, these travellers face the choice of not receiving a vaccine or receiving a fractional dose of vaccine.

In view of this situation, CATMAT makes the following recommendations, applicable to individuals for whom the standard yellow fever vaccine recommendations apply, including young children:

- For travel to a region of a country with risk of yellow fever, health care professionals should first emphasize the importance of receiving a full dose of vaccine or otherwise postponing the trip. This is especially critical for travel to areas experiencing an ongoing outbreak of the disease.
- If a traveller must travel to an endemic area, especially to areas experiencing an ongoing outbreak of yellow fever, and a full dose cannot be located after reasonable efforts, a fractional dose may be administered. The dose should be 1/5 of the usual dose (0.1 ml instead of 0.5 ml) administered by the traditional subcutaneous route. As with a full dose, a fractional dose is considered protective 10 days after it is administered to a person who has never before received the yellow fever vaccine.
- If a traveller planning a high risk itinerary receives a fractional dose of yellow fever vaccine, and then later finds that a full dose has become available, this dose may be administered and the International Certificate of Vaccination or Prophylaxis (ICVP) may be issued.
- Once reconstituted, the vaccine vial should be stored between 2° and 8° Celsius, and used within one hour. Thus, it will be necessary to vaccinate several people within that hour in order to efficiently use the contents of the vial in the allotted time. The health care professional may find that the use of disposable 1 cc insulin syringes with non-detachable needle wastes less vaccine. Four, possibly five, doses may be obtained from one vial. Strict aseptic technique should be observed.
- If fewer than five doses are being administered, it is recommended that the entire contents of the vial be used, equally distributed among those being immunized. This will allow for the administration of somewhat more than 0.1 ml per person.
- Based on available data, a fractional dose (1/5) should be considered protective for one year. Protection may be longer, however long term data is lacking. No recommendation is made at this time regarding repeat fractional dose immunization for subsequent travel.
- Once the supply of yellow fever vaccine is restored in Canada, the use of fractional doses should be discontinued.
- Practitioners are reminded that the WHO now considers a single full dose of yellow fever vaccine protective for life regardless of when it is administered.

Documentation of fractional dose yellow fever vaccination

The WHO states that a fractional dose of the yellow fever vaccine would not qualify for a yellow fever certificate under the International Health Regulations (IHR) (4). Therefore CATMAT does not recommend that practitioners use the official International Certificate of Vaccination or Prophylaxis (ICVP) card to document a fractional dose.

One option for documentation is the use of the Certificate of Medical Contraindication to Vaccination provided by the Public Health Agency of Canada. An explanation can be written inside informing that a fractional dose of 0.1 ml of the yellow fever vaccine was administered subcutaneously due to a severe vaccine shortage.

Additional resources and useful links

Government of Canada – Yellow Fever Vaccinations Centres in Canada. http://www.phac-aspc.gc.ca/tmp-pmv/yf-fj/index-eng.php

World Health Organization – Vaccination requirements and recommendations for international travellers. http://www.who.int/ith/en/

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Conflict of interest

None.

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SYSTEMATIC REVIEW

Canadian and international recommendations on the frequency of HIV screening and testing: A systematic review

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Abstract

Background: In 2014, the Public Health Agency of Canada estimated that 21% of the people living with human immunodeficiency virus (HIV) in Canada were unaware of their infection. Increased screening and testing for HIV is crucial to reducing the number of undiagnosed infections. To ensure the best use of available resources, it is important to determine the optimal intervals for HIV screening and testing.

Objective: To conduct a systematic review of the recommendations for the frequency of HIV screening and testing in different populations.

Methods: To identify eligible guidelines, a comprehensive two-tiered search strategy of journals and websites of governments and non-governmental organizations and a three-tiered screening strategy (title, abstract and full content screen) were used. Guidelines were eligible for inclusion if they, a) were published between 2000 and 2015 in English or French, and b) provided guidance on HIV screening/testing intervals for at least one population.

Results: Of the 609 documents retrieved from the search, 34 guidelines met the eligibility criteria. The most frequently mentioned populations were pregnant women, men who have sex with men (MSM) and the general population. Overall, there was consensus on at least annual testing for MSM, intravenous drug users, individuals with HIV-positive sex partners, individuals with multiple partners, sex workers and their clients, migrants from HIV-endemic countries and indigenous peoples. Of the 20 guidelines that provided recommendations for pregnant women, the most common recommendation (n=9) was to test as early as possible during each pregnancy; four guidelines recommended screening during the first prenatal visit; three recommended routine HIV testing; and four suggested retesting in the third trimester regardless of maternal risk of HIV infection. Consensus on HIV testing of the general public, incarcerated people and individuals diagnosed with other sexually transmitted infections (STIs) was lacking. Four guidelines cited a lack of data for not providing specific recommendations in the general population.

Conclusions: Additional evidence is needed to refine the recommendations for pregnant women and inform the optimal timing of HIV testing, especially in the general population, individuals diagnosed with other STIs and incarcerated people.

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Introduction

Diagnosed and treated human immunodeficiency virus (HIV) infection is considered a chronic disease (1). Early detection and treatment of HIV is important not only for the individuals who are infected but also to prevent transmission of the virus (2). Clinical trials have shown that early initiation of HIV treatment reduces viral load, thereby decreasing infectivity and potentially preventing HIV transmission (3,4).

Low rates of screening and testing have been identified as a potential limiting factor in the success of HIV-prevention strategies (5,6). Approximately 30–50% of new infections are a result of individuals who are unaware of their infection (7,8). Research among men who have sex with men (MSM), injection drug users (IDUs) and heterosexual men and women indicates that once individuals learn of their HIV-positive status they are more likely to take steps to minimize the likelihood of transmission (9). However, it was estimated that at the end

of 2014, about 21% of people living with HIV in Canada were unaware of their infection (10).

The Public Health Agency of Canada (PHAC)'s *HIV Screening and Testing Guide* recommends HIV screening as part of routine care and annual testing for individuals involved in high-risk practices (2). In addition to MSM and IDU, other commonly identified risk groups for HIV infection include individuals with HIV-positive sex partners and individuals with multiple or anonymous partners (2,11-15).

However, the benefits and frequency of HIV testing must be weighed against costs, and there is a lack of clarity as to the ideal frequency of testing in other populations.

The objective of this systematic review was to address the question: What are the recommended intervals for HIV screening and testing among various population groups in Canada and elsewhere?

Methods

Search strategy

A research librarian–designed comprehensive search of electronic databases identified guidelines published in peer-reviewed journals. Government and non-governmental organization (NGO) websites were also searched to identify any guidelines that may have been posted but not published in the scientific literature. The electronic databases searched included MEDLINE, Embase, Scopus, Cochrane Library and the Canadian Electronic Library (CEL). See **Appendix 1** for a complete list of the government and NGO websites searched.

The search terms were the same for both types of searches: "HIV testing frequency," "HIV testing interval," "HIV guideline," "HIV testing guideline," "HIV screening," "HIV screening frequency," "HIV screening guideline," "HIV screening and testing guideline," "HIV screening and testing recommendations," "HIV screening recommendations," "HIV testing recommendations," "STI guidelines," "STI testing intervals" and "STI testing frequency." Search strings for the different databases are identified in **Appendix 2**.

Inclusion and exclusion criteria are listed in **Table 1**. The search was restricted to guidelines published or posted within the last 15 years to capture the influence of new HIV prevention methods (e.g., treatment as prevention [TasP]).

Guideline selection

We conducted a three-tiered screening process: title screen, abstract screen and full content screen. Three authors (TA, GT and SH) independently screened the titles. Titles with the terms "guideline," "strategy," "directive," "recommendation," "guidance" or "position" were included. Guidelines on HIV treatment or the management of opportunistic infections and co-infected populations were excluded. Two authors (TA, GT) independently screened the abstracts and excluded those that did not refer to HIV screening and testing. Disagreements between reviewers at either stage were resolved through discussion with a third reviewer (KT) and a fourth, if required. Two authors (TA, GT) then completed the full content screen. Guidelines that did not provide specific information on the recommended frequency or intervals of HIV screening and testing for any population group were excluded. Only primary source guidelines were included. Guidelines were considered duplicates if the same recommendation was published in multiple locations or if an article summarized or endorsed a guideline.

Table 1: Inclusion and exclusion criteria

Item	Inclusion criteria	Exclusion criteria
Nature of recommendation	Provides position, recommendations or guidance on HIV testing intervals or frequency of testing (all populations and subgroups) Multiple recommendations published from the same organization (e.g., updates or addendums)	No mention of testing intervals or frequency of HIV testing Recommendations related to individuals who already have HIV (e.g., TB/HIV co-infection or HIV treatment/management)
Language of publication	English, French	Languages other than English and French
Date of publication	Recommendations published from January 2000 to August 2015	Guidelines published prior to January 2000

Abbreviations: HIV, human immunodeficiency virus; TB, tuberculosis

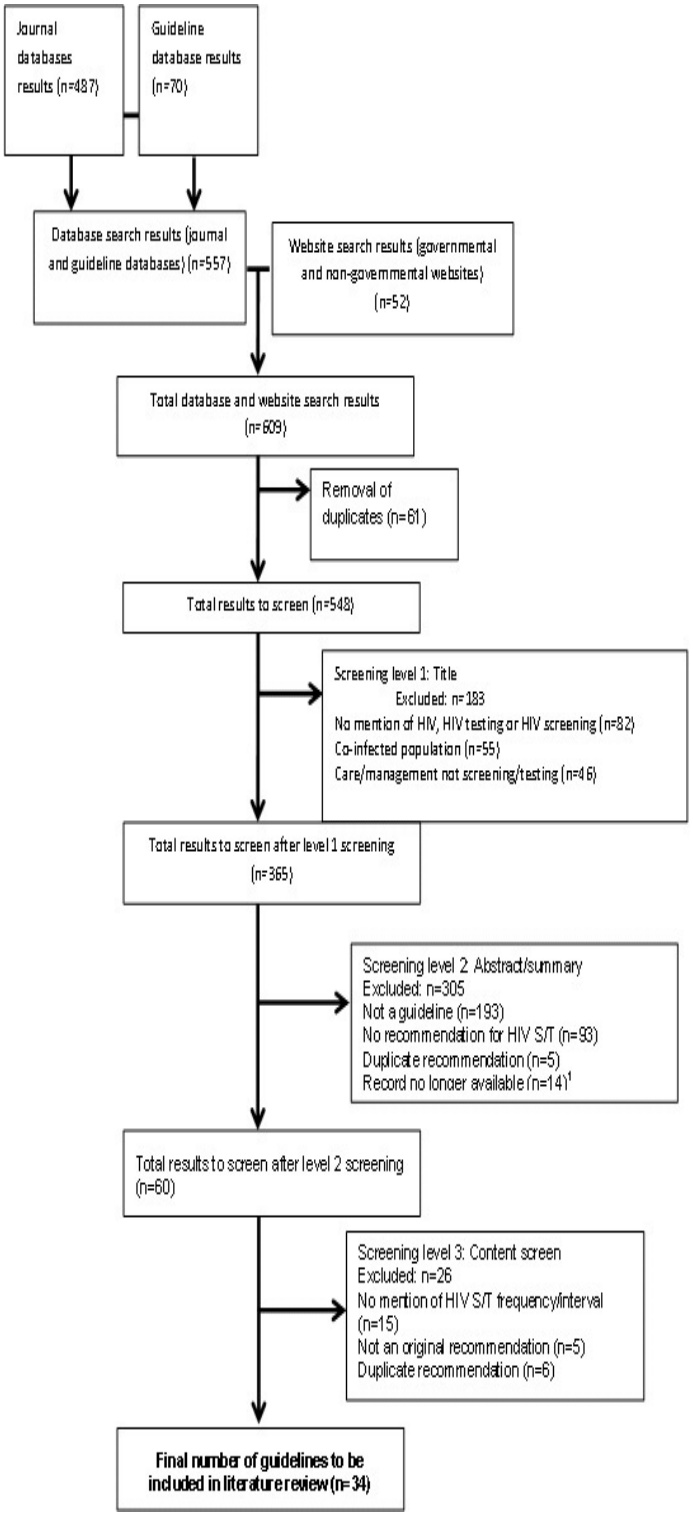
Data extraction

Data were extracted on the country of publication, population screened and testing frequency. Guidelines were categorized as Canadian, foreign, or international (spanning multiple countries, such as those from the World Health Organization). The population groups initially targeted in this review were the general population, MSM and IDU, but other population groups were also noted.

Results

A total of 609 documents were retrieved from the search. After duplicates were removed and inclusion/exclusion criteria applied, the final review included 34 guidelines (**Figure 1**).

Figure 1: Screening methodology and final results flow chart



Abbreviations: HIV, human immunodeficiency virus; S/T, screening/testing

[1] Refers to documents for which abstracts were identified but full texts were either unavailable or inaccessible

The characteristics of included guidelines are summarized in **Table 2**. Two-thirds (65%) came from the United States and Europe. In addition to the general population, MSM and IDU, several other key populations emerged: pregnant women, migrants from HIV-endemic regions, indigenous peoples, adolescents, incarcerated individuals, partners of unknown HIV status and others.

Table 2: Overview of 34 guidelines on the frequency of HIV testing by geographic region and key populations groups

Type	Characteristic	Number (%)
Geographic region	United States	12 (35)
	Europe	10 (29)
	Canada	5 (15)
	Africa	2 (6)
	Australia	2 (6)
	World Health Organization	2 (6)
	Asia	1 (3)
Key populations mentioned	Pregnant	20 (59)
	MSM	19 (56)
	General population	14 (41)
	IDU	13 (38)
	Multiple partners	7 (21)
	HIV-positive sex partner	7 (21)
	Other STI diagnosis	5 (15)
	Sex workers and their clients	4 (12)
	Migrants from HIV-endemic countries	4 (12)
	Indigenous peoples	3 (9)
	Adolescents	3 (9)
	Incarcerated individuals	3 (9)
	Transgender men and women	2 (6)
	Partner with unknown HIV status	2 (6)

Abbreviations: IDU, injection drug user; HIV, human immunodeficiency virus; MSM, men who have sex with men; STI, sexually transmitted infection

All 34 Canadian, foreign and international guideline s are summarized in **Table 3**. Of these, 9 provided recommendations only for high-risk groups and the remaining 25 provided recommendations for other risk groups (e.g., pregnant women and the general population). Five guidelines were updates to previous guidelines.

Table 3: Summarized Canadian, foreign and international HIV screening and testing frequency recommendations

	Source	General	Pregnant	Multiple partners	HIV+ partner	MSM/ MSM sex partner	IDU/IDU sex partner	Incarcerated individuals	Adolescents	Transgender men/women	Partner of unknown HIV status	Sex workers and their clients	Migrants from HIV-endemic countries	Indigenous peoples	Other STIs
Canadian	Quebec (2011) (19)	NSR	First prenatal visit	More frequent	ALA	ALA	ALA	Annual risk evaluation	Annual risk evaluation	NSR	NSR	NSR	NSR	Annual risk evaluation	3-6 months
	PHAC (2012) (2)	Normalized testing	First prenatal visit; repeat if high risk	NSR[2]	NSR[2]	NSR[2]	NSR[2]	NSR[2]	NSR	NSR	NSR	NSR[2]	NSR	NSR	NSR
	Ontario (2012) (32)	After high risk exposure	NSR	ALA	ALA	ALA	ALA	NSR	NSR	NSR	ALA	NSR	ALA	ALA	NSR
	Saskatchewan (2014) (22)	Every 5 years	Routine prenatal care	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	British Columbia (2014) (20)	Routine; every 5 years	First prenatal visit; repeat if high risk	ALA	ALA	ALA	ALA	After incarceration	NSR	NSR	NSR	ALA	ALA	ALA	NSR
Foreign	CDC (multiple years) (13,17,24,25,31,33,34)	Routine; re-test based on risk (13, 17,25)	Each pregnancy (31); retest in 3rd trimester (13,17, 25,31)	ALA (13)	ALA (13)	ALA (13,17, 31)	ALA (13)	Routine (34)	Re-test based on risk (17)	Re-test based on behavioural history (17)	NSR	ALA (13)	NSR	NSR	Retest with new complaint (13)
	Seattle/King County (2001) (35)	NSR	NSR	NSR	NSR	ALA	ALA	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	UK (2006, 2008) (21,36)	Routine; retest after window (21,36)	Beginning of pregnancy (21)	NSR	NSR	ALA (21)	ALA (21)	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	Liberia (2007) (37)	Re-test after window	Re-test in 3rd trimester	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	Afghanistan (2008) (28)	Additional research needed	NSR	6–12 months	6–12 months	6–12 months	6–12 months	NSR	NSR	NSR	NSR	6–12 months	NSR	NSR	NSR
	ACP/HIV Medicine Association (2009) (38)	Routine	Each pregnancy	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	France (2009) (29)	Routine; additional research needed	NSR	NSR	NSR	Annually (if multiple partners)	Annually	NSR	NSR	NSR	NSR	NSR	Annually (if sex partner is from HIV endemic region)	NSR	NSR
	Central African Republic (2010) (39)	Routine testing at STI clinics	Beginning and end of each pregnancy	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	STIs in Gay Men Action Group (2010, 2014) (40,41)	NSR	NSR	NSR	NSR	ALA (40,41)	3–6 months (if MSM) (41)	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	NICE (2011) (27,42)	Routine at specialised clinics (27)	NSR	NSR	Routine (27)	Annually (42); routine (27)	Routine (27)	NSR	NSR	NSR	NSR	NSR	Routine (27)	NSR	Routine (27)
	New York (2011) (43)	NSR	Re-test 3rd trimester	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	USPSTF (2014) (18)	No retest for low risk[3]	Every pregnancy	NSR[3]	NSR[3]	NSR[3]	NSR[3]	NSR[3]	Screen for risk	NSR	NSR	NSR[3]	NSR[3]	NSR[3]	NSR
	ACOG (2015) (44)	NSR	Beginning of pregnancy; retest in 3rd trimester	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
International[1]	Europe (2008, 2014) (16,30)	Routine; additional research needed (16,30)	Routine (16)	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	WHO (2009, 2010) (15,45)	NSR	Beginning of pregnancy; repeat if high risk (15,45)	NSR	ALA (45)	ALA (15,45)	ALA (15,45)	NSR	NSR	ALA (45)	ALA (45)	ALA (15,45)	NSR	NSR	Re-test with new complaint (45)
	EMCDDA (2010) (14)	NSR	NSR	NSR	NSR	NSR	6–12 months	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR
	ECDC (2010, 2015) (23,26)	NSR	Routine (23)	NSR	NSR	Routine (23,26)	NSR	NSR	NSR	NSR	NSR	NSR	NSR	NSR	Routine (23)

Abbreviations: ACOG, The American Congress of Obstetricians and Gynecologists; ACP/HIV, American College of Physicians and HIV Medicine Association; ALA, at least annually Common risk behaviours/risk groups; CDC, United States Centers for Disease Control and Prevention; ECDC, European Centre for Disease Prevention and Control; EMCDDA, European Monitoring Centre for Drugs and Drug Addiction; HIV, human immunodeficiency virus; IDU, intravenous drug use; NSR, No Specific Recommendation; STI, sexually transmitted infection; USPSTF, United States Preventive Services Task Force; WHO, World Health Organization

[1] International = includes multiple countries such as those from the World Health Organization
[2] There is insufficient evidence to provide recommendations for the exact frequency of HIV testing for each scenario. More frequent STI testing for MSM with multiple anonymous partners, MSM who have sex in conjunction with illicit drug use or whose sex partners engage in similar activities
[3] Routine rescreening may not be necessary for individuals not at increased risk since last negative test

More recent guidelines have focused on routine testing (i.e., not recommending a specific testing interval but rather providing a recommendation to test everyone) with more frequent testing for individuals who engage in high-risk behaviours (2,16-18).

The most frequently mentioned populations were pregnant women, MSM and the general population. Of all 20 guidelines that provided recommendations for pregnant women, the most common recommendation (n=9) was to test as early as possible during each pregnancy; 4 guidelines recommended screening during the first prenatal visit (2,19-21); 3 recommended routine HIV testing (16,22,23); and 4 suggested retesting in the third trimester regardless of maternal risk of HIV infection (13,17,24,25).

Of the 19 guidelines that considered MSM, 14 provided a specific testing frequency, 3 recommended routine testing without specific testing intervals (23,26,27) and 2 cited insufficient evidence to determine a testing interval but recommended that MSM be screened more frequently (2,18). Altogether 14 recommended testing at least annually.

Testing at least annually was also the most common recommendation for IDU (11 of 13 guidelines), individuals with HIV-positive sex partners (6 of 7), individuals with multiple partners (4 of 7), sex workers and their clients (4 of 4), migrants from HIV-endemic countries (3 of 4) and indigenous peoples (2 of 3). Overall, the recommendations for frequency of testing higher-risk populations varied little.

Recommendations for the general population varied slightly. Some (2 of 14) focused on a specific time, whereas the majority (8 of 14) focused on routine or normalized testing without providing a specific interval (e.g., PHAC, European Union, Central African Republic). Four guidelines cited a lack of data as reason for not providing specific recommendations in the general population (16,28-30).

The guidelines differ regarding whether sufficient evidence exists to formulate testing frequency recommendations in certain populations (2,18,28,29). This is the case for both populations in which there is consistency across guideline recommendations (e.g., MSM and IDU), and for populations in which there was some consistency or no guideline (e.g., incarcerated people).

Guidelines for people diagnosed with STIs commonly recommend routine HIV testing (n=3) or re-testing with each new STI diagnosis (n=2). The emergence of this population in this review highlights STI diagnoses as a potential proxy for high-risk sexual behaviour and identifying individuals at higher risk for HIV infection.

The least frequently mentioned populations included incarcerated individuals, adolescents, individuals with partners of unknown HIV status, and transgender men and women.

Discussion

This review identified 34 guidelines on the frequency of HIV testing. In addition to testing frequency recommendations for high-risk groups, several guidelines also included recommendations for the general population and pregnant women, highlighting a shift from risk-based and targeted-testing (13,24,33,46) to incorporating HIV testing into routine care (2,13,16,18,21,32,39). There was good consensus that testing at least annually is recommended in higher-risk populations.

Most guidelines suggest testing early in pregnancy, and some recommend testing again in the third trimester. There is a lack of consensus on some subgroups (i.e., incarcerated individuals, the general population and individuals diagnosed with other STIs), and there appears to be insufficient evidence to make recommendations for the general population and incarcerated people. Differences in the recommendations for population groups may be a result of the varying types of evidence used to inform the guidelines.

Several factors should be considered when interpreting these results. The strengths of this review include a thorough search strategy, and consistent, objective assessment and data extraction of the studies. There are also a number of limitations. Guidelines that may have been published in languages other than French and English were not included in this review. Of note, there were few published guidelines from Asia and Africa. Since these regions have high HIV incidence and prevalence rates, guidelines from these regions were either not captured by our search parameters or there is a lack of guidance on the optimal intervals for HIV screening and testing in these regions.

Research is needed to examine and critically appraise the evidence for the frequency of HIV testing recommendations in various populations. Specific research could be aimed at identifying the optimal testing interval for the general population, for adolescents, for transgender men and women and for incarcerated people (47,48) as well as the optimal frequency of testing for indigenous peoples, ethnocultural communities with high incidences of HIV and domestic migrant workers.

In summary, HIV screening and testing is an extremely important tool within the continuum of HIV care. Although many guidelines have been developed to identify the ideal frequency of testing for different populations, there are inconsistencies among them and the evidence base for some populations appear to be lacking. Additional evidence to inform the optimal frequency of HIV screening and testing in different populations could strengthen the global efforts to eradicate this disease.

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Conflict of interest

None.

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Appendix 1: Websites searched

The website search was divided into national and international sites and government and non-governmental/stakeholder sites.

Type of website	Organization
National governmental	Public Health Agency of Canada
	Health Canada
	All Canadian provincial and territorial health departments
International governmental	United States Centers for Disease Control and Prevention (CDC)
	European Centre for Disease Prevention and Control (ECDC)
	National Institutes of Health (NIH)
	National Institute for Health and Care Excellence (NICE)
	Haute autorité de santé (HAS)/French National Authority for Health
	United Kingdom Department of Health
	Australian Department of Health
	New Zealand Ministry of Health
	Scottish Intercollegiate Guidelines Network (SIGN)
	Royal Australian College of General Practitioners (RACGP)
	Australasian Society for HIV Medicine (ASHM)
	British Association for Sexual Health and HIV (BASHH)
National non-governmental / stakeholder	Canadian Medical Association
	Canadian AIDS Treatment Information Exchange (CATIE)
	Canadian Task Force on Preventive Health Care (CTFPHC)
	Canadian AIDS Society (CAS)
	Association of Medical Microbiology and Infectious Disease Canada (AMMI Canada)
	Canadian Nurses Association (CNA)
	College of Family Physicians of Canada (CFPC)
	British Colombia Centre for Excellence in HIV/AIDS
	Canadian Treatment Action Council (CTAC)
	Canadian Association of Nurses in HIV/AIDS Care (CANAC)
	Registered Nurses' Association of Ontario (RNAO)
International non-governmental / stakeholder	Joint United Nations Programme on HIV/AIDS (UNAIDS)
	World Health Organization (WHO) (accessed recommendations from Asia and Africa)
	British HIV Association (BHIVA)
	European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)
	United States Preventive Services Task Force (USPSTF)
	International AIDS Society (IAS)
	International Association of Providers of AIDS Care (IAPAC)
	Infectious Diseases Society of America (IDSA)
	Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM)
	European AIDS Clinical Society (EACS)

Appendix 2: Database search strings

MEDLINE search string

Database(s): Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily, Ovid MEDLINE(R) and Ovid OLDMEDLINE(R) 1946 to Present

No.	Searches	Results
1	(hiv or human immunodeficiency or human immune deficiency or vih).ti.	188944
2	exp *HIV Infections/ or exp *HIV/ or exp HIV Infections/ep	246368
3	(hiv positive* or hiv+ or vih positi* or vih+).ti.	161297
4	1 or 2 or 3	272101
5	exp Mass Screening/	106834
6	(frequency or schedule or interval?).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	1348682
7	(guideline? or recommendation? or policy).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]	614880
8	[(Testing or screening) adj5 (frequency or interval or guideline? or recommendation?)].ti,hw.	2834
9	4 and 7 and 8	178
10	4 and 5 and 6 and 7	94
11	9 or 10	265
12	10 not 9	87
13	[(Testing or screening) adj6 (frequency or interval or guideline? or recommendation?)].ti,hw.	4611
14	4 and 7 and 13	238
15	14 not 9	60
16	limit 14 to (yr="2000 -Current" and (english or french)	182

Abbreviation: No., Number

Scopus search string

Scopus OECD (TITLE (hiv OR aids OR vih) AND (TITLE-ABS-KEY (hiv OR aids OR vih) W/6 (testing OR screening) W/6 (frequency OR interval* OR guidelin* OR recommendation))) AND TITLE-ABS-KEY (guidelin* OR recommendation*) PUBYEAR > 2000) AND (TITLE-ABS-KEY (spain OR slovakia OR poland OR portugal OR greece OR germany OR france OR finland OR denmark OR "Czech Republic" OR canad* OR belgium OR austria OR australia OR norway OR "New Zealand" OR netherlands OR mexico OR luxembourg OR korea OR japan OR italy OR iceland OR hungary OR ireland OR "United States" OR great-britain OR "United Kingdom" OR turkey OR switzerland OR sweden)) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "French")) 284

Embase search string

Database(s): Embase 1974 to 2015 September 21

No.	Searches	Results
1	(Spain or Slovakia or Poland or Portugal or Greece or Germany or France or Finland or Denmark or Czech-Republic or Canada or Belgium or Austria or Australia or Norway or New-Zealand or Netherlands or Mexico or Luxembourg or Korea or Japan or Italy or Iceland or Hungary or Ireland or United-States or Great-Britain or Turkey or Switzerland or Sweden).mp.	3697234
2	(hiv or human immunodeficiency or human immune deficiency or vih).ti.	213771
3	exp *Human immunodeficiency virus/	75032
4	Human immunodeficiency virus infection/ep	32614
5	*Human immunodeficiency virus infection/	154397
6	2 or 3 or 4 or 5	258779
7	exp mass screening/	174825
8	(frequency or schedule or interval?).mp.	1558540
9	(guideline? or recommendation? or policy).mp.	917993
10	6 and 7 and 8 and 9	62
11	[(Testing or screening) adj6 (frequency or interval or guideline? or recommendation?)].ti,hw.	6001
12	6 and 9 and 11	313
13	1 and 12	123
14	12 not 13	190
15	limit 12 to [(english or french) and yr="2000 -Current")]	245

Abbreviation: No., Number

Cochrane library search string

"hiv".ti and "interval".ti and "guideline".ti and "recommendation".ti Publicaton Year from 2000 to 2015 (Word variation have been searched)

Canadian electronic library search string

Canadian Electronic Library: Canadian Publishers Collection, Canadian Public Policy Collection, Canadian Health Research Collection

Title: HIV AND all:screening OR Testing

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Outbreak of acute hepatitis B virus infection associated with exposure to acupuncture

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Abstract

Background: The most common risk factors for acute hepatitis B virus (HBV) infection are sexual contact, injection drug use and perinatal, or nosocomial exposure. Acupuncture, used in China for over 2,500 years, has been gaining popularity as an alternative medical therapy in the western world, but when associated with poor infection control practices, is also a risk for blood-borne infections.

Objective: To describe the outbreak investigation following detection of two cases of acute HBV infection associated with acupuncture services from the same provider within four months of symptom onset.

Methods: The outbreak investigation included genotyping of HBV from the identified cases, on-site assessment of the acupuncturist's infection prevention and control practices and chart review of known clients.

Results: Both cases had HBV genotype D1 with an identical fingerprint and both clients had visited the clinic on the same day denying other recent risk exposures. Inspection of the acupuncturist's practice revealed high-risk re-use and inappropriate storage of disposable needles. The Regional Health Authority ordered cessation of clinic practice until infection control measures were remediated. A public service announcement and mailed notifications to clients identified from practitioner records recommended that all clients be tested for HBV, human immunodeficiency virus (HIV) and hepatitis C.

Conclusions: A clear epidemiological linkage of these two acute HBV infections to the same acupuncture clinic, evidence of substandard infection control practice in the clinic and identical HBV molecular and genotypic profiles of the two cases are highly suggestive that contaminated acupuncture needles likely resulted in at least two cases of acute HBV infection. This is the first known reported transmission of HBV from acupuncturists re-use of disposable needles and the first HBV outbreak associated with exposure to acupuncture reported this century in an industrialized country. Increased provider oversight and patient education may prevent future outbreaks.

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Introduction

Two cases of acute hepatitis B virus (HBV) infection were reported to a Regional Health Authority in British Columbia (BC) between July and October, 2014. The previous five-year annual (2009–2013) average of reported acute HBV for this region was 1.2 cases. Case A, a 54 year-old male, was hospitalized for symptoms of acute hepatitis (jaundice, dark urine, right upper quadrant abdominal pain, nausea, malaise, fatigue and loss of appetite) in July, 2014. Case B, a 53 year-old female, visited the hospital emergency room in October 2014, 13 days after onset of a similar clinical illness. Both were diagnosed with acute HBV infection based on clinical history and serology. Enhanced Hepatitis Strain Surveillance System (EHSSS) case reports (1,2) identified acupuncture as the only significant risk factor for both clients, who notably recalled receiving services on the same day from a traditional Chinese medicine acupuncture clinic (Clinic A) within four months of symptom onset.

Data on hepatitis C virus (HCV) infection in Canada is based on mandatory reporting of cases to the Canadian Notifiable Disease Surveillance System (CNDSS) by provincial and territorial health authorities. However, CNDSS has a limited ability to systematically detect incident infections. Therefore enhanced hepatitis strain surveillance involving the collection of additional epidemiological and laboratory information was undertaken to improve the yield of incident cases (2,3). BC continued using the EHSSS HBV case reporting forms after the EHSSS was

discontinued in 2012 (1). An astute public health nurse identified the common exposure while interviewing the second case. Based on these findings a HBV outbreak was declared and an investigation initiated.

Acupuncture, used in China for over 2,500 years, has been gaining popularity as an alternative medical therapy in the western world over the past two decades (4). A review of English-language publications found six HBV outbreaks associated with acupuncture reported between 1977 and 1999 (5). Most HBV outbreaks were due to patient-to-patient transmission and only one outbreak was reported from provider-to-patient transmission (6,7). HBV infection is a rare complication in industrialized countries where licensure of acupuncturists is generally required.

BC rates of acute HBV have been less than one per 100,000 population since 2007 and lower than the national average since universal childhood HBV vaccine was introduced. Cases occur in adults 25 years of age and older and more frequently in males than females (8-10). HBV is transmitted through exposure to infectious blood and body fluids, most commonly acquired via sexual contact, injection drug use, perinatal, or nosocomial exposure (8). The incubation period usually ranges from 45-180 days with an average of 60–90 days (10). Acute infection can be severe, resulting in acute hepatic necrosis, however the majority of adult cases (50–70%) are asymptomatic and remain undetected. The case-fatality-rate is approximately one percent. The risk of developing chronic infection is highest (20–50%) in children five years and younger, decreasing to one to ten percent in older age groups (8,11).

The objective of this report is to describe the epidemiological, genetic and public health investigation of this outbreak.

Methods

The outbreak investigation was designed to assess the hypothesis that acupuncture was the probable source of transmission, identify those at risk, undertake active case-finding and prevent further spread. The investigation included genotyping and molecular fingerprinting of HBV isolates from the identified cases, a chart review of Clinic A clients, on-site inspection of the practitioner's infection prevention and control practices and review of acute HBV and HCV cases reported in the region over the previous 10 years.

There was insufficient information to determine a risk period for potential practice-associated nosocomial blood-borne infection at Clinic A; therefore, the time frame chosen for potential cases extended back to 2004 when the clinic opened, until it closed in 2014.

The following case definition, adapted from BC provincial guidelines was used for this outbreak: Hepatitis B surface antigen (HBsAg) and immunoglobulin M antibody to hepatitis B core antigen (anti-HBc IgM) positive in the context of a compatible clinical history (8) and epidemiologic link to Clinic A between January 2004 and November 14, 2014.

Results

A review of acute HBV and HCV cases reported in the Regional Health Authority over the past 10 years was conducted to determine if there were any additional cases linked to Clinic A. The majority of cases were diagnosed prior to the establishment of the EHSSS and as such, efforts were made to contact cases by telephone to determine if they had been exposed to acupuncture. Interviews of acute HBV cases and reviews of acute HBV and HCV cases reported in the region did not identify additional acute hepatitis cases linked to Clinic A.

The two cases were in a male and a female, 54 and 53 years of age respectively, both residing in the Regional Health Authority. The only HBV risk exposure that both cases reported was receiving acupuncture at the same traditional Chinese medicine clinic. Both known cases attended this clinic between May and June 2014 and reported receiving acupuncture on the same day in May. Phylogenetic analysis by the National Microbiology Laboratory revealed that both cases had HBV genotype D1 with an identical S-gene "fingerprint" which was highly suggestive of a common source of infection. The acupuncture practitioner had no serologic evidence of prior or current HBV infection.

Clinic A's chart documentation was limited to the first appointment, with no subsequent documentation in patient charts of dates for follow-up appointments. Treatment notes were rare and all had dates missing.

A joint inspection of the acupuncture clinic conducted by a Regional Health Authority Medical Health Officer and the College of Traditional Chinese Medicine Practitioners and Acupuncturists of BC Registrar (the provincial regulator) revealed unhygienic conditions and poor infection control practices. Treatment rooms lacked sinks with hot and cold running water and easily cleanable surfaces. Standardized procedures for disinfection, hand washing and separation of clean and dirty fields were not practiced. Of greatest significance was the finding of single-use acupuncture needles stored in open bowls, open needle packaging and absence of sharps disposal containers, suggesting a high probability of needle re-use.

Given the risks identified during the inspection, the College of Traditional Chinese Medicine Practitioners and Acupuncturists provided notice of immediate temporary license suspension on November 14, 2014 and the Regional Health Authority ordered the practitioner to cease practice on November 15, 2014. There was insufficient information to determine the duration of these unsafe practices given the absence of a previous inspection or monitoring, which led to the determination that all patients of Clinic A were potentially at risk of nosocomial exposure to blood-borne pathogens.

Notifications were mailed to 1,374 of the 1,516 clients identified from clinic intake forms who had valid address information. An estimated 1,200 (79%) of clients received notifications (174 notifications were returned as non-deliverable). A public service announcement was issued by the Regional Health Authority on November 20, 2014, recommending that all clients who had ever received services from Clinic A be tested for HBV, HIV and HCV. Anticipating public concern, a call centre staffed

by Regional Health Authority public health nurses was established. The centre received 114 calls: 103 were from concerned clients or their families and 87 of these individuals were referred to their family doctor for testing. The total number of clients who went for testing is unknown because negative infectious disease test results are not reported to public health in BC.

Once general hygiene and infection control measures were remediated, the College of Traditional Chinese Medicine Practitioners and Acupuncturists lifted the registrant's practice suspension and the Regional Health Authority amended the Order on November 26, 2014, permitting conditional resumption of clinical services at Clinic A, subject to satisfactory findings in ongoing inspections and monitoring.

Discussion

Contaminated acupuncture needles were identified as the likely cause of two cases of acute HBV infection, based on the epidemiologic evidence and identical HBV molecular and genotypic profiles. To our knowledge, this is the first known reported transmission of HBV from acupuncturists re-use of disposable needles and the first HBV outbreak associated with exposure to acupuncture reported this century in an industrialized country.

Access to phylogenetic analysis was a key strength of this investigation as it provided strong evidence of a common source of infection. The investigation was limited by its inability to determine a denominator of the number of acupuncture clinic clients who underwent the recommended testing.

HBV infection is vaccine-preventable. Routine HBV immunization programs in BC have targeted infants and children and have resulted in the elimination of acute HBV within the immunized age cohort (12). Recommendations for adult HBV immunization are based on acquisition risk factors, such as occupation or close contact with a case of acute or chronic HBV (8,13). As such, the majority of adults born prior to 1982 remain susceptible to infection with HBV. More recently, receiving acupuncture treatment from a licensed provider is not generally considered a risk, based in large part on the expectation that routine infection control precautions and practices are in place and consistently followed (14,15).

Publications of previous acupuncture-associated HBV outbreaks recommended prevention through enhanced provider regulations, provider training and sterilization or use of single-use needles as methods to eliminate the potential of future outbreaks (16-18).

Most industrialized countries regulate acupuncturists' practice directly with health practitioner legislation or indirectly by broad legislation governing the use of needles and other "sharps". In North America, related legislation is enacted at the state or provincial level (19,20). The College of Traditional Chinese Medicine Practitioners and Acupuncturists was established in 1996 under the BC *Health Professions Act* to regulate the practice of traditional Chinese medicine and acupuncture. Other health professions may provide acupuncture in accordance with requirements of their regulating bodies. Annual practitioner registration under the provincial *Health Professions Act* requires attestation that by-laws related to such matters as infection control practices are being followed. Compliance inspection or monitoring is not routinely undertaken by the College of Traditional Chinese Medicine Practitioners and Acupuncturists unless it becomes evident that a registrant poses a public health risk (19). The acupuncturist in this instance was licensed with the College of Traditional Chinese Medicine Practitioners and Acupuncturists as a registrant in good standing, but failed to comply with practice standards and ongoing education requirements.

Licensing requirements of North American traditional Chinese or Oriental medicine colleges include satisfactory completion of training at an accredited institute (19,20). Infection control practices to prevent transmission of blood-borne pathogens through the use of needles are a fundamental component of training and certification examinations for all regulated health professionals. A multi-media public information campaign launched by the BC Health Regulators in September 2014 used transit shelter advertisements, articles in community papers, television closed-captioning messages and a new website which emphasized the importance of consulting licensed health professionals in good standing with their regulating body (15,21). Proactive public education could also promote patient awareness of the importance of appropriate use and disposal of single-use needles and other infection prevention and control measures by health professionals during health care encounters.

Acupuncture, when performed in accordance with proper infection control procedures, is safe (14). Exposure to HBV is a risk formerly associated with the improper sterilization of reusable needles (16,17). Single-use disposable needles are the current practice standard in the majority of industrialized countries (22). The clean needle technique is a term used by licensing agencies to define required equipment and processes to provide acupuncture. Developed specifically to prevent transmission of HBV by acupuncturists, clean needle technique requires the use of sterile, single-use needles for acupuncture and confirmation that each needle used has been discarded in an appropriate disposal container (22).

Conclusion

Based on the epidemiologic investigation and identical molecular HBV genotypic profiles, re-use of contaminated acupuncture needles intended for single-use likely resulted in at least two cases of acute HBV infection. The incubation period for HBV usually ranges from 45–180 days (11) with an average of 60–90 days. Exposure ended on November 14, 2014, however given that adults may develop subclinical chronic HBV infection (11), identification of future cases associated with this outbreak remains possible.

To our knowledge, this is the first HBV outbreak associated with exposure to acupuncture reported this century in an industrialized country despite existing regulations regarding safe infection control practices, requirements for extensive provider training and use of disposable needles. The coordinated response between the Regional Health Authority and the College of Traditional Chinese Medicine Practitioners and Acupuncturists ended the potential for transmission of HBV and other blood-borne pathogens from that clinic. Ongoing

vigilance by public health and the College of Traditional Chinese Medicine, ensuring providers are meeting practice standards and actively educating consumers are critical to preventing future outbreaks.

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Conflict of interest

None.

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2016 Summer Olympic and Paralympic Games in Rio de Janeiro, Brazil

Source: Government of Canada. **Travel Health Notices 2016. Summer Olympic and Paralympic Games in Rio de Janeiro, Brazil.** Updated: June 14, 2016. https://travel.gc.ca/travelling/health-safety/travel-health-notices/153.

Level 2: Practise special precautions: The 2016 Summer Olympic and Paralympic Games will be hosted in Rio de Janeiro, Brazil from August 5 to August 21 and September 7 to September 18 respectively. Due to the ongoing outbreak of Zika virus infection in Brazil, the Public Health Agency of Canada recommends that travellers practise special precautions to help ensure a healthy trip when attending the 2016 Summer Olympic and Paralympic Games. Experts now agree that the Zika virus infection is a cause of microcephaly (abnormally small head) in newborns and of Guillian-Barre Syndrome (a neurological disorder).The Agency recommends that pregnant women and those planning a pregnancy should avoid travel to the Olympics. All travellers should protect themselves from mosquito bites.

Before your trip:

- Consult a health care provider or visit a travel health clinic, preferably six weeks before you travel
- Review travel health recommendations for Brazil
- Get vaccinated
- Purchase travel health insurance
- Pack a travel health kit
- Register with ROCA (Registration of Canadians Abroad)

Special precautions for Zika virus:

- Pregnant women and those planning a pregnancy should avoid travel to the Olympics.
- Travellers should protect themselves from mosquito bites at all times, as the Zika virus is transmitted by a mosquito that can bite in daylight and evening hours.
- Most people who have Zika virus illness will have mild symptoms. If you are pregnant, or you have underlying medical conditions, or you develop more serious symptoms should see a health care provider and tell them where you have been travelling or living.

During your trip:

- Practise safe food and water precautions
- Practise insect bite prevention
- Protect yourself from animal-related diseases (e.g., rabies)
- Protect yourself from HIV/AIDS and other sexually transmitted infections (STIs)
- Be alert to crime
- Pay attention to the weather (e.g., stay hydrated)

Drive with caution: The leading cause of death among international travellers is traffic accidents.

If you feel sick during your trip: See a health care provider if you feel very unwell, especially if you have a fever.

After your trip: If you are sick after you return, see a health care provider and tell them where you have travelled and if you are pregnant.

The risk of dengue for non-immune foreign visitors to the 2016 summer olympic games in Rio de Janeiro, Brazil

Source: Ximenes R, Amaku M, Lopez LF, Coutinho FA, Burattini MN, Greenhalgh D, Wilder-Smith A, Struchiner CJ, Massad E. **The risk of dengue for non-immune foreign visitors to the 2016 summer olympic games in Rio de Janeiro, Brazil.** BMC Infect Dis. 2016 Apr 29;16(1):186. doi: 10.1186/s12879-016-1517-z.

BACKGROUND: Rio de Janeiro in Brazil will host the Summer Olympic Games in 2016. About 400,000 non-immune foreign tourists are expected to attend the games. As Brazil is the country with the highest number of dengue cases worldwide, concern about the risk of dengue for travelers is justified.

METHODS: A mathematical model to calculate the risk of developing dengue for foreign tourists attending the Olympic Games in Rio de Janeiro in 2016 is proposed. A system of differential equation models the spread of dengue amongst the resident population and a stochastic approximation is used to assess the risk to tourists. Historical reported dengue time series in Rio de Janeiro for the years 2000-2015 is used to find out the time dependent force of infection, which is then used to estimate the potential risks to a large tourist cohort. The worst outbreak of dengue occurred in 2012 and this and the other years in the history of Dengue in Rio are used to discuss potential risks to tourists amongst visitors to the forthcoming Rio Olympics.

RESULTS: The individual risk to be infected by dengue is very much dependent on the ratio asymptomatic/symptomatic considered but independently of this the worst month of August in the period studied in terms of dengue transmission, occurred in 2007.

CONCLUSIONS: If dengue returns in 2016 with the pattern observed in the worst month of August in history (2007), the expected number of symptomatic and asymptomatic dengue cases among tourists will be 23 and 206 cases, respectively. This worst case scenario would have an incidence of 5.75 (symptomatic) and 51.5 (asymptomatic) per 100,000 individuals.

Rapid Risk Asssesment: The risk of Zika virus to Canadians

Source: Public Health Agency of Canada. **Rapid Risk Assessment: The risk of Zika virus to Canadians**. http://dev.healthycanadians.gc.ca/publications/diseases-conditions-maladies-affections/risks-zika-virus-risques/index-eng.php (Update summary).

- What's new: Several isolated instances of unusual transmission have now been documented; an asymptomatic sexual transmission (likely male-to-female), a likely female-to-male transmission, and a person-to-person transmission without sexual contact. All of these are thought to be rare modes of transmission, requiring particular circumstances to be realized, but these events demonstrate that they are possible.
- For most infected travellers, ZIKV will have little or no health impact (Low impact, with medium confidence). However, severe outcomes (e.g., Guillain Barré Syndrome) might occur in some affected individuals (High impact, high confidence).
- Based on recent evidence, we assess that there could be Very High impact (with high confidence) to the unborn children of women who become infected with ZIKV while pregnant.
- Canadian recommendations for the prevention and management of ZIKV-disease have been developed by the Committee to Advise on Tropical Medicine and Travel.

Note: This summary reflects the July 2016 update. Rapid Risk Assesments are updated on a regular basis and will be posted at the website above.

Correction

CORRECTION FOR CCDR 2016;42(7) pdf
CCDR editorial team

In the pdf of the July 2016 issue of CCDR, the original picture on the cover was found to be incorrect. The picture was replaced by a photo of a boy with measles from the open-access Public Health Image Library of the United States Centers for Disease Control and Prevention. The change was made July 27, 2016. No changes were needed for the web version of the issue.

CCDR

CANADA COMMUNICABLE DISEASE REPORT

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