



STBBI IN KEY POPULATIONS

SCOPING REVIEW

Sexually transmitted infections
testing in Indigenous populations **385**

SURVEY REPORT

Risk factors of STBBI in
Canadian federal prisons **394**

SURVEILLANCE

Assessment of HIV pre-exposure
prophylaxis in Nova Scotia **417**

CCDR

CANADA COMMUNICABLE DISEASE REPORT

The *Canada Communicable Disease Report* (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authoritative and practical information on infectious diseases to clinicians, public health professionals, and policy-makers to inform policy, program development and practice.

The CCDR Editorial Board is composed of members based in Canada, United States of America, European Union and Australia. Board members are internationally renowned and active experts in the fields of infectious disease, public health and clinical research. They meet four times a year, and provide advice and guidance to the Editor-in-Chief.

Editorial Team

Editor Emeritus

Michel Deilgat, CD, BA, MD, MPA,
MEd, MIS (c), CCPE

Associate Scientific Editors

Rukshanda Ahmad, MBBS, MHA
Julie Thériault, RN, BScN, MSc(PH)
Peter Uhthoff, BASc, MSc, MD

Managing Editor

Laura Rojas Higuera, (H) BA Psy (c)

Production Editor & Graphic Designer

Katy Keeler, BA (Hons)

French Editor

Pascale Plante-Defoy, BA (Trad.)

Web Content Manager

Jessica Corey Perkins

Copy Editors

Caroline Ethier
Anton Holland
Laura Stewart-Davis, PhD

Communications Advisor

Chantal Skraba, BA, OCGC

First Nations & Indigenous Advisor

Sarah Funnell, BSc, MD, MPH, CCFP,
FRCPC

Junior Editor

Kanika Sarwal, BHSc, MSc, PhD (C)
Siham Hassan, BHSc, MPH (c)

Indexed

in PubMed, Directory of Open Access
(DOAJ)/Medicus

Available

in PubMed Central (full text)

Contact the Editorial Office

ccdr-rmtc@phac-aspc.gc.ca
613.301.9930

Photo credit

The cover image represents a packaged condom in a pair of jeans. The image was taken from [Adobe Stock #1290914952](#)

CCDR Editorial Board Members

Heather Deehan, RN, BScN, MHSc
Vaccine Distribution and Logistics,
Public Health Agency of Canada,
Ottawa, Canada

Jacqueline J Gindler, MD
Centers for Disease Control and
Prevention, Atlanta, United States

Rahul Jain, MD, CCFP, MScCH
Department of Family and Community
Medicine, University of Toronto and
Sunnybrook Health Sciences Centre
Toronto, Canada

Kenneth Scott, CD, MD, FRCPC
Internal Medicine and Adult Infectious
Diseases
Canadian Forces Health Services
Group (Retired), Ottawa, Canada
Public Health Agency of Canada
(Retired), Ottawa, Canada



TABLE OF CONTENTS

ADVISORY COMMITTEE STATEMENT

Summary of the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) Statement: Recommendations on Screening for *Chlamydia trachomatis* and *Neisseria gonorrhea* in Pregnancy, 2023

S Shanmugasagaram, U Auguste, N Santesso, J Bullard, G Ogilvie, MH Yudin, A-C Labbé

378

SCOPING REVIEW

Barriers and facilitators to sexually transmitted infections testing in Indigenous populations: A scoping review

B Odia, C Sarbu, A Caputo

385

SURVEY REPORT

Risk factors of sexually transmitted and blood-borne infections and access to harm reduction in Canadian federal prisons

M-P Gendron, K Wanamaker, J Smith, S Thompson, D Filoso, W Mahboob, S Johnson

394

Findings from the Tracks survey on sexually transmitted and blood-borne infections and related factors among Two-Spirit people, gay, bisexual, trans and queer men and non-binary people (2S/GBTQ+) in Canada, 2024

M Butler, N Lachowsky, B Klassen, E Wong, H Apelian, T Curtis, K Rohani, A Amato, C Card, S Kiazzyk, J Cox, J Aho

401

INFOGRAPHIC

HIV PrEP Knowledge, Interest and Uptake

Public Health Agency of Canada

416

SURVEILLANCE

An assessment of HIV pre-exposure prophylaxis access in Nova Scotia

T Wahba, J Kancir, MN Wilson, A Robinson, D Gibson, K O'Brien

417

Invasive group A streptococcal disease surveillance in Canada, 2023

AR Golden, A Griffith, GJ Tyrrell, JV Kus, A McGeer, M-C Domingo, JM Grant, J Minion, P Van Caeseele, C Balthazar, D Haldane, Y Yu, X Ding, L Steven, J McFadzen, C Primeau, I Martin

427



Summary of the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) Statement: Recommendations on Screening for *Chlamydia trachomatis* and *Neisseria gonorrhoea* in Pregnancy, 2023

Shamila Shanmugasagaram^{1*}, Ulrick Auguste¹, Nancy Santesso², Jared Bullard³, Gina Ogilvie^{4,5}, Mark H Yudin^{6,7}, Annie-Claude Labbé^{8,9}

Abstract

Background: *Chlamydia trachomatis* and *Neisseria gonorrhoea* are the most common bacterial sexually transmitted infections globally and the most common of the reported sexually transmitted infections in Canada. Undetected and untreated infections in pregnant women/pregnant individuals could lead to adverse pregnancy outcomes and risk of ophthalmia neonatorum and neonatal pneumonia in neonates.

Objective: In 2023, the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) updated the Public Health Agency of Canada's (PHAC) recommendations on prenatal screening for *C. trachomatis* and *N. gonorrhoea* to optimize the prevention of adverse pregnancy outcomes, as well as ophthalmia neonatorum and neonatal pneumonia.

Methods: A health technology assessment and a systematic review were undertaken. A decision-analytic model was used due to lack of comparative studies on the effects of screening strategies on adverse pregnancy outcomes, ophthalmia neonatorum and neonatal pneumonia that met the inclusion criteria. The Working Group used the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach to develop the recommendations. The recommendations were peer-reviewed, voted by the NAC-STBBI and shared with stakeholder groups and Canadian provinces and territories.

Results: Screening all pregnant women/pregnant individuals at first and third trimesters and screening high-risk individuals at first trimester and all at third trimester strategies are cost-effective regardless of the different assumptions in non-high-risk and high-risk settings. Overall, testing in pregnancy is acceptable to pregnant women/pregnant individuals, but there may be some feelings of stigma when the offered testing is perceived to be targeted.

Conclusion: The relevant PHAC STBBI guides were updated in 2023 with the NAC-STBBI recommendations. This work could be adopted or adapted by guideline development groups in Canadian provinces and territories, as well as in other countries, as appropriate, considering factors that are specific to the settings.

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).



Affiliations

¹ Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, Ottawa, ON

² McMaster University, Hamilton, ON

³ University of Manitoba, Winnipeg, MB

⁴ British Columbia Women's Hospital and Health Centre, Vancouver, BC

⁵ University of British Columbia, Vancouver, BC

⁶ St. Michael's Hospital, Toronto, ON

⁷ University of Toronto, Toronto, ON

⁸ Hôpital Maisonneuve-Rosemont, Montréal, QC

⁹ Université de Montréal, Montréal, QC

*Correspondence:

shamila.shanmugasagaram@phac-aspc.gc.ca

Suggested citation: Shanmugasagaram S, Auguste U, Santesso N, Bullard J, Ogilvie G, Yudin MH, Labbé A-C. Summary of the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) Statement: Recommendations on Screening for *Chlamydia trachomatis* and *Neisseria gonorrhoea* in Pregnancy, 2023. Can Commun Dis Rep 2026;52(10):378–84. <https://doi.org/10.14745/ccdr.v52i10a01>

Keywords: chlamydia, gonorrhea, pregnancy, antenatal, prenatal, screening, testing



Introduction

The Public Health Agency of Canada (PHAC) provides national leadership for the prevention and control of sexually transmitted and blood-borne infections (STBBI) through the development of evidence-based public health guidelines (1). Starting in 2019, the recommendations in these guidelines (formerly the Canadian Guidelines on Sexually Transmitted Infections) are being developed by the National Advisory Committee on STBBI (NAC-STBBI), an external advisory body of subject matter experts from across Canada using a rigorous, systematic and transparent process (*unpublished document, Shanmugasagaram S/Public Health Agency of Canada, Methods Manual for the Public Health Agency of Canada Sexually Transmitted and Blood-Borne Infections Recommendations, 2019*) (1,2).

Chlamydia trachomatis (CT) and *Neisseria gonorrhoea* (NG) are the most common bacterial sexually transmitted infections (STIs) globally (3) and the most frequent of the reported STI in Canada (4). Between 2010 and 2019, rates of reported cases of CT infection increased by 33.1% (94,716–139,386 cases; 278.5–370.8 per 100,000 population) and those of NG infection increased by 181.7% (11,381–35,443 cases; 33.5–94.3 per 100,000 population) in Canada (4,5). *Chlamydia trachomatis* and NG infections are often asymptomatic in females (6). Undetected and untreated infections in pregnant women/pregnant individuals (PWPI) could lead to pregnancy-related complications, sexual transmission, and transmission to neonates in the perinatal period (7,8). Untreated CT infection in the birthing parent carries a 30%–50% risk of ophthalmia neonatorum and a 10%–20% risk of CT pneumonia (9) and NG infection in the birthing parent carries a 30% risk of the neonate developing ophthalmia neonatorum (10,11).

In 2016, the Canadian Paediatric Society posted a position statement (reaffirmed in January 2021) advocating for the enhancement of programs for routine screening and treatment of pregnant women (12). Canadian studies show that prenatal screening rates for CT and NG infections are suboptimal with approximately 15%–22% of pregnant persons not being screened at least once for these infections (13–15). Given the increasing rates of reported cases of CT and NG in the general population and suboptimal rates of prenatal screening for CT and NG in Canada, in 2023 the NAC-STBBI reviewed and updated PHAC's previous recommendations (16,17) on prenatal screening for CT and NG infections to optimize the prevention of adverse pregnancy outcomes, as well as ophthalmia neonatorum and neonatal pneumonia. A summary of the guideline (18) is provided herein. This work could be adopted or adapted by guideline development groups in Canadian provinces and territories, as well as in other countries, as appropriate, considering factors that are specific to the settings.

Methods

After prioritizing the topic for recommendation development, a Working Group composed of experts from NAC-STBBI was formed to develop the recommendations. The Working Group developed the questions and an external evidence review team prepared the protocol. Working Group members and a patient group rated the relative importance of outcomes (both beneficial and harmful) for decision-making, based on the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach (19). The external evidence review team conducted a health technology assessment consisting of a clinical review, an economic analysis and a review of patients' perspectives and experiences (20,21). The outcomes of importance considered for the development of the recommendations are as follows:

- Number and percent of NG and/or CT infections detected at screening (including new or repeat infections)
 - Surrogate outcome: number of females treated for infection
 - Surrogate outcomes: true positives and false negatives and false positives and true negatives
- Adverse obstetric outcomes (preterm and still births)
- Number of females declining screening
- Anxiety/fears
- Number and percent of ophthalmia neonatorum cases
- Number and percent of neonatal pneumonia cases

The eligibility criteria for the evidence reviews performed to develop the recommendations included studies conducted in countries comparable to Canada's healthcare context. In the absence of published literature evidence, the Working Group considered other types of evidence, including surveillance and epidemiology information and a decision-analytic model to support the development of the recommendations. The external evidence review team constructed a decision-analytic model of prenatal screening for NG and/or CT infections to predict the outcomes for PWPI and their newborns in Canada (20). The model evaluated the impact of strategies for screening all or only high-risk PWPI at first, second and/or third trimesters and at labour, over approximately one year.

Published literature and clinical experts in obstetrics and gynecology, as well as in adult and paediatric infectious diseases informed the structure and inputs. Given uncertainties of some model parameters and assumptions in the base-case analysis, sensitivity analyses were performed, assuming a lifetime horizon, higher prevalence of infections in PWPI, higher rates of transmission to newborns, lower costs of tests, and greater risk of poor outcomes in PWPI with NG or CT. Outcomes included neonatal CT or NG infections, adverse outcomes to PWPI,



preterm births, quality-adjusted life years (QALY) and costs. Further details on the decision-analytic model considerations are available (see **Appendix**, Supplemental material, List S1) (22,23). A systematic review on acceptability, feasibility, equity and resource use of prenatal screening for NG and CT was also conducted to support the development of the recommendations (24).

The GRADE Evidence to Decision framework was drafted to help the Working Group use evidence in a structured and transparent way to develop the recommendations (19). The Working Group assessed the balance between benefits and harms, patient values and preferences, resource use, equity, acceptability and feasibility using the GRADE approach (19). The Working Group also drafted the recommendations using the GRADE wording for direction and strength (19,25). The NAC-STBBI Statement, including details such as the evidence considered and the recommendations, was prepared. The recommendations were reviewed by external peer-reviewers (outside of NAC-STBBI) with expertise in obstetrics and gynaecology and adult and paediatric infectious diseases, voted by the NAC-STBBI members and shared with Canadian provinces and territories and relevant stakeholder groups. The NAC-STBBI Statement was published on PHAC's website in May 2023 (18). The relevant PHAC STBBI guides were updated in 2023 with the NAC-STBBI recommendations.

Results

Systematic reviews of the benefits, harms, feasibility, acceptability, resource use and the impact on equity of different screening strategies for NG and CT screening in PWPI were conducted (20,21,24). Given the lack of published literature directly comparing different screening strategies, a decision-analytic model specific to the Canadian setting was used to inform the recommendations. **Table 1** shows a summary of the evidence on the effect of select screening strategies on important outcomes to PWPI and their newborns. Other strategies were also considered during the recommendation development process (see Appendix, Supplemental material, Table S1).

Evidence suggests that, as screening is added to each trimester (whether screening all individuals or high-risk groups, i.e., younger than 25 years), there are fewer number of newborns with infection; however, providing screening at the third trimester (in particular for all) may reduce the numbers the most compared to adding screening at the first or second trimester(s). Although the sensitivity and specificity of the assays for the detection of NG and CT are high, there is still a risk of false negative (resulting in a missed infection at that trimester) and false positive (resulting in treatment of individuals who do not have an infection) results; however, the evidence from the model suggests that there are little to no differences in those numbers between the different strategies.

While the absolute cost differences are small, there are differences in QALY (i.e., the cost per additional benefit of a strategy compared to another strategy) with high-risk screening. When reviewing most strategies across the analyses, the evidence suggests that adding screening at more trimesters and screening all at a trimester was more costly and provided fewer benefits. Strategy 2 (screening all at first and third trimester) and Strategy 3 (screening high-risk individuals at first trimester and all at third trimester) may be cost-effective (more health benefit at a lower cost) regardless of the different assumptions in non-high-risk and high-risk settings. Although the costs per additional benefit were lower when screening all only in the third trimester (Strategy 4), there were more infections than with Strategy 2 or Strategy 3. Data for Strategy 1, where all PWPI are screened at first and third trimesters and high-risk individuals are screened at second trimester, may still be cost-effective but the cost per additional benefit was remarkably higher than the other strategies. Adding screening to the second trimester (e.g., Strategy 6 versus Strategy 5), did not reduce newborn infections and was still costly.

There is some evidence available about the feasibility and acceptability of screening for NG and CT infections in PWPI (24). Overall, testing in pregnancy may be acceptable to PWPI (26), but there may be some feelings of stigma when they are offered testing and it is perceived to be targeted (27). This could be reduced by offering universal testing (26).

Recommendations

For the purpose of these recommendations (18), screening is defined as testing asymptomatic individuals. The following recommendations apply to screening of asymptomatic PWPI. These recommendations do not replace recommendations to test and treat PWPI who have symptoms compatible with NG or CT infection or after sexual contact with a person known to have a NG or CT.

The NAC-STBBI suggests screening all PWPI for NG and CT during the first trimester or at the first antenatal visit, and again in the third trimester (conditional recommendation; low certainty evidence).

The NAC-STBBI suggests screening PWPI at the time of labour for NG and CT in any of the following situations (conditional recommendation; low certainty evidence):

- No prenatal screening has occurred (no valid results available at the time of labour)
- Third trimester screening has not occurred
- A positive test result was obtained for NG or CT during pregnancy without appropriate follow-up, including treatment and a test-of-cure

**Table 1: Estimated outcomes, cost and cost-effectiveness of different strategies to screen for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in pregnant women/pregnant individuals in Canada**

Effects of strategies	Screening strategies: Pregnant women/pregnant individuals screened (or not) at each trimester (T)							
	1	2 New recommendation	3	4	5 Strategy in some settings	6	7	8
	T1: All T2: Only HR ^a T3: All Labour ^b	T1: All T2: None ^c T3: All Labour	T1: Only HR T2: None T3: All Labour	T1: None T2: None T3: All Labour	T1: All T2: Only HR T3: Only HR Labour	T1: All T2: None T3: Only HR Labour	T1: All T2: None T3: None Labour	T1: None T2: None T3: None Labour
Adverse infant and obstetric outcomes over 1 year								
Ophthalmia neonatorum								
Cases per 100,000 PWPI	110 ^d	110	124	128	148	149	170	357
Cases per 400,000 PWPI ^e	440 ^d	440	496	512	592	596	680	1,428
CT pneumonia								
Cases per 100,000 PWPI	40 ^d	40	46	48	53	53	62	132
Cases per 400,000 PWPI ^e	160 ^d	160	184	192	212	212	248	528
Preterm, extremely preterm and still births^f								
Cases per 100,000 PWPI	8,514 ^d	8,514	8,521	8,522	8,519	8,519	8,521	8,567
Cases per 400,000 PWPI ^e	34,056 ^d	34,056	34,084	34,088	34,076	34,076	34,084	34,268
False results obtained (%)								
False positives leading to unnecessary treatment	N/A	4.14%	4.11%	4.10%	4.13%	N/A	N/A	4.01%
False negatives leading to missed infections	N/A	0.09%	0.14%	0.16%	0.12%	N/A	N/A	0.18%
Total cost per 100,000 PWPI over 1 year	\$565,722,366	\$565,220,444	\$563,302,330	\$562,780,969	\$563,823,557	\$563,321,635	\$562,812,279	\$561,633,682
Cost-effectiveness per 100,000 PWPI								
Over 1 year (baseline risk for NG/CT in the overall population)	\$214M/QALY more than Strategy 2	\$65M/QALY more than Strategy 3	\$63M/QALY more than Strategy 4	\$3M/QALY more than screening only HR	More costly, less effective than other strategies	More costly, less effective than other strategies	Less costly, less effective than other strategies	Reference
Over 1 year (higher prevalence and risk for NG/CT in the overall population)	Likely more costly, less effective than less screening	\$7M/QALY more than only screening all at T3	More costly, less effective than other strategies	\$481K/QALY more than Strategy 7	More costly, less effective than other strategies	More costly, less effective than other strategies	\$66K/QALY more than Strategy 8	Reference
Over lifetime (baseline risk for NG/CT in the overall population)	Likely more costly, less effective than less screening	\$11K/QALY more than Strategy 3	\$10K/QALY more than Strategy 4	Reference	More costly, less effective than other strategies	More costly, less effective than other strategies	More costly, less effective than other strategies	More costly, less effective than other strategies

Abbreviations: CT, *Chlamydia trachomatis*; HR, high risk (PWPI less than 25 years old); NG, *Neisseria gonorrhoeae*; N/A, not available; PHAC, Public Health Agency of Canada; PWPI, pregnant women/pregnant individuals; QALY, quality-adjusted life year; T, trimester; T1, first trimester; T2, second trimester; T3, third trimester

^a The group with high risks of NG and CT infection was modeled as a group <25 years old with associated risks

^b All strategies include screening of 50% of PWPI at labour and delivery when no prenatal screening is performed

^c None refers to no screening for asymptomatic PWPI

^d Estimates are not available from the model and are based on Strategy 2

^e In 2019, there were 372,038 live births in Canada (23). Estimates were rounded to 400,000 to calculate ophthalmia neonatorum and CT pneumonia

^f Preterm, extremely preterm and still births based on exploratory analysis assuming risk is greater in PWPI who have NG and CT during pregnancy

Note: In the table, starting from Strategy 8 and moving towards Strategy 1 shows that, as screening is added to each trimester, whether screening all individuals or high-risk groups (i.e., less than 25 years), there is a reduction in number of infants with ophthalmia neonatorum and CT pneumonia



Discussion

Screening all PWPI at first and third trimesters and screening high-risk individuals at first trimester and all at third trimester strategies are cost-effective regardless of the different assumptions in non-high-risk and high-risk settings. Overall, testing in pregnancy is acceptable to PWPI, but there may be some feelings of stigma when the offered testing is perceived to be targeted.

The updated (in 2023) recommendations (18) are particularly important in settings where neonatal ocular prophylaxis for the prevention of ophthalmia neonatorum is not part of the current practice. These recommendations do not replace recommendations to test and treat PWPI who have symptoms compatible with NG or CT infection or after a sexual contact with a person infected by NG or CT.

Evidence suggests that screening all individuals could remove the fear of stigmatization and discrimination and normalize the testing practice (26). In addition, the Working Group agreed that screening all PWPI may be more practical than clinicians' efforts to gather risk factors from PWPI and partners. Further, co-infection rates for NG and CT are high (28,29) and combined testing for these STIs could contribute to the acceptability and feasibility of screening.

In settings where there are limited laboratory capacities, priority could be given to screening PWPI with higher risk of those infections during the first trimester (or at the first antenatal visit) and screening all PWPI in the latter part of the third trimester. When identifying PWPI at high-risk for NG and CT infection, risks similar to individuals younger than 25 years old could be used. For positive test results, healthcare providers could continue explaining to PWPI the risk of false positive tests.

Limitations

For the Canada's Drug Agency (formerly Canadian Agency for Drugs and Technologies in Health) health technology assessment (20,21), there was lack of published evidence on the impact of prenatal screening strategies for NG or CT on preventing ophthalmia neonatorum and neonatal pneumonia. For the systematic review on acceptability, feasibility, equity and resource use (24), limitations included the search not capturing eligible literature on acceptability, feasibility and equity of timing of repeating universal screening (e.g., third trimester or at delivery). In addition, it did not identify eligible literature on acceptability of prenatal screening for NG among partners of PWPI.

Future directions

Addressing several research gaps could help inform whether to update or reaffirm these recommendations in the future. There is a need for studies assessing the impact of prenatal screening strategies for NG and CT infections on preventing ophthalmia neonatorum and neonatal pneumonia. In addition,

comparative studies on the number and rates (or proportions) of PWPI for whom screening was undertaken, treated, followed-up with a test-of-cure and rescreened could help inform future recommendations. Further, more studies are needed to monitor the impact and consequences of false positive tests. Also, primary studies on the acceptability, feasibility and equity of timing of repeating universal screening are required. Incidence and prevalence information on NG and CT infections in PWPI, ophthalmia neonatorum and neonatal pneumonia at the national level in Canada and more studies on adverse pregnancy outcomes of NG and CT are also required.

Conclusion

The NAC-STBBI reviewed and updated PHAC's recommendations for healthcare professionals on prenatal screening for CT and NG to optimize the prevention of adverse pregnancy outcomes, as well as ophthalmia neonatorum and neonatal pneumonia. The relevant PHAC STBBI guides were updated with the NAC-STBBI recommendations. This work could be adopted or adapted by guideline development groups in Canadian provinces and territories, as well as in other countries, as appropriate, considering factors that are specific to the settings.

Authors' statement

SS — Conceptualization, writing—original draft, writing—review & editing

UA — Writing—original draft, writing—review & editing

NS — Writing—review & editing

JB — Writing—review & editing

GO — Writing—review & editing

MY — Writing—review & editing

ACL — Writing—review & editing

This work was presented at the Society of Obstetricians and Gynaecologists of Canada's 2024 Annual Clinical and Scientific Conference in Edmonton, Alberta and at the 2025 Health Canada Science Forum in Ottawa, Ontario.

Competing interests

None.

ORCID numbers

None.

Acknowledgements

The authors would like to thank current and former members of the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI), Canada's Drug Agency



(formerly Canadian Agency for Drugs and Technologies in Health) and external peer-reviewers.

NAC-STBBI Prenatal Screening for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* Working Group

Members: Annie-Claude Labbé (Chair), Jared Bullard, Gina Ogilvie and Mark H Yudin

NAC-STBBI

Other members (voting): Ian M Gemmill (Chair), Troy Grennan (Vice-Chair), William A Fisher, Jennifer Gratrix, Todd F Hatchette, Tim T Y Lau, Ed Lee, Petra Smyczek and Marc Steben

Former NAC-STBBI members (non-voting): Max Chernesky, Ron Read, Joan Robinson and Ameeta Singh

Ex-officio representatives (non-voting): Ibrahim Khan, Irene Martin and Tom Wong

Public Health Agency of Canada (Secretariat)

Shamila Shanmugasagaram, Ulrick Auguste, Jennifer Pennock, Annie Fleurant-Ceelen, Stacy Sabourin and Margaret Gale-Rowe

External contributors

Canada's Drug Agency
Nancy Santesso (McMaster University)

External peer-reviewers

Julie van Schalkwyk
Romain Mandel

Funding

The National Advisory Committee on Sexually Transmitted and Blood-Borne Infections is supported by the Public Health Agency of Canada.

References

- Shanmugasagaram S, Gadiant S, Gale-Rowe M. Translating evidence into practice with the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections. *Can Commun Dis Rep* 2020;46(11/12):398–402. [DOI PubMed](#)
- Shanmugasagaram S, Gale-Rowe M. Methodology for developing the Public Health Agency of Canada Sexually Transmitted and Blood-Borne Infections Guidelines. *Advances in Evidence Synthesis. Cochrane Database Syst Rev* 2020;9 Suppl 1:226. <https://abstracts.cochrane.org/2020-abstracts/methodology-developing-public-health-agency-canada-sexually-transmitted-and-blood>
- World Health Organization. Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Geneva, CH: WHO; 2021. <https://www.who.int/publications/i/item/9789240027077>
- Public Health Agency of Canada. Report on Sexually Transmitted Infection Surveillance in Canada, 2019. Ottawa, ON: PHAC; 2021. [Accessed 2022 Dec 27]. <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/report-sexually-transmitted-infection-surveillance-canada-2019/pub1-eng.pdf>
- Public Health Agency of Canada. Notifiable Diseases Online. Ottawa, ON: PHAC; 2025. [Accessed 2022 Feb 1]. <https://diseases.canada.ca/notifiable/>
- Tuddenham S, Hamill MM, Ghanem KG. Diagnosis and treatment of sexually transmitted infections: A review. *JAMA* 2022;327(2):161–72. [DOI](#)
- Peipert JF. Clinical practice. Genital chlamydial infections. *N Engl J Med* 2003;349(25):2424–30. [DOI](#)
- Unemo M, Seifert HS, Hook EW 3rd, Hawkes S, Ndowa F, Dillon JR. Gonorrhoea. *Nat Rev Dis Primers* 2019;5(1):79. [DOI PubMed](#)
- Hammerschlag MR. Conjunctivitis and pneumonia in newborns. *Nelson Textbook of Pediatrics*. 21st ed.: Elsevier; 2020. https://books.google.ca/books/about/Nelson_Textbook_of_Pediatrics_E_Book.html?id=LJuRDwAAQBAJ&redir_esc=y
- Laga M, Nzanze H, Brunham RC, Maitha G, D'Costa LJ, Mati JK, Cheang M, Plummer FA, Namaara W, Ndinya-Achola JO, Ronald AR, Bhullar VB, Fransen L, Piot P. Epidemiology of ophthalmia neonatorum in Kenya. *Lancet* 1986;328(8516):1145–9. [DOI PubMed](#)
- Galega FP, Heymann DL, Nasah BT. Gonococcal ophthalmia neonatorum: the case for prophylaxis in tropical Africa. *Bull World Health Organ* 1984;62(1):95–8. [PubMed](#)
- Moore DL, MacDonald NE; Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Preventing ophthalmia neonatorum. *Paediatr Child Health* 2015;20(2):93–6. [DOI](#)
- Poliquin V, Wylie J, Cole R, Yudin MH, Van Caesseele P. Preparedness for Implementing Change in Neonatal Ocular Prophylaxis Policies. *J Obstet Gynaecol Can* 2016;38(1):7–8. [DOI](#)
- Vainder M, Kives S, Yudin MH. Screening for Gonorrhea and Chlamydia in Pregnancy: room for Improvement. *J Obstet Gynaecol Can* 2019;41(9):1289–94. [DOI](#)



15. Ivensky V, Mandel R, Boulay AC, Lavallée C, Benoit J, Labbé AC. P470 Screening rates and follow-up of Chlamydia trachomatis and Neisseria gonorrhoeae infections during pregnancy. *Sex Transm Infect* 2019;95 Suppl 1:A219. https://sti.bmj.com/content/95/Suppl_1/A219.2
16. Public Health Agency of Canada. Canadian Guidelines on Sexually Transmitted Infections. Section 6: Specific Populations: Pregnancy. Ottawa, ON: PHAC; 2010. [Accessed 2022 Dec 26]. https://publications.gc.ca/collections/collection_2011/aspc-phac/HP40-1-2010-eng.pdf
17. Public Health Agency of Canada. Canadian Guidelines on Sexually Transmitted Infections. Section 5: Management and Treatment of Specific Infections: Chlamydial infections. Ottawa, ON: PHAC; 2010. [Accessed 2022 Dec 23]. https://publications.gc.ca/collections/collection_2011/aspc-phac/HP40-1-2010-eng.pdf
18. Public Health Agency of Canada. National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI). An Advisory Committee Statement (ACS). Recommendations on Screening for Chlamydia trachomatis and Neisseria gonorrhoeae in Pregnancy. Ottawa, ON: PHAC; 2023. <https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/national-advisory-committee-stbbi/statements/recommendations-screening-chlamydia-trachomatis-neisseria-gonorrhoeae-pregnancy.html>
19. Schünemann H, Brozek J, Guyatt G, Oxman A. GRADE Handbook. Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach. 2013. <https://gdt.gradeapro.org/app/handbook/handbook.html>
20. Canadian Agency for Drugs and Technologies in Health. Screening for Chlamydia trachomatis and Neisseria gonorrhoeae During Pregnancy: A Health Technology Assessment. Ottawa, ON: CADTH; 2018.
21. Canadian Agency for Drugs and Technologies in Health. Screening Strategies for the Detection of Chlamydia Trachomatis and/or Neisseria Gonorrhoeae during Pregnancy: Clinical Utility, Safety, and Cost Effectiveness. Ottawa, ON: CADTH; 2020.
22. Aggarwal A, Spitzer RF, Caccia N, Stephens D, Johnstone J, Allen L. Repeat screening for sexually transmitted infection in adolescent obstetric patients. *J Obstet Gynaecol Can* 2010;32(10):956–61. [DOI PubMed](#)
23. Statistics Canada. Live births, by age of mother. Ottawa, ON: StatCan; 2025. [Accessed 2021 Sept 3]. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310041601&pickMembers%5B0%5D=3.1&cubeTimeFrame.startYear=2019&cubeTimeFrame.endYear=2019&referencePeriods=20190101%2C20190101>
24. Shanmugasagaram S, Auguste U, Fleurant-Ceelen A, Sabourin S, Labbé AC, Bullard J, Ogilvie G, Yudin MH, Santesso N. Acceptability, feasibility, equity and resource use for prenatal screening for chlamydia and gonorrhea: A systematic review. *Can Commun Dis Rep* 2024;50(7/8):250–8. [DOI PubMed](#)
25. Andrews J, Guyatt G, Oxman AD, Alderson P, Dahm P, Falck-Ytter Y, Nasser M, Meerpohl J, Post PN, Kunz R, Brozek J, Vist G, Rind D, Akl EA, Schünemann HJ. GRADE guidelines: 14. Going from evidence to recommendations: the significance and presentation of recommendations. *J Clin Epidemiol* 2013;66(7):719–25. [DOI PubMed](#)
26. Bilardi JE, De Guingand DL, Temple-Smith MJ, Garland S, Fairley CK, Grover S, Wallace E, Hocking JS, Tabrizi S, Pirotta M, Chen MY. Young pregnant women's views on the acceptability of screening for chlamydia as part of routine antenatal care. *BMC Public Health* 2010;10:505. [DOI](#)
27. Pereboom M, Spelten ER, Manniën J, Rours GI, Morré SA, Schellevis FG, Hutton EK. Knowledge and acceptability of Chlamydia trachomatis screening among pregnant women and their partners; a cross-sectional study. *BMC Public Health* 2014;14:704. [DOI](#)
28. Leonard CA, Schoborg RV, Low N, Unemo M, Borel N. Pathogenic interplay between Chlamydia trachomatis and Neisseria gonorrhoeae that influences management and control efforts – more questions than answers? *Curr Clin Micro Rpt.* 2019;6:182–91. [DOI](#)
29. Creighton S, Tenant-Flowers M, Taylor CB, Miller R, Low N. Co-infection with gonorrhea and chlamydia: how much is there and what does it mean? *Int J STD AIDS* 2003;14:109–13. [DOI](#)

Appendix

Supplemental material is available upon request to the author: shamila.shanmugasagaram@phac-aspc.gc.ca

List S1: Decision-analytic model considerations

Table S1: Estimated outcomes, cost and cost-effectiveness of all different strategies to screen for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in pregnant women/pregnant individuals in Canada



Barriers and facilitators to sexually transmitted infections testing in Indigenous populations: A scoping review

Blessing Odia¹, Claudia Sarbu², Amanda Caputo^{3*}

Abstract

Background: Indigenous people are disproportionately affected by sexually transmitted and blood-borne infections in Canada. Considering the historical trauma and systemic inequities resulting from colonization, Indigenous people may face distinct barriers to sexually transmitted infection (STI) testing, such as mistrust of healthcare systems and culturally unsafe services in ways that differ from other equity seeking groups.

Objective: To identify the barriers and facilitators to STI testing in Indigenous populations in Canada and comparable high-income countries.

Methods: OVID Medline (1950–), OVID PsycInfo (1872–) and EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1937–) were searched from their inception until December 2024. The Joanna Briggs Institute (JBI) guidance, including the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews, was used throughout. Relevant data were extracted into a data extraction table for analysis.

Results: A total of 240 articles were retrieved from the three databases and only 13 articles were included in the final review. Multiple barriers and facilitators were identified. Common barriers include stigma, cultural and religious norms, general lack of knowledge about STI and testing, service limitations, lack of privacy of the design of testing facilities, and shame and discrimination. Common facilitators were 1) provision of culturally sensitive and appropriate care, sexual health and STI education, 2) inclusion of STI testing to the general routine community-based health screening program and 3) incorporation of STI testing into Indigenous wellness programs and services offered by Indigenous service/wellness centers.

Conclusion: Common barriers and facilitators were easily themed using the determinants of health framework. Most of the barriers and facilitators were directly or indirectly linked with the respective Indigenous cultures, which varied with each community.

Suggested citation: Odia BO, Sarbu C, Caputo AL. Barriers and facilitators to sexually transmitted infections testing in Indigenous populations: A scoping review. Can Commun Dis Rep 2026;52(10):385–93. <https://doi.org/10.14745/ccdr.v52i10a02>

Keywords: marginalized community, health equity, screening uptake, key populations, disease testing, diagnostic services

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Affiliations

¹ Northern Ontario School of Medicine (NOSM) University, Sault Ste. Marie, ON

² Indigenous Service Canada, Ottawa, ON

³ Sault Area Hospital, Sault Ste. Marie, ON

***Correspondence:**
caputoa@sah.on.ca

Introduction

Sexually transmitted infections (STIs) are primarily spread through vaginal, anal, or oral sex without barrier-type protection (1) and include chlamydia, gonorrhea, syphilis and HIV infection (2). When left untreated, STIs can result in infertility, pelvic inflammatory disease, cardiovascular and neurological

complications, and even premature death (1). They also carry significant social and economic consequences, such as stigma, emotional distress, loss of productivity and increased healthcare costs (3).



In Canada, sexually transmitted and blood-borne infections (STBBI) have risen sharply in recent years. National data show a 109% increase in infectious syphilis between 2018–2022 (4), and Ontario has seen gonorrhea and infectious syphilis rates double and triple, respectively (5,6). Indigenous populations are disproportionately affected by STIs (7,8). In January 2025, Indigenous Services Canada issued an alert over rising syphilis cases in First Nations communities. Although STI testing is one of the four key pillars to addressing STBBI in Canada (7,9), evidence suggests low STI testing uptake among Indigenous population. For instance, over one-quarter (27.9%) of First Nation youth aged 12–17 years old reported being sexually active, yet only 9.6% had ever been tested for an STI, and just 6.8% had been tested for HIV (10).

A preliminary literature search on Medline revealed limited current evidence syntheses on this topic. The only identified systematic review was published over a decade ago, was focused solely on HIV testing, and was not specific to Indigenous peoples (11). Considering the historical trauma and systemic inequities resulting from colonization (12,13), Indigenous peoples may face distinct barriers to STI testing, such as mistrust of healthcare systems and culturally unsafe services. Understanding the factors influencing STI testing uptake among this subpopulation is critical for developing targeted, community-informed strategies to improve STI testing and outcomes. As such information is not readily accessible to stakeholders, the findings of this review may offer valuable evidence to support governments, public health organizations, and other relevant stakeholders working with Indigenous populations in informed decision-making, strategic planning, and the development of targeted surveys for similar research in Indigenous communities.

A scoping review approach was selected for this topic as it allows for systematic and comprehensive mapping of available evidence on barriers and facilitators to STI testing among Indigenous populations, and incorporates diverse study designs/methods such as quantitative, qualitative studies, Indigenous research methodologies (14–16). This study focuses on Canada and three comparable high-income countries (Australia, New Zealand and the United States), which share similar colonial histories and ongoing health disparities among Indigenous populations (17).

Objective

The objective of this study is to identify the barriers and facilitators to STI testing among Indigenous populations in Canada and comparable high-income countries.

Research question

What are the barriers and facilitators of STI testing among Indigenous populations in Canada and comparable high-income countries?

Inclusion criteria: Using the population, concept, context framework

The population of interest included any named Indigenous peoples (First Nations, Inuit, Métis, American Indian/Alaska Native, Aboriginal and Torres Strait Islander, Māori and Pacific/Indigenous Pacific peoples) of any age, as well as healthcare workers and stakeholders serving Indigenous communities. Both adolescents and adults were included. The concept focuses on the uptake of STI testing. The context or setting includes barriers and facilitators to STI testing within community, primary care, sexual health, hospital, and outreach settings in both remote and urban areas in high-income countries. These countries were selected for their high-income status and shared histories of colonization and systemic marginalization of Indigenous populations. The types of evidence included were empirical studies (qualitative, quantitative and mixed-methods) along with program evaluations and interventional studies (including experimental and quasi-experimental designs). Grey literature was excluded because empirical studies are based on observable data and are more likely to have undergone a peer-review process, enhancing objectivity and accuracy compared with grey literature, which is not typically peer reviewed and may introduce bias.

Methods

This scoping review adapted the Joanna Briggs Institute (JBI) (16) including the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews (18) and was conducted in consultation with a hospital librarian.

Information sources and search strategy

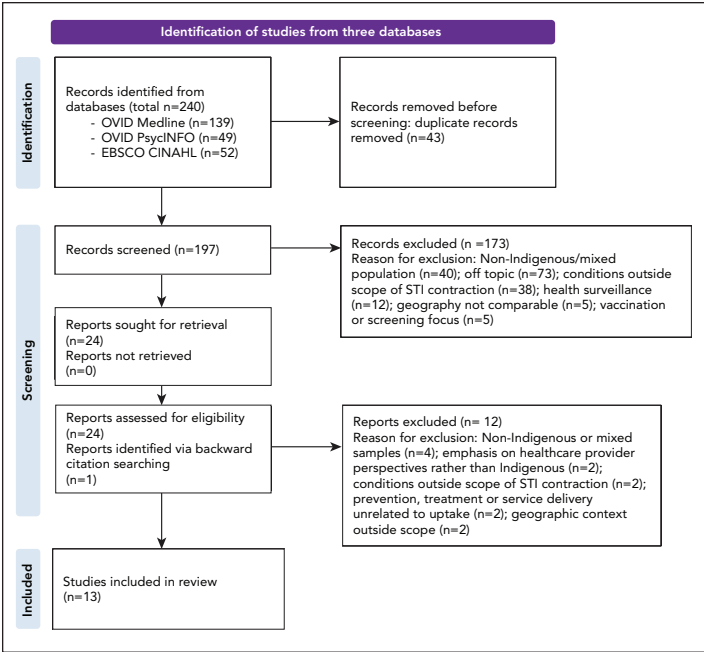
An initial limited search in Medline and Google Scholar was conducted to identify key words and to derive Boolean operators, truncations and index terms in the relevant articles, which were used to develop a full search strategy as applicable. OVID Medline, OVID PsycInfo and EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL) were searched from their inception to December 15 or 16, 2024, combining concepts related to barriers and facilitators to health care access and delivery, STI (including HIV, chlamydia, gonorrhea and syphilis), and testing or screening practices such as point-of-care testing. Terms related to Indigenous populations were also included using modern and outdated terminology as keywords to facilitate retrieval. The main concepts (health care access, STI, testing, barriers, facilitators, Indigenous populations) were searched utilizing a mix of controlled vocabulary and keywords with phrase searching and truncation and combined using the Boolean operator "AND". Results were limited to English-language publications (**Appendix, Supplemental material, List 1**). Backward citation was done for the reference list of all the articles included in the review to retrieve additional relevant articles.



Selection process and data charting

Following the search, all identified citations were imported to Zotero (a citation management software) and duplicates were removed. Screening and data extraction were performed by a single reviewer. Screening was two staged; title/abstract followed by full-text review based on predefined inclusion/exclusion criteria (Figure 1). A data extraction table was developed to collate relevant information, including study characteristics, population details, study methods, STI focus and identified barriers and facilitators (Appendix, Supplemental material, Table S1). Critical appraisal is generally not required for scoping reviews and was not undertaken as our focus was to map existing evidence rather than assess risk of bias. Descriptive analysis, using counts and percentage, was used to summarize study characteristics and identify patterns across the articles. Barriers and facilitators of STI testing uptake were ranked by the frequency of their mention in the studies and further themed using the determinants of health framework. This framework explores the broad spectrum of personal, social, economic, and environmental factors that influence health at both individual and population levels (19). Findings were organized and interpreted around three key determinants: culture; education; and access to care. This approach allowed for systematic identification and synthesis of themes across studies, highlighting how structural and social contexts influence STI testing uptake.

Figure 1: PRISMA flow chart showing the screening process used for the scoping review of barriers and facilitators of sexually transmitted infections testing in Indigenous populations



Abbreviations: CINAHL, Cumulative Index to Nursing and Allied Health Literature; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; STI, sexually transmitted infection

Results

Search result

The initial search identified 240 articles. After screening using the inclusion criteria, 12 articles were selected. A backward citation search identified one more study, to make the final review articles 13 (Figure 1).

Data analysis

Thirteen studies were included in this scoping review (Table 1), with the majority conducted in Australia (54%) and Canada (23%). The objectives of all the studies focused on Indigenous populations, and most (77%) included exclusively Indigenous participants. For studies including healthcare providers or related professional, participants were mostly serving Indigenous communities and/or have good knowledge about Indigenous people. Study populations varied by age and gender, with most employing qualitative (62%) or mixed methods (23%). Only one study assessed STI re-testing (20). Nearly 40% addressed chlamydia and gonorrhea, while studies focused solely on HIV (30%) were conducted in Canada and the United States (21–24). Majority of the studies (92%) examined both barriers and facilitators of STI testing across Indigenous populations (Table 2).

Table 1: Inclusion/exclusion criteria

Inclusion	Exclusion
Studies containing one or more of the search term or key words	Articles not published in English
Age categories – adolescent and adult	Articles with mixed population including Indigenous population
All genders	Government documents
Qualitative and/or quantitative studies	Other review papers
Only articles from similarly developed countries	

Identified barriers and facilitators were themed using components of the determinants of health framework (19) and ranked according to the frequency of mention across the 13 studies (Table 3).

High ranked barriers were linked by theme into three groups: 1) culture-stigma (22,23,25–30), cultural and religious norms (20,22,24,28,31,32); 2) sexual health education, poor sexual health knowledge (20,23,26,28,30); and 3) access to suitable healthcare services, limited-service availability (25,27,28,32), discriminatory staff attitudes, lack of privacy (20,27,30,31) and feelings of shame or embarrassment during testing (20,22,28,30).

Low ranked barriers include perceived lack of anonymity (22,24,25), fear of testing positive (22,24,25), denial and ignoring symptoms (25,32).



Table 2: Description of articles included in the scoping review

Data extracted	# articles (n=13)	Percentage (%)
Year of publication (1997–2024)		
Before 2000	1	8
After 2000	12	92
Countries of publications		
Australia	7	54
Canada	3	23
United States	2	15
New Zealand	1	8
Study population		
Indigenous	10	77
Health workers who serve Indigenous clients/communities	2	15
Health workers who serve Indigenous clients/communities and Indigenous clients/patients	1	8
Study type and data collection methods		
Qualitative	8	62
In-depth interview	3	38
Key informant interview	2	25
Focus group discussion	1	13
Focus group discussion and in-depth interview	1	13
Focus group discussion and key informant interview	1	13
Quantitative: Longitudinal analysis of routine data	1	8
Mixed methods	3	23
Focus group discussion, in-depth interview and survey	2	67
In-depth interview and survey	1	33
Interventional program	1	8
STI of study focus/interest		
HIV only	4	31
STIs (not specified)	3	23
Chlamydia and gonorrhea (C and G)	2	15
Chlamydia and gonorrhea and syphilis	1	8
Chlamydia and gonorrhea and trachomatis	1	8
HIV, HBV, HCV and syphilis	1	8
Concept of interest		
STI testing	12	92
STI re-testing	1	8
Context of interest		
Barriers and facilitators	12	92
Barriers only	1	8

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; STI, sexually transmitted infection

Table 3: Ranking and themes of barriers and facilitators of sexually transmitted infections testing in Indigenous populations

Ranking	Themes	%	Counts (n=13)	Themes based on determinant of health framework
Barriers				
1	Stigma	62	8	Culture
2	Cultural/religious norms or context	46	6	
3	General lack of knowledge, information and awareness about STI testing	39	5	Sexual health education
4	Service limitations	31	4	Access to suitable sexual health services
5	Lack of privacy in the physical location	31	4	
6	Feeling of shame and embarrassment	31	4	
7	Perceived lack of anonymity/confidentiality	23	3	
8	Fear of testing positive	23	3	N/A
9	Others e.g., denial and ignoring symptoms, time constraints	15 or fewer	2 or fewer	N/A
Facilitators				
1	Cultural sensitivity and culturally appropriate sexual health information and services	54	7	Culture
2	Sexual health and STI testing education	38	5	Sexual health education
3	Inclusion of STI testing to the general routine community-based health screening program	31	4	Access to suitable sexual health service
4	Incorporating STI testing into Indigenous wellness program and services offered by Indigenous service/wellness centers	31	4	
5	Availability of suitable skilled medical practitioners and Indigenous health workers	23	3	
6	Others e.g., DBST/POCT, free testing and flexible access, discrete packaging, free transportation to services	15 or fewer	2 or fewer	

Abbreviations: DBST, dried blood spot testing; N/A, not applicable; POCT, point-of-care testing; STI, sexually transmitted infection



High ranked facilitators were linked by theme into three groups: 1) culture-cultural sensitivity and culturally appropriate sexual health information and services including training providers in Indigenous practices and gender-aligned services (20–22,25,27,28,31); 2) sexual health education-peer- and community-led sexual health education, multigenerational programs and outreach via social networks were recommended strategies (22,23,28–30); and 3) access to suitable healthcare services- and access-enhancing strategies included skilled and Indigenous health workers (24,26,28), integration of STI testing into routine community (26,28,29,31) or routine Indigenous wellness programs (21–23,28).

Low ranked facilitators include free transport, flexible testing (online, home or pharmacy) (28), discreet self-test kits and electronic reminders (23).

Discussion

The scoping review identified multiple barriers and facilitators to STI testing in Indigenous populations. Barriers to STI testing included stigma, lack of sexual health education and access to suitable healthcare services, influenced by cultural and religious norms and context. Common facilitators to STI testing included cultural sensitivity, culturally appropriate care, sexual health education and access to suitable healthcare services. Other facilitators included strategies to promote STI testing, including such as training healthcare providers in cultural competencies, providing gender-aligned care and incorporating STI testing into community-based health check programs.

Barriers

Culture and sexual health education: Stigma emerged as the most frequently reported barrier, aligning with previous research (20,25,32,33–35). It is often perpetuated within communities by family and peers (20) and stemmed largely from cultural and religious norms (22,25,36) and poor sexual health literacy (21,24,25,27,29). Cultural beliefs discouraging open discussions about sexual health, particularly with healthcare providers, further reinforced this barrier (22). The absence of formal sexual health education in schools and limited parental guidance also restricted young people's awareness of STI prevention and testing (29).

These findings highlight the complex interplay between culture, stigma and education, underscoring the need for interventions guided by frameworks such as the root cause analysis model (37) to address underlying social determinants of stigma.

Access to suitable healthcare services: Access-related barriers were also prominent, including service limitations, lack of privacy, and feelings of shame or embarrassment when interacting with healthcare workers. Restricted service hours, particularly in rural and remote settings (38), along with perceived discriminatory

attitudes among staff (28), discouraged health care engagement and contributed to delayed or forgone care (39). The physical design of facilities also influenced testing behavior. For instance, shared waiting rooms for men and women deterred Indigenous men from seeking STI testing due to fears of being perceived by their female counterparts as weak or unwell (25). Shame and embarrassment were linked to previous negative healthcare experiences (22), difficulty communicating symptoms (27), lengthy pretest assessments (22), and close community ties between patients and Indigenous healthcare workers (24,25).

The findings have important clinical implications as stigma and lack of education can lead to delayed diagnosis and treatment of STIs, impacting individual health outcomes. Addressing these barriers is crucial to prevent severe health consequences and improve overall community health. From a public health perspective, low STI testing rates in Indigenous populations can contribute to the spread of STIs and outbreaks in communities. Though less frequently reported, factors such as lack of motivation (22), denial and symptom neglect (21,27) also affected testing behaviors.

Facilitators

The most frequently identified facilitator was cultural sensitivity and culturally appropriate care, consistent with previous studies (20,25,32,33) and aligned with national reconciliation efforts (40). Key strategies to promote cultural safety include training healthcare providers in Indigenous teachings and spirituality (22), ensuring gender-aligned care (20,25,26), and providing separate waiting areas for men and women (25).

Enhance sexual health education was also critical. Recommended approaches included peer-based and community education programs (26), intergenerational education integrating Indigenous wellbeing models (24,29), and outreach through kinship and social networks (22,27,29), emphasizing the importance of tailoring strategies to local contexts (29).

Improving access to suitable healthcare services was another major facilitator. This involved employing skilled healthcare providers and Indigenous health workers (19,21,29). This is corroborated by a study that concluded that Indigenous health workers were found to be impactful in facilitating culturally appropriate care for cardiac inpatient (41). Conversely, this review also showed that respondents from remote communities perceived STI testing with an Indigenous health worker as a barrier due to lack of anonymity (23,25,32). Other factors under this theme include integrating STI testing into community health checks (21,26,29,32) and Indigenous wellness programs (20,22,24,29), and normalizing testing as part of Indigenous holistic wellness (29,42).

Other supportive measures include providing free or flexible testing options (online, home or pharmacy), free transport, discreet packaging for self-test kits, and electronic recall



systems (20,29,32). Although less frequently mentioned, these strategies may hold greater importance in specific community contexts.

Tailored interventions, such as culturally sensitive care and increased access to healthcare services, can help improve STI testing uptake and reduce the burden of STIs in Indigenous communities.

Strengths

This scoping review systematically maps barriers and facilitators to STI testing among Indigenous populations in high-income countries. Its rigorous approach facilitates transparent study selection and data extraction and analysis. Including qualitative and mixed-methods studies provided rich insights into cultural, structural and educational influences on STI testing.

Limitations

This scoping review included primarily qualitative studies across diverse Indigenous populations, limiting generalizability. Restriction to English-language publications and variability in study designs hindered direct comparisons. Intervention effectiveness was not assessed, and potential selection bias exists as only a single reviewer conducted the search and analysis of this review.

Applications and future directions

This scoping review may be useful to governments, public health organizations, and other relevant stakeholders working with Indigenous populations for decision-making, planning or to further guide and contribute to the development of focused survey for similar research in Indigenous communities of interest. Further primary research or a systematic review could deepen our understanding of this topic.

Conclusion and recommendations

This review underscores the critical need to address cultural barriers and improve access to culturally appropriate healthcare services to enhance STI testing among Indigenous populations. Promoting cultural safety, respecting Indigenous values in care delivery, and offering comprehensive sexual health education are essential to reducing stigma and encouraging timely testing.

Based on the evidence reviewed, STI testing programs should focus on building cultural competence among healthcare providers, offering gender-aligned care, and linking testing to community-based health activities. Working directly with communities and completing situational assessments can help ensure that interventions are relevant and effective. Improving access, such as through free transportation, discreet self-testing options, and better use of electronic health records, may also support higher testing uptake. Together, these approaches can help reduce barriers and promote more equitable STI testing for Indigenous populations.

Authors' statement

BO — Conceptualization, methodology, formal analysis, writing—original draft, visualization
CS — Conceptualization, supervision, writing—review & editing
AC — Methodology, validation, writing—review & editing

Competing interests

None.

ORCID numbers

Amanda Caputo — [0000-0002-5117-1411](https://orcid.org/0000-0002-5117-1411)

Acknowledgements

The authors gratefully acknowledge the supports provided from NOSM University library team.

Funding

This work was not funded.

References

1. World Health Organization. Sexually transmitted infections (STIs). Geneva, CH; WHO. [Accessed 2025 Jun 12]. <https://www.who.int/health-topics/sexually-transmitted-infections>
2. Public Health Agency of Canada. Booklet: Sexually Transmitted Infections. Ottawa, ON: PHAC; 2020. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/booklet-sexually-transmitted-infections.html>
3. Elendu C, Amaechi DC, Elendu ID, Elendu TC, Amaechi EC, Usoro EU, Chima-Ogbuiyi NL, Arrey Agbor DB, Onwuegbule CJ, Afolayan EF, Balogun BB. Global perspectives on the burden of sexually transmitted diseases: A narrative review. *Medicine (Baltimore)* 2024;103(20):e38199. DOI PubMed
4. Public Health Agency of Canada. Infectious syphilis and congenital syphilis in Canada, 2022. Ottawa, ON: PHAC; 2024. [Accessed 2025 May 3]. <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2023-49/issue-10-october-2023/infectious-congenital-syphilis-canada-2022.html>



5. Public Health Agency of Canada. Chlamydia, gonorrhea and infectious syphilis in Canada: 2021 surveillance data update. Ottawa, ON: PHAC; 2023. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/chlamydia-gonorrhea-infectious-syphilis-2021-surveillance-data.html>
6. Public Health Ontario. Gonorrhea in Ontario: Focus on 2023. Toronto, ON: PHO; 2025. <https://www.publichealthontario.ca/-/media/Documents/G/25/gonorrhea-ontario-focus-2023.pdf>
7. Public Health Agency of Canada. Reducing the health impact of sexually transmitted and blood-borne infections in Canada by 2030: A pan-Canadian STBBI framework for action. Ottawa, ON: PHAC; 2018. [Accessed 2025 Mar 6]. <https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/reports-publications/sexually-transmitted-blood-borne-infections-action-framework.html>
8. National Collaborating Centre for Indigenous Health and National Collaborating Centre for Infectious Diseases. COVID-19 and Indigenous peoples' access to STBBI and related health services: National survey results. Prince George, BC/Winnipeg MB: NCCIH/NCCID; 2024. https://www.nccih.ca/495/COVID-19_and_Indigenous_peoples%E2%80%99_access_to_STBBI_and_related_health_services__National_survey_results.nccih?id=10471
9. Public Health Agency of Canada. Sexually Transmitted and Blood Borne Infections (STBBI) prevention guide. Ottawa, ON: PHAC; 2025. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/stbbi-prevention-guide.html>
10. First Nations Information Governance Centre. First Nations Regional Health Survey (RHS) 2008/10: National report on adults living in First Nations communities. Ottawa, ON: FNIGC; 2012. https://fnigc.ca/wp-content/uploads/2020/09/5eedd1ce8f5784a69126edda537dccfc_first_nations_regional_health_survey_rhs_2008-10_-_national_report_adult_2.pdf
11. Laprise C, Bolster-Foucault C. Understanding barriers and facilitators to HIV testing in Canada from 2009-2019: A systematic mixed studies review. *Can Commun Dis Rep* 2021;47(2):105–25. [DOI PubMed](#)
12. Bombay A, Matheson K, Anisman H. The intergenerational effects of Indian Residential Schools: implications for the concept of historical trauma. *Transcult Psychiatry* 2014;51(3):320–38. [DOI PubMed](#)
13. Department of Justice. Understanding the Overrepresentation of Indigenous people in the Criminal Justice System. Ottawa, ON: DOJ; 2025. [Accessed 2025 Jun 12]. <https://www.justice.gc.ca/socjs-esjp/en/ind-aut/uo-cs>
14. Munn Z, Peters MD, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* 2018;18(1):143. [DOI PubMed](#)
15. Why a scoping review? JBI Manual for Evidence Synthesis. 2024. [Accessed 2025 Oct 17]. <https://jbi-global-wiki.refined.site/space/MANUAL/355862553/10.1.1+Why+a+scoping+review%3F>
16. Peters MD, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. Scoping Reviews. JBI Manual for Evidence Synthesis. 2024. <https://jbi-global-wiki.refined.site/space/MANUAL/355862497/10.+Scoping+reviews>
17. Cooke M, Mitrou F, Lawrence D, Guimond E, Beavon D. Indigenous well-being in four countries: an application of the UNDP'S human development index to indigenous peoples in Australia, Canada, New Zealand, and the United States. *BMC Int Health Hum Rights* 2007;7:9. [DOI PubMed](#)
18. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MD, Horsley T, Weeks L, Hempel S, Akl EA, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson MG, Garritty C, Lewin S, Godfrey CM, Macdonald MT, Langlois EV, Soares-Weiser K, Moriarty J, Clifford T, Tunçalp Ö, Straus SE. PRISMA Extension for Scoping Reviews (PRISMA-ScR): checklist and Explanation. *Ann Intern Med* 2018;169(7):467–73. [DOI PubMed](#)
19. Public Health Agency of Canada. Social determinants of health and health inequalities. Ottawa, ON: PHAC; 2024. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/health-promotion/population-health/what-determines-health.html>
20. Su JY, Belton S, Ryder N. Why are men less tested for sexually transmitted infections in remote Australian Indigenous communities? A mixed-methods study. *Cult Health Sex* 2016;18(10):1150–64. [DOI PubMed](#)
21. Hengel B, Wand H, Ward J, Rumbold A, Garton L, Taylor-Thomson D, Silver B, McGregor S, Dyda A, Mein J, Knox J, Maher L, Kaldor J, Guy R; STRIVE Investigators. Patient, staffing and health centre factors associated with annual testing for sexually transmissible infections in remote primary health centres. *Sex Health* 2017;14(3):274–81. [DOI PubMed](#)



22. Bucharski D, Reutter LI, Ogilvie LD. "You need to know where we're coming from": canadian Aboriginal women's perspectives on culturally appropriate HIV counseling and testing. *Health Care Women Int* 2006;27(8):723–47. DOI PubMed
23. Prescott MR, Montoya JL, Perry C, Teran R, Armenta R, Gaines TL. Community-Identified Implementation Strategies for Promoting the Adoption of HIV Self-Testing in a Southern California American Indian community: A Rapid Qualitative Analysis. *AIDS Behav* 2024;28(6):2101–12. DOI PubMed
24. Mill JE, Jackson RC, Worthington CA, Archibald CP, Wong T, Myers T, Prentice T, Sommerfeldt S. HIV testing and care in Canadian Aboriginal youth: a community based mixed methods study. *BMC Infect Dis* 2008;8(1):132. DOI PubMed
25. Burks DJ, Robbins R, Durtschi JP. American Indian gay, bisexual and two-spirit men: a rapid assessment of HIV/AIDS risk factors, barriers to prevention and culturally-sensitive intervention. *Cult Health Sex* 2011;13(3):283–98. DOI PubMed
26. Landy R, Atkinson D, Ogilvie K, St Denys R, Lund C, Worthington C; DRUM & SASH team. Assessing the acceptability of dried blood spot testing for HIV and STBBI among Métis people in a community driven pilot project in Alberta, Canada. *BMC Health Serv Res* 2022;22(1):1496. DOI PubMed
27. Ubrihien A, Lewis DA, Rambaldini B, Kirwan M, Gwynne K. Clinicians' perspectives on why young Aboriginal people are not testing for sexually transmissible infections in Western Sydney. *Int J STD AIDS* 2023;34(11):803–8. DOI PubMed
28. Rose SB, Gardiner T, Dunlop A, Cole M, Garrett SM, McKinlay EM. Māori and Pacific young people's perspectives on testing for sexually transmitted infections via an online service: a qualitative study. *J Prim Health Care* 2024;16(3):258–69. DOI PubMed
29. Bowden FJ, Bastian I, Johnston F. A community-based approach to the control of sexually transmitted diseases in the Northern Territory. *Aust N Z J Public Health* 1997;21(5):519–23. DOI PubMed
30. Bell S, Aggleton P, Ward J, Murray W, Silver B, Lockyer A, Ferguson T, Fairley CK, Whiley D, Ryder N, Donovan B, Guy R, Kaldor J, Maher L. Young Aboriginal people's engagement with STI testing in the Northern Territory, Australia. *BMC Public Health* 2020;20(1):459. DOI PubMed
31. Hengel B, Guy R, Garton L, Ward J, Rumbold A, Taylor-Thomson D, Silver B, McGregor S, Dyda A, Knox J, Kaldor J, Maher L. Barriers and facilitators of sexually transmissible infection testing in remote Australian Aboriginal communities: results from the Sexually Transmitted Infections in Remote Communities, Improved and Enhanced Primary Health Care (STRIVE) Study. *Sex Health* 2015;12(1):4–12. DOI PubMed
32. Natoli L, Guy RJ, Shephard M, Whiley D, Tabrizi SN, Ward J, Regan DG, Badman SG, Anderson DA, Kaldor J, Maher L; TTANGO investigator group. Public health implications of molecular point-of-care testing for chlamydia and gonorrhoea in remote primary care services in Australia: a qualitative study. *BMJ Open* 2015;5(4):e006922. DOI PubMed
33. Roseby R, Adams K, Leech M, Taylor K, Campbell D. Not just a policy; this is for real. An affirmative action policy to encourage Aboriginal and Torres Strait Islander peoples to seek employment in the health workforce. *Intern Med J* 2019;49(7):908–10. DOI PubMed
34. Cunningham SD, Kerrigan DL, Jennings JM, Ellen JM. Relationships between perceived STD-related stigma, STD-related shame and STD screening among a household sample of adolescents. *Perspect Sex Reprod Health* 2009;41(4):225–30. DOI PubMed
35. Rusch M, Shoveller J, Burgess S, Stancer K, Patrick D, Tyndall M. Association of sexually transmitted disease-related stigma with sexual health care among women attending a community clinic program. *Sex Transm Dis* 2008;35(6):553–7. DOI PubMed
36. Lee AS, Cody SL. The Stigma of Sexually Transmitted Infections. *Nurs Clin North Am* 2020;55(3):295–305. DOI PubMed
37. Kumah A, Nwogu CN, Issah AR, Obot E, Kanamitie DT, Sifa JS, Aidoo LA. Cause-and-Effect (Fishbone) Diagram: A Tool for Generating and Organizing Quality Improvement Ideas. *Glob J Qual Saf Healthc* 2024;7(2):85–7. DOI PubMed
38. Public Health Agency of Canada. Key Health Inequalities in Canada: A National Portrait – Executive Summary. Ottawa, ON: PHAC; 2018. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/publications/science-research-data/key-health-inequalities-canada-national-portrait-executive-summary.html>



39. Shavers VL, Fagan P, Jones D, Klein WM, Boyington J, Moten C, Rorie E. The state of research on racial/ethnic discrimination in the receipt of health care. *Am J Public Health* 2012;102(5):953–66. DOI PubMed
40. Public Health Agency of Canada. Accelerating our response: Government of Canada five-year action plan on sexually transmitted and blood-borne infections. Ottawa, ON: PHAC; 2021. [Accessed 2025 Jun 12]. <https://www.canada.ca/en/public-health/services/reports-publications/accelerating-our-response-five-year-action-plan-sexually-transmitted-blood-borne-infections.html>
41. Taylor KP, Thompson SC, Smith JS, Dimer L, Ali M, Wood MM. Exploring the impact of an Aboriginal Health Worker on hospitalised Aboriginal experiences: lessons from cardiology. *Aust Health Rev* 2009;33(4):549–57. DOI PubMed
42. First Nations Health Authority. First Nations Perspective on Health and Wellness. Vancouver, BC; FNHA. [Accessed 2025 Jun 12]. <https://www.fnha.ca:443/wellness/wellness-for-first-nations/first-nations-perspective-on-health-and-wellness>

Appendix

Supplemental material is available online: <https://osf.io/7e4px>

List S1: Database search strategies

Table S1: Data extraction table for barriers and facilitators of sexually transmitted infections testing in Indigenous populations (data extracted from 13 relevant studies)



Risk factors of sexually transmitted and blood-borne infections and access to harm reduction in Canadian federal prisons

Marie-Pierre Gendron^{1*}, Kayla Wanamaker¹, Jonathan Smith¹, Shannon Thompson^{2,3}, Daniella Filoso¹, Wardah Mahboob¹, Sara Johnson¹

Abstract

Background: Incarcerated people are disproportionately affected by sexually transmitted and blood-borne infections (STBBI) and have a high prevalence of STBBI risk factors.

Objective: This study aimed to determine the prevalence of risk factors for STBBI (tattooing and sexual activities in the last six months), as well as the awareness of, and utilization of harm reduction resources in federal prison.

Methods: A cross-sectional survey was developed and administered across Canada between September 2022 and January 2023. Participants included people who were incarcerated in federal men's and women's institutions in the last six months.

Results: In total, 1,404 people who are incarcerated responded to the survey: 91.5% from men's institutions, and 8.5% from women's institutions. Overall, 44.6% reported that they had received a tattoo at some point during incarceration, and 8.8% reported having had sex in the last six months. Difficulties in accessing barrier-type items for sexual protection were reported by 5.0% of all participants, of which a majority reported difficulties in accessing condoms. Awareness of pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) was reported by 8.7% and 7.1% of participants, respectively. However, utilization was below 1% for both.

Conclusion: Tattooing and sex without barriers could contribute to the transmission of STBBI among people who are incarcerated. Increased efforts to ensure that harm reduction supplies are available in sufficient quantities and in private and known locations are recommended to maximize their utilization. Education on PrEP and PEP availability should be improved to ensure an optimal use by those who could benefit from it.

Suggested citation: Gendron M-P, Wanamaker K, Smith J, Thompson S, Filoso D, Mahboob W, Johnson S. Risk factors of sexually transmitted and blood-borne infections and access to harm reduction in Canadian federal prisons. *Can Commun Dis Rep* 2026;52(10):394–400. <https://doi.org/10.14745/ccdr.v52i10a03>

Keywords: sexually transmitted and blood-borne infections, harm reduction, tattooing, sexual activity, incarceration

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Affiliations

¹ Research Branch, Correctional Service Canada, Ottawa, ON

² Health Services, Correctional Service Canada, Ottawa, ON

³ School of Epidemiology and Public Health, University of Ottawa, Ottawa, ON

*Correspondence:

marie-pierre.gendron@csc-scc.gc.ca

Introduction

In Canada, STBBI disproportionately affect certain populations, including people who use drugs, people who sell or purchase sex, Indigenous Peoples, and people who experience incarceration (1). People who are incarcerated have a higher prevalence of STBBI risk factors, such as sexual activities without barriers and unsterile tattooing (needle/ink sharing), compared to the general population (2–5).

As part of its role of administering sentences of two years or more, Correctional Service Canada (CSC) is responsible for providing essential health care and reasonable access to non-essential health care, in keeping with professional standards (6). Consistent with this requirement, CSC has implemented different harm reduction and prevention initiatives to reduce the transmission of STBBI in its institutions over time. These include



the Prison Needle Exchange Program and Overdose Prevention Service (supervised consumption site) in selected institutions, as well as the provision of pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP), and barrier-type items (condoms, lubricant, and dental dams) in all institutions. Subsequently, the prevalence of HIV and hepatitis C virus (HCV) infections in CSC institutions declined. HIV prevalence decreased from 4.6% in 2007 (7) to 1.19% in 2014 and 0.93% in 2020 (8), while HCV prevalence fell from 31.0% in 2007 (7) to 21.0% in 2010 and 3.2% in 2021 (8).

Surveys are a useful method to measure unobservable data, such as people's preferences, attitudes, and behaviours (9). The National Inmate Infectious Diseases and Risk-Behaviours Survey (NIIDRBS), reported by Zacharia *et al.* in 2007, was undertaken prior to the implementation of the most recent harm reduction measures in CSC (7). Since then, the information available on STBI risk behaviours for members of the Canadian population who are federally incarcerated has been limited.

Therefore, the primary objectives of this study were to determine the prevalence of:

- Tattooing (at any time during incarceration and in the previous six months)
- Device and ink sharing (among those who received a tattoo in the previous six months)
- Sexual activities while incarcerated, including gender of the partner, the use of and difficulties in accessing barrier-type items for sexual protection
- The use and awareness of PrEP and PEP, in Canadian federal prisons

The results of this research will allow for a better understanding of the health needs of people who are incarcerated and will contribute to the maintenance of effective health services programs within correctional institutions.

Methods

Using a questionnaire and method based on the 2007 NIIDRBS, a cross-sectional survey was conducted among a sample of people who are incarcerated in federal institutions between September 2022 and January 2023. A stratified random sampling approach was used to recruit eligible participants in men's institutions, whereas all eligible participants in women's institutions were invited to participate. Each site received an ordered list of individuals who met the survey eligibility criteria, along with a target number of participants to recruit. These targets reflected the site's demographic weight within the total federally incarcerated population in Canada (including targets specific for White, Indigenous, Black, and other racialized participants in men's institutions). To be eligible, participants

had to be continuously incarcerated in a federal prison in the previous six months; be able to complete the questionnaire in English or French; and consent to participate through the assistance of a survey administrator.

Two sections of the questionnaire asked questions about risk behaviours while in prison, including tattooing and sex without barriers. The tattooing section contained questions about whether the devices and/or ink had been previously used by someone else. Questions about sexual activity asked participants if they had engaged in sex within the past six months while in federal prison (including oral, vaginal, and/or anal sex), and whether barrier-type protection had been used. Those who said yes were also asked whether they had access to condoms, lubricant, and/or dental dams when it was needed, and the reasons why they may not have had access. Moreover, participants who reported having had sex in the last six months in federal prison were asked about whether they exchanged sex for either money, drugs, or other items (such as canteen items, tobacco, a needle, etc.). Finally, questions examining participants' knowledge of and access to PrEP and PEP within the past six months while in federal prison were included. All questions were dichotomous (e.g., possible responses were 'yes' or 'no' but did contain the option of indicating that the question was not applicable). When non-responses exceeded 50%, results were not reported. The survey was approved by the Health Canada Research Ethics Board, the CSC, and the University of Ottawa Research Ethics Board. For more information on the 2022 National Health Survey (2022 NHS) methodology, see Wanamaker *et al.*, 2024 (10). For confidentiality and privacy reasons, questions with less than five respondents were not reported in this study. Frequencies and proportions out of the total sample were calculated for each question. Analyses were conducted using IBM SPSS version 29 (11).

Results

A total of 1,404 participants were included in the analysis. A large proportion were from the Québec region (33.2%), housed in medium-security institutions (47.7%), incarcerated in men's institutions (91.5%), aged 31–40 years old (26.7%), and identified as White (41.7%) (**Table 1**). It was not possible to calculate the survey response rate as not all participating sites recorded the refusals. However, a comparison with the CSC general incarcerated population at the end of the 2022–2023 fiscal year demonstrated that women, and the Québec region, were over-represented in the study sample.

Nearly half of participants reported that they had received a tattoo at some point during their federal incarceration ($n=626/1,404$; 44.6%), while 53.1% ($n=746/1,404$) had not, and 2.3% ($n=32/1,404$) did not answer this question.



Table 1: A 2022 National health survey participant characteristics (n=1,404)

Characteristics	Frequency % (n)
Region	
Atlantic	10.8 (n=151)
Québec	33.2 (n=466)
Ontario	23.5 (n=330)
Prairie	17.4 (n=244)
Pacific	15.2 (n=213)
Institutional security level	
Minimum	15.5 (n=218)
Medium	47.7 (n=670)
Maximum	13.5 (n=190)
Multi	23.2 (n=326)
Gender^a	
Men	91.5 (n=1,285)
Women	8.5 (n=119)
Age^b	
18 or less to 30	17.7 (n=248)
31–40	26.7 (n=375)
41–50	20.4 (n=287)
51–60	17.7 (n=248)
61+	12.8 (n=180)
Ethnocultural group^c	
White	41.7 (n=585)
Indigenous	36.8 (n=516)
Black	7.3 (n=102)
Other ethnocultural	13.5 (n=189)

^a Gender is based on the institution in which the participant was housed; some participants may not identify with the gender associated with that institution

^b Missing age for 66 participants (4.7%)

^c Missing ethnocultural group for 12 participants (0.9%). Percentages may not add to 100 due to rounding and/or missing data

Note: This table provides a description of the study population, including Correctional Service Canada region, gender, age, and ethnocultural group

When asked about tattooing in the last six months, almost a third of the participants reported that they had engaged in this activity (n=186; 29.7%). Among those who received a tattoo in the past six months, almost a quarter indicated that the device that they used had been used before them (n=46; 24.7%) and less frequently, sharing ink (n=14; 7.5%) (Table 2).

Table 2: Tattooing behaviours in the previous six months in Canadian federal prisons (n=1,404)

Tattooing behaviours	Frequency % (n)
Received a tattoo	29.7 (n=186)
Among those who received a tattoo	
Device was used before	24.7 (n=46)
Ink was used before	7.5 (n=14)

Note: This table presents the proportion of people who reported having had received a tattoo in prison in the last six months, along with the proportion who reported having shared the tattoo device and ink. Almost 30% of participants received a tattoo within the last six months; among those participants, close to one quarter (25%) used a device that had been used before, while 7.5% reported using ink that had been used before

Most participants indicated that they did not have sex within the last six months (n=1,204/1,404; 85.8%) or had missing data on the questions regarding sex in prison (77 participants, 5.5%). The remaining 123 participants (8.8%) indicated that they had sex (oral, vaginal, and/or anal) in the last six months while in federal prison. A greater number of participants reported sexual activity with a woman (n=87; 6.2%) than with a man (n=32; 2.3%). When asked about the use of barrier-type protection (condom, lubricant, and dental dams) during sexual activities, more than half of those who had oral or anal sex with a man reported that they never or rarely used barrier-type protection (n=21/32; 65.6%) (Table 3). A similar finding was observed for those who had oral or vaginal sex with a woman, where more than half reported that they never or rarely used barrier-type protection (n=50/87; 57.5%) (Table 4). Among the participants who reported having had sex in the last six months in federal prison, 1.1% (n=15/1,404) exchanged sex for goods.

Table 3: Sexual behaviours with a man in Canadian federal prisons in the last six months (n=32)

Sexual activity with a man	Frequency % (n)		
	Oral	Vaginal	Anal
Rarely or never used barrier-type protection	65.6 (n=21)	28.1 (n=9)	65.6 (n=21)

Note: This table presents the proportion of participants who did not use barrier-type protection when they had sex with a man in prison, within the last six months. Results are presented by type of sexual activity (oral, vaginal, and anal). Approximately two-thirds never used barrier-type protection when having oral and anal sex with a man

Table 4: Sexual behaviours with a woman in Canadian federal prisons in the last six months (n=87)

Sexual activity with a woman	Frequency % (n)		
	Oral	Vaginal	Anal
Rarely or never used barrier-type protection	57.5 (n=50)	57.5 (n=50)	34.5 (n=30)

Note: This table presents the proportion of participants who did not use barrier-type protection when they had sex with a woman in prison, within the last six months. Results are presented by type of sexual activity (oral, vaginal, and anal). Slightly more than half reported having never used barrier-type protection when having oral and vaginal sex with a woman

Among the total sample, 70 participants reported that they had difficulty accessing items for sexual protection (5.0%). The most frequently reported issue was an insufficient quantity. For example, 40.0% (n=28/70) who reported difficulties indicated that when they went to obtain condoms, there were none left. Not knowing where to find condoms, lubricant, and/or dental dams was also frequently reported. Furthermore, participants reported being worried/afraid that other people could see them obtaining these supplies (Table 5).

Finally, participants were asked about their awareness of PrEP and PEP in federal prison. It was found that 8.7% (n=122/1,404) were aware that they could access PrEP in federal prison. Among these participants, 8.2% (n=10/122) said they have been on PrEP in federal prison, of which 50.0% (n=5/10) indicated that they had been on it within the last six months. Similarly, awareness of PEP availability in federal prison was reported



Table 5: Issues accessing harm reduction supplies in Canadian federal prisons (n=70)

Issues reported	Frequency % (n)		
	Harm reduction supply	Condoms	Lubricant
When I went to get some, there weren't any left		40.0 (n=28)	35.7 (n=25)
I didn't know where to find them		20.0 (n=14)	17.1 (n=12)
I was worried other people in custody could see me getting them		18.6 (n=13)	20.0 (n=14)

Note: This table presents the main issues reported by participants when they tried to access harm reduction supplies in prison. Reasons are presented by type of supply, including condoms, lubricant, and dental dams. A majority reported that there were no condoms (40%) or dental dams (17%) left when they needed the items, and that they did not know where to find them. For lubricant, most reported that they were worried that other people in custody would be able to see them when getting it (20%)

by 7.1% (n=100/1,404) of participants. Among this group, 11.0% (n=11/100) reported that they had been on PEP while in federal prison, while a small number (n<5) reported being on PEP within the last six months.

Discussion

This study is the largest to measure the prevalence of STBBI risk factors among federally incarcerated Canadians since 2007. Results indicate that tattooing may be growing in popularity, with 44.6% of participants reporting that they had received a tattoo in 2022, compared to 38.0% in 2007 (7). Although this difference is small, it could represent significant clinical implications for CSC in terms of STBBI prevention and treatment. This proportion is higher than what has been reported in Australia and the United States (US). In Australian prisons, the prevalence of tattooing was 13.4% among women and 24.6% among men, while in the US prisons, it was estimated at 8.7% among women and 19.3% among men (12). This proportion also appears to be higher among people who are incarcerated compared to the general population. For example, national data from 2006 estimated that 24.0% of the US population had tattoos, and 14.0% had body piercings (13). Similarly, 13.0% of the participants in the 2007 survey reported having ever had a piercing (7). Given that participants of the 2022 NHS were not asked about body piercings in prison, more research would be needed to determine the prevalence of body-piercing in Canadian prisons. Considering the possibility of being in contact with infected blood, body piercing represents a potential risk for STBBI transmission in prison.

A modest increase in sexual activity during incarceration was observed in 2022 relative to 2007 (2022: 8.8%; 2007: 7.2%) (14). However, since these proportions are similar, this difference may not be indicative of a significant upward trend. The results of the present study are consistent with a survey conducted in Australia,

where the authors found that 7.0% of men who are incarcerated and 36% of women reported having had sex with another person who is incarcerated (15). However, the results of this study may not be directly comparable to existing literature, as the 2022 NHS also included sexual activity with a person who is not incarcerated (i.e., private family visits) and was not restricted to sexual activity with another person who is incarcerated.

Results from this study showed that 65.6% of people who are incarcerated who had sex with men and 57.5% of those who had sex with women reported that they rarely or never used barrier-type protection (e.g., condoms, dental dams). This is consistent with research from the US which showed that although 65% of incarcerated men who have sex with men and male-to-female transgender women reported using condoms, 75% also reported a sexual intercourse without condom (16). Comparatively, research from New South Wales, in Australia, showed that 56.8% of men who are incarcerated engaged in anal sex reported using condoms. It is important to note, that when comparing with Queensland, Australia, where condoms are not provided to people who are incarcerated, the proportion reporting anal sex was equally low. Therefore, the researchers concluded that there was no evidence to suggest that providing condoms increases consensual or non-consensual sexual activity in prison (17).

Only a small proportion of participants reported difficulties in accessing harm reduction supplies (5%). Nonetheless, nearly half of these individuals (40%) disclosed that condoms were not available when they needed them. Among those who reported having difficulty accessing supplies, participants reported different reasons, including an insufficient quantity of supplies (most frequently reported), not knowing where to find supplies, and worrying that other people in custody could see them obtaining these supplies. Considering the above findings, this suggests that individuals may be aware of the program to supply barrier-type protection items, but that the lack of supply is preventing use, thereby leading to higher-risk sexual encounters. More research would be needed to determine the reasons why participants reported an insufficiency in supplies. Lack of access and/or insufficient quantity of supplies has significant implications for programming given the results from Scott *et al.* who found that condoms in prison reduced the annual incidence of syphilis by 99.0%, gonorrhea by 98.0%, hepatitis B by 71.0%, chlamydia by 27.0%, and HIV by 50.0% (18).

Finally, this study found that 7% and 8% of participants, respectively, were aware of PrEP and PEP availability in Canadian prisons. These proportions are higher compared to 3% and 4%, respectively, observed in three state prisons in the Northeastern region of the US (19). Although this finding is somewhat encouraging, only a small proportion of participants actually used PrEP and PEP in federal prison (less than 1% of all participants).

One strength of this study is that the 2022 NHS was confidential and self-administered, which could have helped to minimize



information biases such as social desirability. An interviewer-administered option was available for individuals where low literacy prevented the self-administered option and for those to whom it was preferred. The sample used in this study included all Canadian provinces, as well as people housed in both men's and women's institutions.

Limitations

However, considering a total population of 12,399 individuals at the end of the fiscal year 2020–2021, study participants represented 11.3% of the total CSC population (20). Given that the current sample reflects a small proportion of the in-custody population at CSC, this could have had an impact on the representativeness of the sample. Indeed, this study's sample included more women and people who are incarcerated in the Québec region, proportionally, to the total federally incarcerated population. Therefore, results may be more representative of the situation in this region. For example, in a report of the 2022 NHS results focusing on men's institutions (representing 91.5% of the sample), it was found that fewer participants reported having ever been tested for HCV in Québec compared to the other regions (21). It is possible that participants who have been tested against STBBI are more likely to be aware of the availability of PrEP and PEP in correctional institutions if they have had a discussion with Health Services staff about this aspect of their health. The same report found that significantly more participants in the Atlantic and Pacific regions had ever received a tattoo while in prison (21). The higher proportion of participants from Québec in the sample may therefore have resulted in a lower estimate of tattooing in prison than would be expected at the national level if the sample were fully representative. A small proportion of people who are incarcerated could have been excluded for not being able to participate in English or French. This proportion was not calculated for the 2022 NHS but represented less than 0.5% in the 2007 NIIDRBS (7). Although there was no change in STBBI testing and immunization policies during the period of time between the surveys, it is possible that disruptions during the COVID-19 pandemic, as observed in the community (22), had an impact on services and the behaviours of participants. Furthermore, although a previous report descriptively reported on differences across correctional institutional security levels (21), more advanced analysis is needed to determine whether the risk factors and needs for harm reduction measures differ depending on the security levels of correctional institutions. Finally, as the NIIDRBS was conducted 15 years before the 2022 NHS, the administration of additional surveys would be needed to draw conclusions on trends related to the risk factors among people who are federally incarcerated. Nevertheless, this study provided valuable information on the behaviours of the federally incarcerated population in Canada. Understanding risk behaviours and barriers faced when accessing harm reduction measures is essential to providing adequate protection against STBBI in prison.

Conclusion

The results of this study suggest that device-sharing during tattooing and sexual activities without barriers while incarcerated could be important risk factors of STBBI transmission among people who are incarcerated. Continuous efforts are needed to ensure that the supply of harm reduction items (particularly condoms) in sufficient quantities are available to maximize their utilization and impact on prevention. For future research, there is a need to better understand the relationship between these risk factors to identify opportunities for harm reduction and prevention programs that would likely have the greatest impact on reducing transmission. More research is needed to better understand the impact of tattooing on HIV and HCV risk and to assess the potential of harm reduction programs in federal prisons to reduce transmission. A health promotion campaign could also help increase awareness of the availability of PrEP and PEP in federal prison among individuals at highest risk of HIV and HCV due to tattooing and sexual encounters, and potentially increase participation in these programs.

Authors' statement

MP-G — Conceptualization, formal analysis, writing—original draft, writing—review & editing

KW — Conceptualization, formal analysis, writing—review & editing

JS — Conceptualization, writing—review & editing

ST — Conceptualization, writing—review & editing

DF — Formal analysis, writing—review & editing

WM — Formal analysis, writing—review & editing

SJ — Formal analysis, writing—review & editing

Competing interests

All authors have no competing interest to declare.

ORCID numbers

Marie-Pierre Gendron — [0009-0003-0678-3229](#)

Kayla Wanamaker — [0000-0002-0211-4672](#)

Jonathan Smith — [0009-0002-1687-0062](#)

Shannon Thompson — [0009-0009-6627-4980](#)

Daniella Filoso — [0009-0009-1218-7611](#)

Wardah Mahboob — [0000-0001-7607-6376](#)

Sara Johnson — [0009-0002-1994-4573](#)

Acknowledgements

The authors would like to acknowledge the contribution of the following individuals who made this research possible: Lynne Leonard from the University of Ottawa, Michael Martin, Jean-Pascal Nadeau, Roger Martin, Hallye Ward, Ian Broom,



and all Regional Health Services staff of Correctional Service Canada (CSC) who participated to the data collection. Thank you to Paul Sandstrom and Emma R Lee, from the Public Health Agency of Canada's National HIV & Retrovirology Laboratory. Finally, thank you to the people who are incarcerated in CSC institutions who participated in the 2022 National Health Survey for the valuable information they provided.

Funding

This work was supported by Correctional Service Canada.

References

1. Public Health Agency of Canada. Reducing the health impact of sexually transmitted and blood-borne infections in Canada by 2030: A pan-Canadian STBBI framework for action. Ottawa, ON: PHAC; 2018. <https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/reports-publications/sexually-transmitted-blood-borne-infections-action-framework.html>
2. Kluger N. The Tattooed and the Social Environment: Epidemiology of Tattoos in Industrialized Countries. *Curr Probl Dermatol* 2015;48:6–20. DOI PubMed
3. Hellard ME, Aitken CK, Hocking JS. Tattooing in prisons--not such a pretty picture. *Am J Infect Control* 2007;35(7):477–80. DOI PubMed
4. Taylor S, Neufeld J. Incarceration and sexually transmitted and blood-borne diseases. National Collaborating Centre for Infectious Diseases. 2021. <https://nccid.ca/publications/incarceration-and-STBBI/>
5. Tran NT, Dubost C, Baggio S, Gétaz L, Wolff H. Safer tattooing interventions in prisons: a systematic review and call to action. *BMC Public Health* 2018;18(1):1015. DOI PubMed
6. Correctional Service Canada. Health Services. Ottawa, ON: CSC; 2022. <https://www.canada.ca/en/correctional-service/programs/offenders/health-services.html>
7. Correctional Service Canada. Summary of emerging findings from the 2007 National Inmate Infectious Diseases and Risk-Behaviours Survey. Ottawa, ON: CSC; 2010. <https://www.canada.ca/en/correctional-service/corporate/library/research/report/211-full-report.html>
8. Gendron MP, Thompson S. HIV and HCV Surveillance at CSC and PNEP/OPS overview and update. Presentation at the Satellite SA037, 24th International AIDS Conference. 2022.
9. Williams M. Research Methods for Criminal Justice Students, Chapter 13. Surveys. Pressbooks. 2022. <https://uen.pressbooks.pub/researchmethodscriminaljusticestudents/chapter/chapter-13-surveys/>
10. Correctional Service Canada. Health Services. Infectious Diseases, Risk-Behaviours, and Harm-reduction Approaches: A Summary of Findings from the 2022 National Health Survey. (Research Report R-477). Ottawa, ON: CSC; 2022. <https://publications.gc.ca/site/eng/9.940651/publication.html>
11. IBM. IBM SPSS Software. <https://www.ibm.com/spss>
12. Moazen B, Saeedi Moghaddam S, Silbernagl MA, Lotfzadeh M, Bosworth RJ, Alammehrjerdi Z, Kinner SA, Wirtz AL, Bärnighausen TW, Stöver HJ, Dolan KA. Prevalence of Drug Injection, Sexual Activity, Tattooing, and Piercing Among Prison Inmates. *Epidemiol Rev* 2018;40(1):58–69. DOI PubMed
13. Laumann AE, Derick AJ. Tattoos and body piercings in the United States: a national data set. *J Am Acad Dermatol* 2006;55(3):413–21. DOI PubMed
14. Public Safety Canada. Awareness and Use of Harm Reduction Measures for Sexually Transmitted Infections (STIs) in Canadian Penitentiaries. Ottawa, ON: PSC; 2010. <https://www.publicsafety.gc.ca/lbrr/archives/cn21406-eng.pdf>
15. Donovan B. Sex in Australian prisons: the facts. University of New South Wales. 2011. https://static1.1.sqspcdn.com/static/f/556710/11700892/1302663289963/unsu_sex_in_prisons.pdf
16. Harawa NT, Sweat J, George S, Sylla M. Sex and condom use in a large jail unit for men who have sex with men (MSM) and male-to-female transgenders. *J Health Care Poor Underserved* 2010;21(3):1071–87. DOI PubMed
17. Australian Institute of Health and Welfare. The health of people in Australia's prisons 2022. Canberra, ACT: AIHW; 2024. <https://www.aihw.gov.au/reports/prisoners/the-health-of-people-in-australias-prisons-2022/contents/health-risk-behaviours/at-risk-sexual-behaviours>



18. Scott N, McBryde E, Kirwan A, Stoové M. Modelling the Impact of Condom Distribution on the Incidence and Prevalence of Sexually Transmitted Infections in an Adult Male Prison System. PLoS One 2015;10(12):e0144869. DOI PubMed
19. Valera P, Ali ZS, Cunningham D, McLaughlin C, Acevedo S. Exploring Pre-Exposure Prophylaxis (PrEP) and Post-Exposure Prophylaxis (PEP) Knowledge in Incarcerated Men. Am J Mens Health 2022;16(4):15579883221107192. DOI PubMed
20. Public Safety Canada. 2021 Corrections and conditional Release Statistical Overview, Figure C1: Total offender population 2020-21. Ottawa, ON: PSC; 2023. <https://www.publicsafety.gc.ca/cnt/rsrccs/pblctns/ccrso-2021/#sec-c1>
21. Correctional Service Canada. Infectious diseases, risk behaviours, and harm-reduction in Men's Institutions: Findings from the 2022 National Health Survey. (Research Report R-484). Ottawa, ON: CSC; 2025. https://publications.gc.ca/collections/collection_2025/scc-csc/PS83-3-484-eng.pdf
22. Public Health Agency of Canada. Survey on the impact of COVID-19 on the delivery of STBBI prevention, testing and treatment, including harm reduction services, in Canada. Ottawa, ON: PHAC; 2022. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/survey-impact-covid-19-delivery-stbbi-prevention-testing-treatment.html>

Get **CCDR** delivered to your inbox

- Know the trends
- Get the testing guidelines
- Stay current on new vaccines
- Learn about emerging infections
- Get the table of contents straight to your inbox

SUBSCRIBE TODAY

Web search: CCDR+Subscribe





Findings from the Tracks survey on sexually transmitted and blood-borne infections and related factors among Two-Spirit people, gay, bisexual, trans and queer men and non-binary people (2S/GBTQ+) in Canada, 2024

Megan Butler¹, Nathan Lachowsky^{2,3,4}, Benjamin Klassen², Elsie Wong¹, Herak Apelian¹, Tyrone Curtis³, Kimia Rohani³, Anthony Amato^{3,4}, Catherine Card⁵, Sandra Kiazzyk⁵, Joseph Cox^{1,6}, Josephine Aho^{1*}

Abstract

Background: Population health data are scarce for sexual- and gender-diverse communities who are disproportionately affected by sexually transmitted and blood-borne infections (STBBI). The Tracks survey of Two-Spirit people, gay, bisexual, trans and queer men and non-binary people (2S/GBTQ+) collected data from 43 Pride and community events in 19 cities across Canada in summer 2024.

Objective: To describe the self-reported prevalence of STBBI, including HIV, and associated factors among 2S/GBTQ+ people.

Methods: The self-administered questionnaire collected information on sociodemographics, social determinants of health, sexual behaviours, substance use, use of STBBI prevention services, HIV pre-exposure prophylaxis (PrEP), care and treatment for HIV and experiences of discrimination and abuse. Descriptive analysis was performed.

Results: Of the 4,880 participants, 52.2% described their sexual orientation as gay, 26.5% as queer and 24.1% as bisexual; 62.2% identified as a man and 22.4% as non-binary; 28.5% identified as trans; and median age was 30 years. Of participants aged 18 years or older, 63.3% experienced discrimination in the past 12 months and 45.5% had sex forced upon them in their lifetime. In the past 12 months, 5.6% of participants self-reported having been diagnosed with gonorrhea, 5.2% with chlamydia and 2.3% with syphilis; overall, 4.2% of participants self-reported living with HIV. Among participants who self-reported being HIV-negative, 17.5% were currently taking HIV PrEP.

Conclusion: High levels of discrimination and abuse were found among study participants. While most participants were aware of HIV PrEP, fewer than one in four currently used it. Findings from this survey will help inform STBBI programs and policies. The intentional inclusion of diverse participants provides important information on populations who have been previously less engaged in STBBI research.

Suggested citation: Butler M, Lachowsky NJ, Klassen BJ, Wong E, Apelian H, Curtis TJ, Rohani K, Amato AT, Card C, Kiazzyk S, Cox J, Aho J. Findings from the Tracks survey on sexually transmitted and blood-borne infections and related factors among Two-Spirit people, gay, bisexual, trans and queer men and non-binary people (2S/GBTQ+) in Canada, 2024. *Can Commun Dis Rep* 2026;52(10):401–15.

<https://doi.org/10.14745/ccdr.v52i10a04>

Keywords: HIV, sexually transmitted and blood-borne infections, Tracks survey, Sex Now, GBMSM, Two-Spirit, trans men, non-binary people, HIV PrEP

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Affiliations

¹ Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, Ottawa, ON

² Community-Based Research Centre, Vancouver, BC

³ School of Public Health and Social Policy, University of Victoria, Victoria, BC

⁴ Faculty of Human and Health Sciences, University of Northern British Columbia, Prince George, BC

⁵ National Microbiology Laboratory Branch, Public Health Agency of Canada, Winnipeg, MB

⁶ Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, QC

*Correspondence:

josephine.aho@phac-aspc.gc.ca



Introduction

In Canada, sexual- and gender-diverse populations, including Two-Spirit people, gay, bisexual, queer and trans men, trans women, pansexual people and non-binary people, face numerous health and social inequities as a result of homophobia, transphobia, ableism, colonization, racism and other intersecting forms of discrimination (1,2). Gay, bisexual and other men who have sex with men (GBMSM), a subset of the sexual- and gender-diverse communities, continue to be disproportionately affected by sexually transmitted and blood-borne infections (STBBI) (3–5). In 2023, among the 2,434 newly diagnosed cases of HIV in Canada, 40.5% were among GBMSM (3). Further, despite a faster increase in infectious syphilis cases in the non-GBMSM population since 2018, data from eight provinces and territories in 2023 found that 27% of all infectious syphilis cases were among cisgender GBMSM (4).

While more STBBI data exist for GBMSM, very little population health data are available for Two-Spirit, trans and non-binary people in Canada, making it a challenge to quantify the burden of STBBI in these populations (6). This is, in part, because data on variables such as gender identity or being Two-Spirit are not widely captured through routine and notifiable disease surveillance systems; therefore, to better understand the current STBBI trends and related factors among Two-Spirit people, gay, bisexual, trans and queer men and non-binary people (2S/GBTQ+), enhanced surveillance data are needed (7).

As part of efforts to collect enhanced surveillance data, the Public Health Agency of Canada (PHAC) implemented the Tracks surveillance program in 2002. This program monitors the prevalence of HIV, hepatitis C, syphilis and other STBBI, and associated factors in key populations in Canada by conducting periodic, biobehavioural surveys (questionnaire and biological sample). With provincial, regional and local public health partners, two phases of the Tracks survey among GBMSM were previously conducted: Phase 1 (2005–2007) in five cities (Victoria, Winnipeg, Toronto, Ottawa and Montréal) (N=4,838); and Phase 2 (2008–2010) in two cities (Vancouver and Montréal) (N=3,042) (8,9). For Phase 3 (2024), PHAC collaborated with the Community-Based Research Centre (CBRC) to conduct a survey with 2S/GBTQ+ people (10). This shift in study population from GBMSM to 2S/GBTQ+ reflects a need to be inclusive of broader communities and understand their varied experiences (6).

The Tracks 2S/GBTQ+ Phase 3 survey is also referred to as the in-person Sex Now 2024 survey. It is one survey in a series of periodic “Sex Now” community-led surveys undertaken by CBRC since 2002 to collect sexual health, HIV and other STBBI data (11). The Sex Now survey has evolved from originally being a provincial study of sexual relationships between men in British Columbia to a Canada-wide survey on the health of people with diverse sexual orientations and gender identities (11,12).

This article presents descriptive findings from the national Tracks 2S/GBTQ+ Phase 3 survey, conducted from June 1, 2024 to September 15, 2024. The objectives are to describe 1) self-reported prevalence of HIV, syphilis and other STBBI and 2) care and treatment for HIV. It also reports on social determinants of health, experiences of discrimination and abuse, sexual behaviours, substance use, and use of prevention services.

Methods

Tracks Phase 3 (Sex Now 2024) survey of 2S/GBTQ+ people in Canada is a biobehavioural survey involving the administration of a questionnaire and the collection of a biological sample to test for HIV, hepatitis C, syphilis and hepatitis B. The current report presents only the results from the questionnaire component of the 2024 biobehavioural survey since only 39.4% of participants who were invited to provide a biological sample opted to do so. An analysis of biological test results will be conducted and presented in a future report.

Sampling methods

Similar to other Tracks surveys of key populations and previous Sex Now surveys, venue-based sampling was used for the Tracks 2S/GBTQ+ Phase 3 survey. Local study teams, trained by the CBRC research team, actively recruited at venues by approaching potential participants and providing them with information (e.g., survey objectives, what participation entails, eligibility) as outlined in the recruitment script. Recruitment of participants took place at Pride festivals or other 2S/GBTQ+-related venues/events (e.g., picnics, community dinners, Pow Wows, bars) across Canada in summer 2024. Promotion of the survey included social media posts, mainstream media engagement, word-of-mouth and leveraging relationships with Pride Societies and local community-based organizations.

With the aim to include at least one study site per province, the following factors were considered when selecting study sites: large 2S/GBTQ+ population; higher prevalence of HIV than the general population in the region; local community support; ability of local partners to implement the survey; and study site participation in prior Sex Now surveys.

Eligibility and consent

Eligible participants had to self-identify as 1) Indigenous Two-Spirit, OR 2) a non-binary person or trans man OR 3) a gender other than woman (cis or trans) and either gay, bisexual, queer or another non-heterosexual identity or report having engaged in sexual activity with a man (cis or trans) in the past five years. Survey participants also had to be 1) 15 years of age or older, 2) living in Canada and 3) able to provide informed consent and complete the questionnaire in English, French or Spanish.



Individuals who had already participated in the current survey were excluded from participating again.

Eligible participants were presented with a consent form on the study tablet or their personal device. Participants had the opportunity to ask any questions to local study team members. Consent was then obtained by clicking on a standard checkbox. Consenting participants completed the self-administered questionnaire and had the option to provide a biological sample in the form of a dried blood spot (DBS) specimen. Only participants 18 years or older were invited to provide a DBS specimen. Participants had the option to have the results of their DBS specimen test returned to them by trained CBRC peers.

Participants who reported a blood disorder in which their blood does not clot properly (e.g., hemophilia or von Willebrand disease) or who recently underwent chemotherapy were excluded from the option to provide a DBS specimen. The total number of individuals approached and reasons for declining to participate were not recorded.

Questionnaire

The questionnaire was based on questions used in prior Tracks or Sex Now surveys and demonstrated both face and content validity. Questionnaire development was also informed by a review of the epidemiology and literature of 2S/GBQ+ people and STBBI; a review of published GBMSM questionnaires; and consultations by CBRC with community partners to ensure questions reflected the experiences, data needs and concerns of community members.

The Tracks 2S/GBQ+ Phase 3 (Sex Now 2024) questionnaire asked about the following: sociodemographic characteristics; social determinants of health; sexual behaviours and relationships; substance use; use of STBBI health and prevention services (including testing); care and treatment for HIV and hepatitis C; knowledge and use of HIV pre-exposure prophylaxis (HIV PrEP), doxycycline PrEP (doxy PrEP) and doxycycline post-exposure prophylaxis (doxy PEP) (13); experiences of discrimination and abuse; community and social connections; and mental health. This questionnaire took an average of 27 minutes (interquartile range [IQR]=17–30 minutes) to complete.

The questionnaire was programmed into LimeSurvey version 3 software and piloted by PHAC and CBRC staff, as well as 2S/GBQ+ community members. Piloting was conducted to estimate the time required to self-complete the questionnaire and identify any of the following: errors in skip logic or validation rules; unclear questions or response options; typing or editing errors; and formatting issues. The English questionnaire was subject to four rounds of piloting and the French and Spanish questionnaires to two rounds. This pilot testing included multiple members of the study population. Local study teams were trained on survey processes. The self-administered questionnaire,

with optional assistance from the study team, CBRC staff or volunteers, was accessible on electronic tablets provided by the study team or on a participant's own device via scanning a QR code. Questionnaire data were stored on secured PHAC servers. Participants who completed the questionnaire and were aged 18 years or older had the option to provide a finger-prick blood sample collected on a DBS filter card for STBBI testing. As mentioned previously, given the low uptake of DBS, results from STBBI testing are not presented in this article.

Participants received \$10 CAD cash for their participation in the questionnaire and a Sex Now branded tote bag for providing an optional DBS sample. The protocol and questionnaire were approved by research ethics boards at Health Canada-PHAC (REB 2023-042P), University of Victoria (BC24-0135), University of British Columbia (H24-00806) and Simon Fraser University (H24-00806). Data sharing agreements were established between PHAC, CBRC and the University of Victoria.

Analysis

Overall, 4,880 eligible participants were recruited from 43 events in 19 Canadian cities from June 1, 2024 to September 15, 2024. The purpose of this report and the analyses undertaken were descriptive in nature and focused on questionnaire data. The DBS test result data will be reported in future articles. Small cell counts (i.e., questionnaire response categories with a limited number of observations) were assessed to determine the risk of identifying individual participants and were left in when it was determined that there was no risk of re-identification, as per PHAC's *Directive for the Collection, Use and Dissemination of Information Relating to Public Health* (14). Where data in the table contain small cell counts, the results should be interpreted with caution. All descriptive statistics were computed using R Statistical Software version 4.3.2 (15).

Participants who selected questionnaire response options "I don't know", "Prefer not to answer" or "Unsure" were included in the analyses. Participants who selected the questionnaire response option "Not Applicable" or whose response option was manually coded as "skipped" (i.e., did not meet criteria to view and answer question), "blank" (i.e., did not answer question and proceeded to answer next question) or "exited" (i.e., exited questionnaire before completion) were excluded from analyses for that variable. As a result, denominators differ across variables depending on the number of participants who provided valid responses for each item. Of the 4,880 eligible individuals who consented to participate, 4,640 (95.1%) completed the entire questionnaire.

Descriptive analyses were performed to characterize the study population. Categorical variables are presented as frequencies (n) and proportions (%). Age was analyzed both categorically (using age groups) and continuously (using the median and range).



Select subgroup comparisons were conducted to explore potential differences in key variables. Pearson's chi-square tests of independence were calculated for these comparisons. These analyses were exploratory in nature and future manuscripts will provide more detailed characterisations of specific subgroups.

Results

Sociodemographic characteristics

Participant recruitment occurred in all ten Canadian provinces with approximately half of participants recruited from one of the following three cities: Toronto (25.0%), Ottawa (13.0%), and Vancouver (9.4%) (Table 1). The median age of participants was 30 years old, with ages ranging from 15 to 84 years. Overall, 28.5% of participants identified as a person with a disability. The most commonly reported ethnicity was white (64.2%), followed by Indigenous (11.2%). Of the 547 Indigenous participants, 63.4% were Two-Spirit.

Just over half of participants (52.2%) identified as gay, with queer (26.5%) and bisexual (24.1%) as the next most common sexual orientations. Around two-thirds of participants identified as a man (62.2%), and 22.4% as non-binary. About two-thirds of participants were GBMSM (69.4%). Of GBMSM participants, 39.7% (1,345/3,386) were between the ages of 15 and 29 years (data not shown in table). More than one-quarter of participants identified as trans (28.5%). Half ($n=710/1,390$, 51.1%) of trans participants were between the ages of 15 and 24 years, compared with only 18.5% ($n=646/3,490$) of participants who did not identify as trans (data not shown in table); this difference was statistically significant ($p<0.001$).

Social determinants of health

Two-thirds of participants (66.5%) had completed post-secondary school (e.g. certificate, diploma), a bachelor's degree or higher (Table 2). In the six months prior to the survey, 71.9% of participants were employed, 17.6% were students, 15.4% were unemployed and 7.2% were on government assistance. More than one-third (37.6%) of participants experienced financial strain (i.e., had to cut back or could not make ends meet) and 10.6% were unstably housed in the past six months. Overall, 5.3% of participants had been incarcerated in their lifetime.

Just under half of participants (45.5%) had sex forced upon them in their lifetime, and half ($n=1,425/2,787$, 51.1%) had experienced verbal, physical and/or sexual abuse by a partner in their lifetime (data not shown in table). More than half (56.3%) of participants reported currently being in a relationship and the majority of participants (94.8%) had at least one person they can count on for support. Only 54.5% of participants were satisfied with their connection to Two-Spirit, lesbian, gay, bisexual, trans, queer, questioning, intersex, asexual and other sexual and gender diverse (2SLGBTQIA+) communities.

Box 1 presents information on experiences of discrimination among study participants aged 18 years or older. Two-thirds of participants (63.3%) have experienced at least one form of discrimination in the past 12 months.

Box 1: Experiences of discrimination among participants aged 18 years or older in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024^a

Overall experience of discrimination:

- 63.3% (1,733/2,738) of participants experienced at least one form of discrimination in the past 12 months
- 22.1% (620/2,805) of participants avoided healthcare services due to fear of, or concern about, stigma or discrimination in the past 12 months

Experiences of discrimination among specific participant groups, past 12 months:

- Among non-binary participants, 61.1% (408/668) experienced discrimination based on their gender expression
- Among GBMSM, 25.1% (487/1937) experienced discrimination based on their sexual orientation
- Among trans participants, 64.2% (522/836) experienced discrimination based on their trans experience
- Among participants with a disability, 52.6% (437/831) experienced discrimination based on their disability status
- Among Indigenous participants, 40.1% (112/279) experienced discrimination based on their Indigenous identity
- Among participants who self-reported living with HIV, 25.0% (27/108) experienced discrimination based on their HIV status

Abbreviations: GBMSM, gay, bisexual and other men who have sex with men; 2S/GBTQ+, Two-Spirit people, gay, bisexual, trans and queer men and non-binary people

^a Questions on discrimination were only asked to participants aged 18 years or older. Participants were informed in advance that this section of the questionnaire was on discrimination and abuse and were given the option to skip the entire section. Participants who skipped the entire section or the relevant question(s) were excluded from the denominator. Of those aged 18 years or older, 36.0% (1,618/4,498) did not consent to viewing questions on discrimination and abuse, and an additional 1.6% (71/4,498) did not respond to the consent question for this section and thus also did not see these questions

Sexually transmitted and blood-borne infection risk exposure: Sexual behaviours and substance use

Sexual behaviours

Overall, 831 participants (17.8%) did not have any sexual partners in the past six months and thus were not asked any subsequent questions about sexual activity (Table 3). Of these, 282 participants (33.9%) reported having never had sex (data not shown). Among GBMSM participants in this study, a higher proportion of trans GBMSM (17.0%, 90/529) than non-trans GBMSM (9.2%, 238/2,593) reported having no sexual partners in the past six months (data not shown in table). This difference was statistically significant, ($p<0.001$).



Table 1: Sociodemographic characteristics of participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880)

Sociodemographic characteristics		n	Total ^a	%
City of recruitment	Victoria, BC	241	4,880	4.9
	Vancouver, BC	458	4,880	9.4
	New Westminster, BC	131	4,880	2.7
	Kelowna, BC	127	4,880	2.6
	Calgary, AB	264	4,880	5.4
	Edmonton, AB	133	4,880	2.7
	Saskatoon, SK	95	4,880	1.9
	Regina, SK	77	4,880	1.6
	Winnipeg, MB	301	4,880	6.2
	London, ON	332	4,880	6.8
	Hamilton, ON	128	4,880	2.6
	Toronto, ON	1,218	4,880	25.0
	Ottawa, ON	633	4,880	13.0
	Montréal, QC	313	4,880	6.4
	Québec City, QC	42	4,880	0.9
	Moncton, NB	58	4,880	1.2
	Halifax, NS	167	4,880	3.4
	Charlottetown & New London, PEI	96	4,880	2.0
	St John's, NL	66	4,880	1.4
Age group	15–17 years	158	4,880	3.2
	18–24 years	1,198	4,880	24.5
	25–29 years	950	4,880	19.5
	30–39 years	1,362	4,880	27.9
	40–54 years	728	4,880	14.9
	55 years or older	484	4,880	9.9
Identify as a person with a disability	Yes	1,372	4,808	28.5
	No	3,096	4,808	64.4
	Unsure	340	4,808	7.1
Born in Canada	Yes	3,452	4,805	71.8
	No	1,353	4,805	21.2
	Permanent status ^b	835	1,347	62.0
	Temporary status ^c	512	1,347	38.0
Ethnoracial identity ^d	Black	370	4,872	7.6
	East/Southeast Asian	492	4,872	10.1
	Indigenous	547	4,872	11.2
	Latina, Latino, Latinx, Latine	359	4,872	7.4
	Middle Eastern	177	4,872	3.6
	South Asian	256	4,872	5.3
	White	3,127	4,872	64.2
	None of the above	89	4,872	1.8

Table 1: Sociodemographic characteristics of participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880) (continued)

Sociodemographic characteristics		n	Total ^a	%
Two-Spirit ^e	Yes	347	547	63.4
	No	138	547	25.2
	Prefer not to answer ^f	62	547	11.3
Sexual orientation ^d	Asexual	337	4,867	6.9
	Bisexual	1,174	4,867	24.1
	Demisexual	54	4,867	1.1
	Gay	2,539	4,867	52.2
	Heteroflexible	78	4,867	1.6
	Homoflexible	121	4,867	2.5
	Pansexual	680	4,867	14.0
	Queer	1,292	4,867	26.5
	Questioning	132	4,867	2.7
	Straight	118	4,867	2.4
	Another term	122	4,867	2.5
Gender identity ^d	Agender	146	4,873	3.0
	Genderfluid	443	4,873	9.1
	Genderqueer	469	4,873	9.6
	Man	3,030	4,873	62.2
	Non-binary	1,092	4,873	22.4
	Questioning	184	4,873	3.8
	Trans man	552	4,873	11.3
	Transmasculine	52	4,873	1.1
	Trans woman ^g	74	4,873	1.5
	Woman ^g	158	4,873	3.2
	Another term	112	4,873	2.3
Identify as GBMSM ^h		3,386	4,880	69.4
Identify as trans		1,390	4,880	28.5

Abbreviations: AB, Alberta; BC, British Columbia; GBMSM, gay, bisexual and other men who have sex with men; MB, Manitoba; NB, New Brunswick; NL, Newfoundland; NS, Nova Scotia; ON, Ontario; PEI, Prince Edward Island; QC, Québec; SK, Saskatchewan; 2S/GBTQ+, Two-Spirit people, gay, bisexual, trans and queer men and non-binary people

^a Total represents the number of participants who provided a valid response to the corresponding survey question. Denominators vary because participants who selected "Not Applicable," skipped the question, left it blank or exited the questionnaire were excluded from analyses for that variable

^b Permanent status defined as participants who are not born in Canada and are a Canadian citizen or permanent resident

^c Temporary status defined as participants who are not born in Canada and are an international student, refugee or asylum seeker, temporary foreign worker, visitor or person without status

^d Proportions do not add up to 100% as options were not mutually exclusive; participants could select more than one response

^e This question was asked only to Indigenous participants

^f Prefer not to answer is included when it was an actual response option for the question

^g Women (including trans women) were eligible for inclusion if they were Two-Spirit or identified as another gender identity in addition to "Woman" or "Trans woman" and also met the other eligibility criteria

^h GBMSM defined as men (cis or trans) who 1) identified as gay, bisexual, queer, homoflexible, pansexual, demisexual, questioning or heteroflexible or 2) reported having had sex with a man (cis or trans) in the past five years



Table 2: Social determinants of health of participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880)

Social determinants of health		n	Total ^a	%
Education, highest level	Did not finish high school	341	4,776	7.1
	High school equivalent	1,260	4,776	26.4
	Post-secondary school	1,121	4,776	23.5
	Bachelor's degree	1,254	4,776	26.3
	Above a bachelor's degree	800	4,776	16.8
Employment status, past six months ^b	Employed ^c	3,443	4,790	71.9
	Unemployed	738	4,790	15.4
	Student	843	4,790	17.6
	Government assistance	344	4,790	7.2
	Retired	202	4,790	4.2
	Unable to work	240	4,790	5.0
	None of the above	37	4,790	0.8
Financial situation, past six months	Comfortable, with extra	1,316	4,806	27.4
	Enough, but no extra	1,682	4,806	35.0
	Have to cut back	1,138	4,806	23.7
	Cannot make ends meet	670	4,806	13.9
Unstable housing, past six months ^d		502	4,756	10.6
Ever incarcerated		246	4,676	5.3
Anyone ever forced sex on participant ^e		1,272	2,796	45.5
Ever experienced abuse from a partner ^e	Verbal abuse	1,286	2,795	46.0
	Physical abuse	613	2,793	21.9
	Sexual abuse	744	2,795	26.6
Number of people participant can count on for support	No one	237	4,570	5.2
	1 person	293	4,570	6.4
	2–3 people	1,652	4,570	36.1
	4–9 people	1,768	4,570	38.7
	10 or more people	620	4,570	13.6
Currently in a relationship ^f		2,508	4,453	56.3
Participant satisfied with their connection to 2SLGBTQQIA+ communities ^g	Yes	2,409	4,421	54.5
	No	988	4,421	22.3
	Unsure	1,024	4,421	23.2

Abbreviations: 2S/GBTQ+, Two-Spirit people, gay, bisexual, trans and queer men and non-binary people; 2SLGBTQQIA+, Two-Spirit, lesbian, gay, bisexual, trans, queer, questioning, intersex, asexual and additional people who identify as part of sexual and gender diverse communities

^a Total represents the number of participants who provided a valid response to the corresponding survey question. Denominators vary because participants who selected "Not Applicable," skipped the question, left it blank or exited the questionnaire were excluded from analyses for that variable

^b Proportions do not add up to 100% as options were not mutually exclusive; participants could select more than one response

^c Includes participants who were employed full-time, employed part-time, and/or self-employed in the past six months

^d Participants are classified as being unstably housed if they lived in any of the following places in the past six months: hotel/motel room, rooming/boarding house, shelter/hostel, transition house/halfway house, psychiatric institution, drug treatment facility, public place like a street/park/stairwell and/or in a vehicle. Participants who only lived in their own and/or another person's apartment, condo or house in the past six months are classified as stably housed. Participants who selected "None of the above" are excluded

^e Only asked to participants aged 18 years or older. Participants were informed in advance that this section of the questionnaire was on discrimination and abuse and were given the option to skip the entire section. Participants who skipped the entire section or this specific question were excluded from the denominator

^f Only asked to participants who reported that they have ever had sex

^g Excludes participants who selected "Not Applicable"

Among those who reported having had sex in the previous six months, 42.0% had one sexual partner, 35.3% had two to five sexual partners, 6.9% had six to nine sexual partners and 15.8% had ten or more sexual partners. Three-quarters (76.0%) of participants had sex with a man (cis or trans), 19.4% had sex with a woman (cis or trans) and 19.8% had sex with a non-binary person in the past six months.

The most common type of sexual activity reported by participants in the past six months was oral sex (85.7%) (Table 3). Around two-fifths of participants engaged in anal sex as the bottom (42.0%) or anal sex as top (41.1%) in that timeframe. Among those who had anal sex in the past six months, 14.0% always used condoms with their recurring sex partner(s) and 19.3% always used condoms with their one-off sex partner(s). Around one-quarter (22.7%) of participants engaged in sex between three or more people (i.e., threesome, group sex) in the past six months. As a measure of transactional sex, 3.6% of participants received money, goods or services in exchange for sex in the past six months.

Substance use

Three-quarters (74.9%) of participants reported using substances in the past six months (Table 3). Of those, 24.5% have used substances to enhance sexual experience during that timeframe. Among participants who have used substances to enhance sexual experience, the most common substances used were cannabis (68.1%), alcohol (52.8%) and poppers/amyl nitrite (40.5%). Other substances used to enhance sexual experience include erection drugs (19.5%), tobacco or nicotine (14.7%), ecstasy (14.6%), psychedelics (12.0%), cocaine (11.5%), crystal meth (10.0%), gamma-hydroxybutyrate (GHB) or gamma-butyrolactone (GBL) (8.0%) and ketamine (5.8%). The vast majority of participants (95.0%) had never injected substances for non-medical uses.

Access to and use of healthcare, sexually transmitted and blood-borne infection prevention and testing services

Primary healthcare and mental health

Two-thirds of participants (68.4%) currently had a regular family doctor or nurse practitioner. Of those, 67.9% said their regular healthcare provider was aware of their sexual orientation (Table 4). Lifetime HIV testing was more prevalent among participants whose healthcare provider was aware of their sexual orientation (n=1,610/1,903, 84.6%) as compared to participants whose healthcare provider was not aware of their sexual orientation (n=260/484, 53.7%) (data not shown in table). This difference was statistically significant ($p < 0.001$). Among trans participants, 72.3% (n=699/966) said their regular healthcare provider was aware of their gender identity (data not shown in table). Over one-third of participants (38.9%) reported having fair or poor mental health status. Half of participants either accessed (41.4%) or tried to access (11.1%) mental health counselling services in the past 12 months.



Table 3: Sexual behaviours and substance use among participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880)

Sexual behaviours and substance use		n	Total ^a	%
Sexual behaviours, past six months				
No sex partner		831	4,675	17.8
Number of sex partners ^b	1 partner	1,614	3,844	42.0
	2–5 partners	1,358	3,844	35.3
	6–9 partners	266	3,844	6.9
	10 or more partners	606	3,844	15.8
Has had sex with a man (cis or trans) ^b		2,914	3,835	76.0
Has had sex with a woman (cis or trans) ^b		743	3,835	19.4
Has had sex with a non-binary person ^b		758	3,835	19.8
Types of sexual activity ^{b,c}	Oral sex	3,273	3,819	85.7
	Mutual masturbation	2,635	3,819	69.0
	Fingering	2,344	3,819	61.4
	Sex with prosthetics or sex toys	1,618	3,819	42.4
	Rimming	1,612	3,819	42.2
	Anal sex as bottom	1,604	3,819	42.0
	Anal sex as top	1,569	3,819	41.1
	Vaginal sex	1,171	3,819	30.7
	Sex between three or more people	866	3,819	22.7
	Online sex	816	3,819	21.4
	Fisting	390	3,819	10.2
	None of the above	72	3,819	1.9
Always used condoms during anal sex with recurring sex partner(s) ^{b,d}		299	2,137	14.0
Always used condoms during anal sex with one-off sex partner(s) ^{b,d}		336	1,742	19.3
Has given money, goods or services in exchange for sex ^b		66	3,798	1.7
Has received money, goods or services in exchange for sex ^b		136	3,798	3.6
Substance use, past six months				
Used any substances (including cigarettes, alcohol and cannabis) ^e	Yes	3,387	4,525	74.9
	No	1,030	4,525	22.8
	Prefer not to answer ^f	108	4,525	2.4
Substance use to make sex more intense, less inhibited or last longer ^g	Yes, past six months	813	3,313	24.5
	Yes, more than six months ago	556	3,313	16.8
	No, never	1,944	3,313	58.7

Table 3: Sexual behaviours and substance use among participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880) (continued)

Sexual behaviours and substance use		n	Total ^a	%
Substance use, past six months (continued)				
Substances used to make sex more intense, less inhibited or last longer ^{c,h}	Cannabis	551	809	68.1
	Alcohol	427	809	52.8
	Poppers/amyl nitrite	328	809	40.5
	Erection drugs	158	809	19.5
	Tobacco or nicotine	119	809	14.7
	Ecstasy/"E"/MDMA	118	809	14.6
	Psychedelics	97	809	12.0
	Cocaine	93	809	11.5
	Crystal meth/Tina/"T"	81	809	10.0
	GHB or GBL	65	809	8.0
	Ketamine	47	809	5.8
	Crack/freebase	24	809	3.0
	Amphetamine/speed	20	809	2.5
	Opioids	18	809	2.2
Injected substance for non-medical use ^g	Tranquilizers/benzos	7	809	0.9
	Non-medical steroids	<5	809	N/A ⁱ
	Other	<5	809	N/A ⁱ
	Yes, past six months	69	3,360	2.1
	Yes, more than six months ago	100	3,360	3.0
	No, never	3,191	3,360	95.0

Abbreviations: GBL, gamma-butyrolactone; GHB, gamma-hydroxybutyrate; MDMA, 3,4-methylenedioxymethamphetamine; N/A, not applicable; 2S/GBTQ+, Two-Spirit people, gay, bisexual, trans and queer men and non-binary people

^a Total represents the number of participants who provided a valid response to the corresponding survey question. Denominators vary because participants who selected "Not Applicable," skipped the question, left it blank or exited the questionnaire were excluded from analyses for that variable

^b Among participants who reported having one or more sexual partners in the past six months

^c Proportions do not add up to 100% as options were not mutually exclusive; participants could select more than one response

^d Question was only asked to participants who reported having anal sex in the past six months

^e Substances include alcohol, tobacco, nicotine, cannabis, poppers, cocaine, ecstasy, erection drugs, GBL/GBL, crystal meth, ketamine, crack, tranquilizers/benzos, amphetamine, psychedelics, opioids, non-medical steroids, and "other" substances

^f Prefer not to answer is included when it was an actual response option for the question

^g Question was only asked to participants who reported using substances in the past six months

^h Question was only asked to participants who reported using substances to enhance sexual experience in that past six months

ⁱ Data suppressed due to small cell counts



Table 4: Access to and use of healthcare, STBBI prevention and testing services among participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880)

Access to and use of healthcare, STBBI prevention and testing services		n	Total ^a	%
Primary healthcare and mental health				
Has a regular family doctor or nurse practitioner		3,139	4,588	68.4
Regular family doctor or nurse practitioner aware of participant's sexual orientation ^b	Yes	2,075	3,055	67.9
	No	493	3,055	16.1
	Don't know	487	3,055	15.9
Mental health status, self-reported	Excellent or very good	1,522	4,618	33.0
	Good	1,298	4,618	28.1
	Fair or poor	1,798	4,618	38.9
Tried to access mental health counselling services, past 12 months	Yes, able to access	1,899	4,588	41.4
	Yes, but not able to access	508	4,588	11.1
	No, did not try to access	2,181	4,588	47.5
HIV PEP/PrEP				
Aware of HIV PEP		2,860	4,759	60.1
Aware of HIV PrEP	All participants	3,832	4,771	80.3
	GBMSM	2,826	3,309	85.4
	Other	1,006	1,462	68.8
Ever taken HIV PrEP ^c	Yes, currently taking	753	4,307	17.5
	Yes, but stopped	317	4,307	7.4
	No, never taken	3,237	4,307	75.2
Currently taking HIV PrEP ^c	GBMSM	696	2,960	23.5
	Other	57	1,347	4.2
Ever tried to get HIV PrEP ^{c,d}		178	3,212	5.5
Interested in using HIV PrEP ^{c,e}	Yes	860	3,485	24.7
	No	1,309	3,485	37.6
	Unsure	1,316	3,485	37.8
Doxy PrEP/PEP^f				
Aware of doxy PrEP/PEP		2,201	4,757	46.3
Ever taken doxy PrEP/PEP	Yes	540	4,755	11.4
	No	4,065	4,755	85.5
	Don't know	150	4,755	3.2
Interested in using doxy PrEP/PEP ^g	Yes	1,250	4,140	30.2
	No	1,544	4,140	37.3
	Unsure	1,346	4,140	32.5
Vaccinations				
Ever vaccinated against hepatitis B	Yes	2,758	4,550	60.6
	No	597	4,550	13.1
	Don't know	1,195	4,550	26.3
Ever vaccinated against HPV	Yes	2,034	4,536	44.8
	No	1,345	4,536	29.7
	Don't know	1,157	4,536	25.5
Number of doses of mpox vaccine participant received	One dose	502	4,567	11.0
	Two or more doses	882	4,567	19.3
	None	2,355	4,567	51.6
	Don't know	828	4,567	18.1

Table 4: Access to and use of healthcare, STBBI prevention and testing services among participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880) (continued)

Access to and use of healthcare, STBBI prevention and testing services		n	Total ^a	%
STBBI testing				
Tested for HIV ^c	Past 12 months	2,172	4,449	48.8
	- Past three months	1,223	4,449	27.5
	- Four to six months ago	485	4,449	10.9
	- Seven to 12 months ago	464	4,449	10.4
	More than 12 months ago	941	4,449	21.2
	Never tested	1,086	4,449	24.4
	Don't know	250	4,449	5.6
Tested for HIV ^c (in past 12 months)	GBMSM	1,693	3,045	55.6
	Other (non-GBMSM)	479	1,404	34.1
	Trans	431	1,328	32.4
	Other (non-Trans)	1,741	3,121	55.8
Tested for hepatitis C	Past 12 months	1,724	4,631	37.2
	- Past three months	902	4,631	19.5
	- Four to six months ago	435	4,631	9.4
	- Seven to 12 months ago	387	4,631	8.4
	More than 12 months ago	952	4,631	20.6
	Never tested	1,018	4,631	22.0
	Don't know	937	4,631	20.2
Tested for an STI other than HIV or hepatitis C	Past 12 months	2,271	4,613	49.2
	- Past three months	1,271	4,613	27.6
	- Four to six months ago	522	4,613	11.3
	- Seven to 12 months ago	478	4,613	10.4
	More than 12 months ago	1,030	4,613	22.3
	Never tested	919	4,613	19.9
	Don't know	393	4,613	8.5

Abbreviations: doxy, doxycycline; GBMSM, gay, bisexual, and other men who have sex with men; HPV, human papillomavirus; PEP, post-exposure prophylaxis; PrEP, pre-exposure prophylaxis; STBBI, sexually transmitted and blood-borne infection; STI, sexually transmitted infection; 2S/GBTQ+, Two-Spirit people, gay, bisexual, trans and queer men and non-binary people
^a Total represents the number of participants who provided a valid response to the corresponding survey question. Denominators vary because participants who selected "Not Applicable," skipped the question, left it blank, or exited the questionnaire were excluded from analyses for that variable

^b Question was only asked to participants who reported having a regular family doctor or nurse practitioner

^c Among participants who self-reported having never been diagnosed with HIV

^d Question was further restricted to participants who have never taken HIV PrEP

^e Question was further restricted to participants who have never taken OR have stopped taking HIV PrEP

^f Questions asking about doxy PrEP/PEP awareness, use, and interest did not differentiate between doxy PrEP and doxy PEP; asked about doxy PrEP/PEP combined

^g Question was only asked to participants who have not taken or don't know whether they have taken Doxy PrEP/PEP



Sexually transmitted and blood-borne infection prevention: HIV PEP/PrEP, doxy PrEP/PEP and vaccinations

Awareness of HIV PEP was lower than for HIV PrEP (60.1% vs. 80.3%) (Table 4) and HIV PrEP awareness was higher among GBMSM than non-GBMSM study participants (85.4% vs. 68.8%); this difference was statistically significant ($p<0.001$). Among all participants who self-reported being HIV-negative, 17.5% were currently taking HIV PrEP and 7.4% had previously taken HIV PrEP but were not currently using it. Of those who had stopped taking or had never taken HIV PrEP, 24.7% were interested in using HIV PrEP, and 37.8% were unsure if they would be interested in using it.

Less than half of participants (46.3%) were aware of doxy PrEP/PEP, and only 11.4% of participants had ever taken doxy PrEP/PEP (Table 4). Among participants who haven't taken doxy PrEP/PEP or who don't know whether they have taken it, 30.2% were interested in using it and 32.5% were unsure if they would be interested in using it. In terms of vaccinations, 60.6% of participants reported vaccination for hepatitis B, 44.8% for human papillomavirus (HPV), and 19.3% of participants had received two or more doses of the mpox vaccine.

Sexually transmitted and blood-borne infection testing

In the past 12 months, 48.8% of participants reported testing for HIV, 37.2% for hepatitis C, and 49.2% for other sexually transmitted infections (STIs). Testing for HIV in the past 12 months was more common among GBMSM than other study participants (55.6% vs. 34.1%; $p<0.001$) while less common among trans than other study participants (32.4% vs. 55.8%; $p<0.001$). One-quarter of participants (24.4%) have never been tested for HIV, 22.0% for hepatitis C and 19.9% for other STI.

HIV care cascade and sexually transmitted and blood-borne infection prevalence

All estimates of prevalence for HIV, hepatitis C and other STBBI are based on self-reported data from the questionnaire (Table 5). No DBS data are presented here, and thus awareness of infection status (i.e., comparison of a participant's self-reported status with their DBS test result for each infection) cannot be determined.

HIV prevalence and care cascade

Among study participants, 4.2% self-reported living with HIV. Of these, almost all participants (98.0%) had a clinic or provider for their HIV care and 96.8% were currently taking antiretroviral therapy. Among participants currently taking antiretroviral therapy, 92.6% reported a suppressed viral load on their most recent viral load test. Only 5.5% of participants living with HIV reported avoiding HIV medical care or treatment in the past 12 months due to fear of, or concern about, stigma or discrimination.

Table 5: HIV care cascade and STBBI prevalence among participants in the Tracks survey of 2S/GBTQ+ people in Canada, Phase 3, 2024 (n=4,880)

HIV care cascade and STBBI prevalence		n	Total ^a	%
HIV self-reported prevalence				
Self-reported having ever been diagnosed with HIV	Yes, I am living with HIV	198	4,713	4.2
	No, I have never been diagnosed with HIV ^b	3,292	4,713	69.8
	No, I have never been tested for HIV	1,086	4,713	23.0
	Prefer not to answer ^c	137	4,713	2.9
HIV care cascade (among participants who self-reported living with HIV, n=198)				
Currently have a clinic or provider for HIV care		194	198	98.0
Currently taking ART	Yes	182	188	96.8
	No	6	188	3.2
Self-reported results of most recent viral load test ^d	Suppressed	162	175	92.6
	Not suppressed	4	175	2.3
	I do not know or I am not sure	9	175	5.1
Avoided HIV medical care and treatment due to fear of, or concern about, stigma or discrimination, past 12 months ^e		6	110	5.5
Hepatitis C self-reported prevalence				
Self-reported hepatitis C status	I have hepatitis C now	16	4,606	0.3
	I have had hepatitis C before, but I cleared the virus without treatment (spontaneously)	44	4,606	1.0
	I have had hepatitis C before, but I cleared the virus with treatment	68	4,606	1.5
	I have never been diagnosed with hepatitis C ^b	3,460	4,606	75.1
	I have never been tested for hepatitis C	1,018	4,606	22.1
Self-reported prevalence of other STBBI, past 12 months ^f				
Gonorrhea		254	4,534	5.6
Chlamydia		236	4,551	5.2
Herpes (genital or anal)		111	4,522	2.5
Syphilis		106	4,517	2.3
Shigella		22	4,508	0.5
Mpox		19	4,510	0.4
Lymphogranuloma venereum		11	4,507	0.2

Abbreviations: ART, antiretroviral therapy; STBBI, sexually transmitted and blood-borne infection

^a Total represents the number of participants who provided a valid response to the corresponding survey questions. Denominators vary because participants who selected "Not Applicable," skipped the question, left it blank, or exited the questionnaire were excluded from analyses for that variable

^b Participants report having been tested, but not diagnosed, with the STBBI

^c Prefer not to answer is included when it was an actual response option for the question

^d Restricted to participants who are currently taking ART drugs

^e Only asked to participants aged 18 years or older. Participants were informed in advance that this section of the questionnaire was on discrimination and abuse and were given the option to skip the entire section. Participants who skipped the entire section or this specific question were excluded from the denominator

^f Estimates are among all participants, regardless of whether they have ever been tested for the STBBI. Denominators vary due to non-response



Hepatitis C prevalence

Among all study participants, 0.3% reported currently having hepatitis C and 2.5% previously had hepatitis C but had since cleared the virus. Among participants with a current hepatitis C infection, 53.3% had a hepatitis C healthcare provider (data not shown).

Sexually transmitted and blood-borne infection prevalence

In the past 12 months, 5.6% of participants self-reported having been diagnosed with gonorrhea, 5.2% with chlamydia, 2.5% with herpes (genital or anal) and 2.3% with syphilis.

Discussion

The 2S/GBTQ+ population in Canada is diverse, with people who have varying experiences related to ongoing STBBI epidemics. This survey provides essential information to better understand STBBI prevalence, access to STBBI prevention, STBBI testing and treatment, related sociodemographic characteristics, and risk exposure within the study sample. Overall, 4.2% of participants self-reported living with HIV and, while most participants were aware of HIV PrEP, fewer than one in four currently used it. High levels of discrimination and abuse were found among study participants.

While previous Tracks surveys have focused on GBMSM (8,9), this Phase 3 survey included the broader 2S/GBTQ+ community. As a result, this survey is not directly comparable with previous surveys that included only participants identifying as men. Further, previous Tracks surveys among GBMSM have only been eligible to men who have had sex with another man. Similar sexual activity-based eligibility criteria were not applied to this study, and thus some participants were eligible even if they have never had sex. Accessing this population is essential for primary prevention and health promotion efforts to educate and support STBBI knowledge and harm reduction practices. The current survey also recruited primarily from Pride festivals, while Tracks Phase 1 (2005–2007) and Phase 2 (2008–2010) surveys involved more recruitment from bars, associations, businesses and bathhouses. These differences in sampling location may further contribute to differences in the study populations, in addition to historical and societal changes.

Previous research has been done with the 2S/GBTQ+ population in Canada, but results of this study are also not directly comparable with these other studies. For example, there are meaningful differences in diversity and representation within the study population as compared to Sex Now 2018, a previous in-person Sex Now survey of 2S/GBTQ+ people at Pride festivals; the proportion of trans participants and non-binary participants more than quadrupled between the two surveys (16). The current study also had higher proportions of all racial/ethnic minority populations, with an increase in Black participants from 4.1% in 2018 to 7.6% in 2024 (16). While the current study composition

may not reflect the actual composition of the 2S/GBTQ+ population in Canada, it does provide valuable information on specific populations of this broader community.

As compared with Sex Now 2018, a higher proportion of participants in this 2024 survey have never been tested for HIV (8.4% vs. 24.4%), hepatitis C (9.3% vs. 22.0%) or other STI (7.9% vs. 19.9%) (16). Testing for HIV was less common among trans than other participants in this study. Lower STBBI testing uptake among trans and non-binary people as compared with cisgender people has been found in previous research with the 2S/GBTQ+ population (16). There are several reasons why trans and non-binary participants may be less likely to test for STBBI. First, as a result of cisnormative policies (e.g., gender segregated clinic hours), a lack of provider knowledge about trans identities and trans-specific healthcare needs and various forms of discrimination, trans and non-binary people often face barriers to accessing STBBI testing services (17,18). Further, a study using data from the Sex Now 2015 survey found that the proportion of trans GBMSM who were sexually inactive in the last 12 months was significantly higher than for cisgender GBMSM (19). This may contribute to a lower perceived or actual risk of STBBI, and thus lower testing uptake. Among GBMSM participants in this study, a higher proportion of trans GBMSM than non-trans GBMSM reported having no sexual partners in the past six months (17.0% vs. 9.2%).

The self-reported prevalence of HIV in this study (4.2%) is nearly 25 times higher than the estimated HIV prevalence in the general Canadian population in 2022 of 0.17% (3). Nevertheless, it is likely to be an underestimation of the true prevalence within the study sample, given that it is based on self-reported data and because of the younger age skew of the study sample. Nearly one-quarter of the sample reported having never been tested for HIV, and even among participants who had previously tested negative for HIV, it is possible that some may have seroconverted since their most recent HIV test. Subgroup analyses of HIV prevalence will also be important, as half of people living with HIV in Canada as of 2022 were GBMSM (3). The Engage Cohort Study of GBMSM in Canada has also found HIV prevalence estimates in Montréal, Toronto, and Vancouver that are three-to-five times higher than the estimate in this study, highlighting the need for further population- and geographic-specific analyses (20).

At a federal level, Canada has made commitments to meeting the 95-95-95 global targets to end HIV/AIDS as a public health concern (21). While progress towards the first target, awareness of HIV status, cannot be determined from these self-reported data, this study provides insights into the remaining two targets among the study population. Among participants in this study who self-reported living with HIV, 96.8% reported currently taking HIV antiretroviral therapy drugs. Of those currently taking antiretroviral therapy drugs, 92.6% reported a suppressed viral load on their most recent viral load test. These are similar to HIV



care continuum metrics from studies among GBMSM in Canada in 2017–2019 (3).

Sexual behaviours and substance use are important risk exposures related to STBBI. Among participants who have used substances to make sex more intense, less inhibited or last longer, the most commonly used substance was cannabis, followed by alcohol and poppers. These results are similar to a 2021 study among 2S/GBTQ+ people, which found that poppers were the most commonly used substance to enhance sexual experiences, followed by cannabis and alcohol (22).

In this study, one in five participants (19.3%) who had anal sex with one-off sex partner(s) and 14.0% who had anal sex with recurring sex partner(s) in the past six months reported consistent condom use. Consistent condom use is lower than was observed in a previous Tracks survey with GBMSM in 2005–2007 (9). While this may, in part, be due to differences in study population, decreasing trends in condom-protected sexual events were also found in other Canadian studies among GBMSM (23). An Australian study among GBMSM from 2013 to 2017 found a rapid decrease in consistent condom use alongside a rapid increase in HIV PrEP use (24).

In addition to sexual behaviour and substance use data, this study also collected information on STBBI prevention and healthcare services. Previous studies have shown increasing knowledge about HIV PrEP from 2015 to 2019 and increasing use of HIV PrEP between 2018 and 2020, among 2S/GBTQ+ people in Canada (25). The present study shows slight decreases in both of these measures as compared with 2019 and 2020, respectively, although comparison with these studies is challenging. This decrease reflects greater study participation from non-GBMSM people, among whom HIV PrEP uptake is lower compared with GBMSM study participants. An analysis of data from the 2019 Trans PULSE survey among trans and non-binary people in Canada found current HIV PrEP use was 0.9% (26), which is drastically lower than 17.3%, the proportion of participants who reported currently using HIV PrEP in a Sex Now study of 2S/GBTQ+ people in the same year (25).

Doxycycline, an antibiotic commonly used to treat chlamydia and sometimes used to treat syphilis in Canada, is increasingly being prescribed off-label to prevent bacterial STI. Several large-scale studies have shown promising results for doxy PEP (27–29). Most of this research on doxy PEP has been among GBMSM, and less research data exists for doxy PrEP (13). In this study, 46.3% of participants were aware of doxy PrEP/PEP, and 11.4% had ever taken doxy PrEP/PEP. Work is currently underway by the National Advisory Committee on Sexually Transmitted and Blood-Borne Infections at PHAC to investigate the effectiveness of doxycycline prophylaxis and concerns of antimicrobial resistance (30).

One-third of participants (31.6%) did not have a regular primary healthcare provider. Of those who did, 67.9% said that

their provider was aware of their sexual orientation. Provider awareness of the participant's sexual orientation may be an important factor related to HIV testing. For participants whose provider was aware of their sexual orientation, 84.6% were ever tested for HIV, compared with only 53.7% of participants whose provider did not know their sexual orientation. This aligns with existing literature that disclosure of sexual orientation to one's healthcare provider is associated with increased uptake of HIV testing (31,32). One reason for non-disclosure may be fear of stigma and discrimination (32). This highlights the importance of continuing to advance access to sexuality-affirming health care (33).

The majority of study participants experienced discrimination (63.3%) in the 12 months prior to the study, with many participants having experienced multiple forms of discrimination based on their intersecting identities. Experiences of stigma and discrimination create stressful environments that can place sexual and gender minorities at increased risk of poor mental health and prevent them from seeking care (34). In the present study, only 33.0% of participants rated their mental health as excellent or very good, compared with 53.7% of the general population in Canada in the same year (35).

Experiences of intimate partner violence and forced sex were common among study participants. Previous studies in Canada have similarly found that sexual and gender minorities are at increased risk of experiencing these types of violence (36,37). An analysis of data from the 2018 Survey of Safety in Public and Private Spaces found that, since the age of 15 years, sexual minority men were almost two times more likely to have experienced physical or sexual assault by an intimate partner, and three times more likely to have experienced sexual assault by anyone, as compared with heterosexual men (36). This study also found that compared with cisgender people, trans and non-binary people were more likely to have experienced physical and sexual assault since the age of 15 years (37).

Strengths and limitations

The Tracks 2S/GBTQ+ Phase 3 survey involved recruitment from all ten provinces during the summer of 2024. Expansion of the eligibility criteria for Sex Now surveys over the years has resulted in the current sample being inclusive of Indigenous Two-Spirit people and a wide range of sexual orientations and gender identities and containing a large sub-sample of trans participants. This is an important source of information at local, provincial and federal levels to inform public health action; however, these results may not be generalizable to the whole 2S/GBTQ+ population in Canada, or in any specific city, because non-probability-based sampling was used to recruit participants. While no gold standard data on the 2S/GBTQ+ population exists to be able to assess the representativeness of the sample, research has shown that nonprobability sexual minority community venue-based samples may underrepresent certain subgroups, such as those who are unemployed or have



lower incomes (38). Further, some sites, such as Montréal, also experienced bad weather and/or logistical challenges for survey recruitment in 2024, leading to lower sample sizes than originally anticipated. Since this study relies on self-reported data (with the exception of DBS test results), it is possible that certain factors are under- or over-represented.

Conclusion and next steps

This survey provides information on the health and well-being of a diverse sample of 2S/GBTQ+ people across Canada. High levels of experiences of discrimination and abuse were found among study participants. The intentional inclusion of diverse participants provides important information on populations who have been previously less engaged in STBBI research, such as non-binary people, while still allowing for future sub-analyses with populations more commonly known to be disproportionately impacted by STBBI, such as GBMSM. These further sub-analyses focusing on specific population groups (e.g., Two-Spirit people, trans men, GBMSM, non-binary people) are important for informing STBBI programs and policies. Collaboration with Indigenous researchers and organizations will provide key pathways for analysis and mobilization of data from Indigenous Two-Spirit and Indigenous LGBTQ+ participants. Broader engagement with researchers, community organizations and populations affected by STBBI will help ensure these data are effectively applied to STBBI prevention and care efforts. Qualitative research with 2S/GBTQ+ people in Canada can also help contextualize these findings and provide input into topics to be included in future surveys with this population.

Authors' statement

MB — Methodology, formal analysis, writing—original draft, writing—review & editing
 NL — Conceptualization, methodology, supervision, writing—review & editing
 BK — Conceptualization, methodology, supervision, writing—review & editing
 EW — Conceptualization, methodology, formal analysis, writing—original draft, writing—review & editing
 HA — Methodology, writing—review & editing
 TC — Conceptualization, writing—review & editing
 KR — Conceptualization, methodology, formal analysis, writing—review & editing
 AA — Methodology, formal analysis, writing—review & editing
 CC — Methodology, resources, supervision, writing—review & editing
 SK — Methodology, resources, writing—review & editing
 JC — Conceptualization, methodology, writing—review & editing
 JA — Conceptualization, funding acquisition, supervision, methodology, writing—review & editing

Competing interests

None.

ORCID numbers

Megan Butler — 0009-0008-1851-7012
 Nathan Lachowsky — 0000-0002-6336-8780
 Benjamin Klassen — 0000-0002-8203-724X
 Herak Apelian — 0000-0003-0553-2172
 Anthony Amato — 0000-0002-7978-6514
 Catherine Card — 0000-0002-2561-9649
 Joseph Cox — 0000-0002-7041-1556
 Josephine Aho — 0000-0003-1518-9582

Acknowledgements

The authors would like to thank all study participants who took the time to complete the questionnaire, including those who additionally provided a biological sample; staff at the Community-Based Research Centre and University of Victoria; and volunteers. We acknowledge the excellent technical expertise of the National Laboratory for HIV Reference Services (NLHRS) of the National Microbiology Laboratory in all aspects related to the use of dried blood spots (DBS) in this survey. We especially thank J Kim and P Lacap from the NLHRS for their technical guidance and work in the testing of DBS samples. We would also like to thank S Totten for guidance in study conception, data analysis, and manuscript development. A special thank you to A Fahlman for the coding of the questionnaire and S Ambrose and T Le for their expertise in knowledge mobilization. We recognize the valuable input of A Amson and J Helwig in their review of this manuscript. Finally, we would like to thank the community partner organizations who supported local recruitment, including Ribbon Community, Queer & Trans Health Collective, Centre for Sexuality, Our Own Health Centre, The 519, Muslim Pride Toronto, MAX Ottawa, RÉZO, PEERS Alliance, AIDS Coalition of Newfoundland and Labrador and Quadrangle NL.

Funding

The Tracks survey of 2S/GBTQ+ people in Canada was funded by the Public Health Agency of Canada as part of its HIV and Hepatitis C Enhanced Surveillance System (Tracks Surveys).

References

1. Crenshaw K. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. University of Chicago Legal Forum. 1989; Issue 1 (Article 8):139–67. <https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1052&context=uclf>



2. Amato AT, Émond G. A systematic review of psychosocial challenges for MSM living with HIV among diverse intersecting minorities. *Can J Hum Sex* 2023;32(3):340–53. DOI
3. Public Health Agency of Canada. Canada's progress towards ending the HIV epidemic, 2022. Ottawa, ON: PHAC; 2024. <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/canada-progress-towards-ending-hiv-epidemic-2022/canada-progress-towards-ending-hiv-epidemic-2022.pdf>
4. Public Health Agency of Canada. Infectious syphilis and congenital syphilis in Canada, 2023. *Can Commun Dis Rep* 2025;51(2/3):112. <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2025-51/issue-2-3-february-march-2025/infectious-congenital-syphilis-2023.html>
5. Public Health Agency of Canada. Government of Canada's Sexually Transmitted and Blood-borne Infections (STBBI) Action Plan, 2024-2030. Ottawa, ON: PHAC; 2024. <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/sexually-transmitted-blood-borne-infections-action-plan-2024-2030/government-of-canada-stbbi-action-plan-final-en.pdf>
6. Bigio J, Butler M, Sood S, Cox J, Jackson B, Marshall Z, Aho J. Sexually transmitted and blood-borne infections in transgender and non-binary people in Canada: A scoping review. *PLoS One* 2025;20(5):e0322521. DOI PubMed
7. United Nations Programme on HIV/AIDS, World Health Organization, UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance. Second generation surveillance for HIV: the next decade. Geneva, CH: UNAIDS/WHO; 2000. https://www.unaids.org/sites/default/files/media_asset/jc370-2ndgeneration_en_0.pdf
8. Public Health Agency of Canada. HIV/AIDS Epi Updates Chapter 9: HIV/AIDS among gay, bisexual and other men who have sex with men in Canada. Ottawa, ON: PHAC; 2010. https://www.phac-aspc.gc.ca/aids-sida/publication/epi/2010/pdf/EN_Chapter9_Web.pdf
9. Public Health Agency of Canada. M-Track: Enhanced surveillance of HIV, sexually transmitted and blood-borne infections, and associated risk behaviours among men who have sex with men in Canada. Phase 1 Report. Ottawa, ON: PHAC; 2011. https://publications.gc.ca/collections/collection_2012/aspc-phac/HP40-64-1-2011-eng.pdf
10. Community-Based Research Centre. Vancouver, BC: CBRC. <https://www.cbrc.net/about>
11. Community-Based Research Centre. Gay Generations: Life Course and Gay Men's Health. Vancouver, BC: CBRC; 2017. https://www.cbrc.net/gay_generations_life_course_and_gay_mens_health
12. Community-Based Research Centre. Sex Now 2022: Let's get physical to travel to Pride festivals across Canada asking GBT2Q people about their health. Vancouver, BC: CBRC; 2022. https://www.cbrc.net/sex_now_2022_let_s_get_physical_to_travel_to_pride_festivals_across_canada_asking_gbt2q_people_about_their_health
13. BC Centre for Disease Control. The BCCDC Position Statement on Doxycycline as Prophylaxis for Sexually Transmitted Infections. Vancouver, BC: BCDC; 2023. https://smartsexresource.com/wp-content/uploads/resources/BCCDC_Position_Doxycycline_Prophylaxis_FINAL_15Dec2023.pdf?x50711
14. Public Health Agency of Canada. Directive for the collection, use and dissemination of information relating to public health. April 2013.
15. Posit team. RStudio: Integrated Development Environment for R. Boston, MA: PBC; 2025. <https://support.posit.co/hc/en-us/categories/200098757-R-language-open-source-RStudio-IDE>
16. Rutherford L, Stark A, Ablona A, Klassen BJ, Higgins R, Jacobsen H, Draenos CJ, Card KG, Lachowsky NJ. Health and well-being of trans and non-binary participants in a community-based survey of gay, bisexual, and queer men, and non-binary and Two-Spirit people across Canada. *PLoS One* 2021;16(2):e0246525. DOI PubMed
17. Scheim AI, Travers R. Barriers and facilitators to HIV and sexually transmitted infections testing for gay, bisexual, and other transgender men who have sex with men. *AIDS Care* 2017;29(8):990–5. DOI PubMed
18. Stewart M, Ryu H, Blaque E, Hassan A, Anand P, Gómez-Ramírez O, MacKinnon KR, Worthington C, Gilbert M, Grace D. Cisnormativity as a structural barrier to STI testing for trans masculine, two-spirit, and non-binary people who are gay, bisexual, or have sex with men. *PLoS One* 2022;17(11):e0277315. DOI PubMed
19. Ferlatte O, Panwala V, Rich AJ, Scheim AI, Blackwell E, Scott K, Salway T, Knight R. Identifying health differences between transgender and cisgender gay, bisexual and other men who have sex with men using a community-based approach. *J Sex Res* 2020;57(8):1005–13. DOI PubMed



20. Hart TA, Moore DM, Noor SW, Lachowsky N, Grace D, Cox J, Skakoon-Sparling S, Jollimore J, Parlette A, Lal A, Apelian H, Sang JM, Tan DHS, Lambert G; Engage Study Team. Prevalence of HIV and sexually transmitted and blood-borne infections, and related preventive and risk behaviours, among gay, bisexual and other men who have sex with men in Montreal, Toronto and Vancouver: Results from the Engage Study. *Can J Public Health* 2021;112(6):1020–9. DOI PubMed
21. Public Health Agency of Canada. Canada takes action by endorsing global declaration on Undetectable=Untransmittable (U=U). Ottawa, ON: PHAC; 2022. <https://www.canada.ca/en/public-health/news/2022/07/canada-takes-action-by-endorsing-global-declaration-on-undetectable--untransmittable-uu.html>
22. Community-Based Research Centre. Substance use among GBT2Q. Vancouver, BC: CBRC; 2022. https://www.cbrc.net/substance_use_gbt2q
23. Lachowsky NJ, Tanner Z, Cui Z, Sereda P, Rich A, Jollimore J, Montaner JS, Hogg RS, Moore DM, Roth EA. An event-level analysis of condom use during anal intercourse among self-reported human immunodeficiency virus-negative gay and bisexual men in a treatment as prevention environment. *Sex Transm Dis* 2016;43(12):765–70. DOI PubMed
24. Holt M, Lea T, Mao L, Kolstee J, Zablotska I, Duck T, Allan B, West M, Lee E, Hull P, Grulich A, De Wit J, Prestage G. Community-level changes in condom use and uptake of HIV pre-exposure prophylaxis by gay and bisexual men in Melbourne and Sydney, Australia: Results of repeated behavioural surveillance in 2013–17. *Lancet HIV* 2018;5(8):e448–56. DOI PubMed
25. Lachowsky N, Arthur S, Card K, Klassen B, Draenos C, Hu A, Amato AT, Ho D, Vattiata M, Kwag M, Hull M, Tan DHS, Pruden H, Salway T, Gilbert M, Feriatte O. Population-level trends in HIV pre-exposure prophylaxis (PrEP) knowledge, interest and use among Two-Spirit, gay, bisexual, queer, trans men and non-binary people across Canada, 2015–2020. 24th International AIDS Conference 2022. https://www.researchgate.net/profile/Anthony-Amato-2/publication/375606691_Population-Level_Trends_in_HIV_Pre-Exposure_Prophylaxis_PrEP_Knowledge_Interest_and_Use_Among_Gay_Bisexual_Queer_and_Trans_Men_and_Two-Spirit_and_Non-Binary_People_Across_Canada_2015-2020/links/6552c79d3fa26f66f4fdf275/Population-Level-Trends-in-HIV-Pre-Exposure-Prophylaxis-PrEP-Knowledge-Interest-and-Use-Among-Gay-Bisexual-Queer-and-Trans-Men-and-Two-Spirit-and-Non-Binary-People-Across-Canada-2015-2020.pdf
26. Hallarn J, Scheim AI, Bauer GR. Pre-exposure prophylaxis awareness and use among transgender and nonbinary individuals in Canada. *J Acquir Immune Defic Syndr* 2024;96(4):341–49. DOI PubMed
27. Molina JM, Charreau I, Chidiac C, Pialoux G, Cua E, Delaugerre C, Capitant C, Rojas-Castro D, Fonsart J, Bercot B, Bébéar C, Cotte L, Robineau O, Raffi F, Charbonneau P, Aslan A, Chas J, Niedbalski L, Spire B, Sagaon-Teyssier L, Carette D, Mestre SL, Doré V, Meyer L; ANRS IPERGAY Study Group. Post-exposure prophylaxis with doxycycline to prevent sexually transmitted infections in men who have sex with men: An open-label randomised substudy of the ANRS IPERGAY trial. *Lancet Infect Dis* 2018;18(3):308–17. DOI PubMed
28. Molina JM, Bercot B, Assoumou L, Rubenstein E, Algarte-Genin M, Pialoux G, Katlama C, Surgers L, Bébéar C, Dupin N, Ouattara M, Slama L, Pavie J, Duvivier C, Loze B, Goldwirt L, Gibowski S, Ollivier M, Ghosn J, Costagliola D; ANRS 174 DOXYVAC Study Group. Doxycycline prophylaxis and meningococcal group B vaccine to prevent bacterial sexually transmitted infections in France (ANRS 174 DOXYVAC): A multicentre, open-label, randomised trial with a 2 × 2 factorial design. *Lancet Infect Dis* 2024;24(10):1093–104. DOI PubMed
29. Luetkemeyer AF, Vittinghoff E, Buchbinder SP, Scott H, Charlebois ED, Havlir DV, Soge OO, Celum C; DoxyPEP Study Team. Postexposure doxycycline to prevent bacterial sexually transmitted infections. *N Engl J Med* 2023;388(14):1296–306. DOI PubMed
30. Public Health Agency of Canada. National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI): Workplan. Ottawa, ON: PHAC; 2024. <https://www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/national-advisory-committee-stbbi/workplan.html>
31. Ng BE, Moore D, Michelow W, Hogg R, Gustafson R, Robert W, Kanters S, Thumath M, McGuire M, Gilbert M. Relationship between disclosure of same-sex sexual activity to providers, HIV diagnosis and sexual health services for men who have sex with men in Vancouver, Canada. *Can J Public Health* 2014;105(3):e186–91. DOI PubMed
32. Qiao S, Zhou G, Li X. Disclosure of same-sex behaviors to health-care providers and uptake of HIV testing for men who have sex with men: A systematic review. *Am J Mens Health* 2018;12(5):1197–214. DOI PubMed



33. Gilmore JP. Healthcare rights for gender and sexual minorities. In: Mali J, editor. Human Rights in Contemporary Society: Challenges From an International Perspective. IntechOpen; 2023. DOI
34. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. Psychol Bull 2003;129(5):674–97. DOI PubMed
35. Statistics Canada. Perceived mental health. Ottawa, ON: StatCan; 2025. <https://www.statcan.gc.ca/hub-carrefour/quality-life-qualite-vie/health-sante/mental-health-sante-mentale-eng.htm>
36. Statistics Canada. Intimate partner violence: Experiences of sexual minority men in Canada, 2018. Ottawa, ON: StatCan; 2021. <https://www150.statcan.gc.ca/n1/en/pub/85-002-x/2021001/article/00004-eng.pdf?st=SKQ0sl6I>
37. Statistics Canada. Experiences of violent victimization and unwanted sexual behaviours among gay, lesbian, bisexual and other sexual minority people, and the transgender population, in Canada, 2018. Ottawa, ON: StatCan; 2020. https://www150.statcan.gc.ca/n1/en/pub/85-002-x/2020001/article/00009-eng.pdf?st=UlxgNH_E
38. Salway TJ, Morgan J, Ferlatte O, Hawkins B, Lachowsky NJ, Gilbert M. A systematic review of characteristics of nonprobability community venue samples of sexual minority individuals and associated methods for assessing selection bias. LGBT Health 2019;6(5):205–15. DOI PubMed



HIV PrEP Knowledge, Interest and Uptake

Findings from the *Tracks 2S/GBTQ+ Phase 3 (Sex Now 2024)* survey

In summer 2024, the Public Health Agency of Canada (PHAC) collaborated with the Community-Based Research Centre (CBRC) to conduct a survey on the health and well-being of Two-Spirit people, gay, bisexual, trans and queer men, and non-binary (2S/GBTQ+) people. Participants were recruited from 43 Pride and community events in 19 cities across all Canadian provinces.

What is HIV Pre-exposure Prophylaxis (PrEP)?

HIV PrEP is medication that people without HIV can take on an ongoing basis to prevent an HIV infection.

Who should consider HIV PrEP?

Individuals who are **HIV negative** and who participate in activities that have **increased risk of exposure** to HIV, such as sex without condoms, sex with the use of alcohol or drugs, sharing drug use equipment, and people with a history of other sexually transmitted and blood-borne infections.

Refer to the [Biomedical prevention of HIV - HIV PrEP and HIV PEP](#) to learn more about HIV PrEP.

Participants who may benefit from HIV PrEP

63% of participants (3,064/4,880) reported increased risk for HIV and may benefit from HIV PrEP.

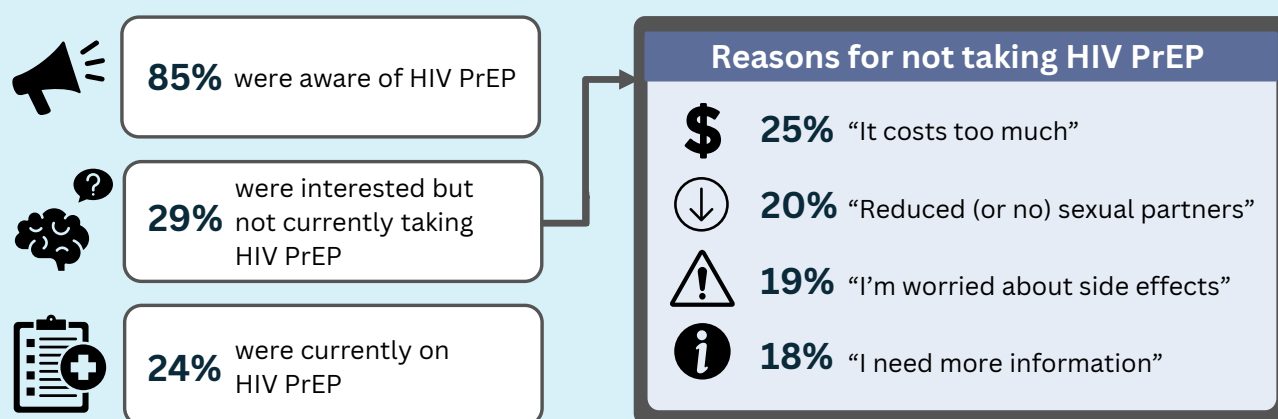
Among the 3,064 participants who may benefit from HIV PrEP:

73% were gay, bisexual, and other men who have sex with men

70% were between the ages of 20 and 39 years old

37% experienced financial strain

Awareness and use of HIV PrEP among participants who may benefit (n=3,064)



Acknowledgements: The authors gratefully acknowledge the contributions of participants who completed the survey; the staff at the Community-Based Research Centre and University of Victoria, and volunteers; and the National Microbiology Laboratory. The full published manuscript of survey results can be [accessed here](#).



Public Health
Agency of Canada

Agence de la santé
publique du Canada

Canada

cbrc **sex**
NOW
Community-Based Research Centre



An assessment of HIV pre-exposure prophylaxis access in Nova Scotia

Tamer Wahba^{1*}, Jesse Kancir², Maria N Wilson³, Alysia Robinson³, Diana Gibson³, Kristen O'Brien³

Abstract

Background: The HIV pre-exposure prophylaxis (PrEP) is an effective HIV prevention strategy, but access in Nova Scotia has not been well characterized. This study evaluated PrEP access in Nova Scotia by examining prescribing and dispensing practices, uptake, and the demographics of individuals using PrEP.

Methods: A descriptive analysis was conducted to track persons who used PrEP from 2019 to 2023. The numbers and geographic locations of prescribers and dispensing pharmacies were determined using their respective licence numbers. The linear distance between patients and providers was calculated to determine the distance travelled to access PrEP services.

Results: The rate of persons who were dispensed PrEP in Nova Scotia doubled from 2019 to 2023, and the male-to-female ratio increased from 7:1 in 2019 to 15:1 in 2023. Most dispensations occurred to those aged 30–34 and to those located in the Central Zone. The number of prescriptions increased by 139.9%. The number of PrEP prescribers increased by 116%. In 2023, 38.5% of clinicians prescribed PrEP only once. The number of pharmacies that dispensed PrEP between 2019 and 2023 was 236. Most users travelled a distance less than 20 kilometres to access the service.

Conclusion: These findings will inform targeted actions to increase PrEP access in Nova Scotia. More work is needed to address the lack of increased uptake by females and to expand PrEP access outside of the Halifax Regional Municipality. Ensuring that more individuals at high risk have access to this effective prevention method can help curb the spread of HIV in the province.

Suggested citation: Wahba T, Kancir J, Wilson MN, Robinson A, Gibson D, O'Brien K. An assessment of HIV pre-exposure prophylaxis access in Nova Scotia. *Can Commun Dis Rep* 2026;52(10):417–26. <https://doi.org/10.14745/ccdr.v52i10a05>

Keywords: HIV pre-exposure prophylaxis, access to PrEP services, PrEP uptake, prescribing patterns, PrEP dispensing, Nova Scotia

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Affiliations

¹ Centre for Emergency Preparedness, Regulatory, Operations and Emergency Management Branch, Public Health Agency of Canada, Halifax, NS

² Department of Health and Wellness, Government of Nova Scotia, Halifax, NS

³ Science and System Performance Planning and Evaluation, Nova Scotia Health, Halifax, NS

*Correspondence:

tamer.wahba@phac-aspc.gc.ca

Introduction

According to national estimates, 65,270 Canadians were living with HIV at the end of 2022, resulting in a prevalence rate of 170 cases per 100,000 population (1). The Public Health Agency of Canada (PHAC) reports that the national rate of new HIV diagnoses in 2023 was 6.1 cases per 100,000 population, with males experiencing a higher rate (8.1) than females (3.9) (2). From 2014–2023, the number of first-time diagnoses in Canada was fairly stable until 2020, declined during early COVID-19 years, and then increased in 2021–2023 (2). Provincially, in 2023, Nova Scotia (NS) reported 33 HIV cases, with a rate of 3.1 cases per 100,000 population. The rate among males was notably higher at 5.0 cases per 100,000 population,

compared to 1.3 cases per 100,000 population among females. The highest age-specific rate was observed in individuals aged 25–39 years, at 7.0 cases per 100,000 population (3).

The HIV infection can remain asymptomatic for up to ten years (4). National estimates indicate that, at the end of 2022, Approximately 11% of individuals living with HIV remained undiagnosed (1). This underscores the importance of preventive measures, especially for high-risk populations. Alongside traditional prevention strategies, PHAC highlights the effectiveness of HIV pre-exposure prophylaxis (PrEP) in reducing transmission (5).



Pre-exposure prophylaxis is defined as the use of prescription antiretroviral medication by HIV-negative individuals to prevent infection. Taken prior to potential exposure, it disrupts the virus's ability to replicate and establish infection (5). It is recommended for men and transgender women who have condomless anal sex with men, HIV-negative individuals with HIV-positive partners engaging in condomless vaginal or anal sex, and those who share needles (6). Pre-exposure prophylaxis is available in oral pill form and as an injectable medication, both prescribed by healthcare professionals (5). In NS, oral PrEP is covered through the provincial pharmacare program (with special authorization) and some private insurance plans (7).

Several barriers exist to initiating PrEP usage, many of these which may be exacerbated when living in more rural areas, including fear of stigma, lack of access to a primary healthcare provider willing to prescribe PrEP, and residing far away from healthcare services. Research has shown that the further individuals are from healthcare services, the more likely their access to care is diminished. This phenomenon, known as "distance decay," refers to the reduction in healthcare access as travel distance or time increases (8). Therefore, it is important to examine the impact of distance on HIV PrEP accessibility. This is the first provincial analysis to assess accessibility of HIV PrEP services by using the linear distance between client, prescriber, and dispenser postal codes as a proxy for travel distance. Additionally, it seeks to describe the demographic characteristics and geographic distribution of individuals currently accessing PrEP in NS to identify potential gaps in service coverage.

Objectives

For the 2019–2023 analysis period, the objectives were to:

- 1) describe individuals who have been dispensed HIV PrEP;
- 2) define HIV PrEP prescribers and dispensing pharmacies;
- 3) understand prescribing patterns of HIV PrEP; and 4) assess the accessibility of HIV PrEP services for clients.

Methods

A secondary data analysis was conducted using a dataset provided by the NS Department of Health and Wellness.

Data sources

Data sources included PrEP dispensing data from the Nova Scotia Drug Information System (DIS) for 2019–2023, population estimates from the 2021 Statistics Canada Census, and physician registry data from the College of Physicians and Surgeons of Nova Scotia (CPSNS) for 2024.

Analysis

The DIS provided all data required for this analysis. The dataset included client demographic characteristics (e.g., age, gender, and postal code), as well as prescriber information, such as professional designation, licence number, and practice location.

It also contained dispensing pharmacy identifiers and geographic location, and prescription-level records included the drug name and reason for dispensing. Physician specialties were ascertained using the publicly available CPSNS registry (9). Population data for NS were obtained from publicly available datasets provided by Statistics Canada.

A unique person identifier was assigned to each client in the DIS data by the NS Department of Health and Wellness. Clients were characterized by variables such as age, gender, dispensing year, and geographic location of residence. The number of clients per year was calculated by counting the first occurrence of each unique person identifier within each calendar year. Annual rates were determined using the total number of clients as the numerator and the 2021 NS census population as the denominator. A descriptive analysis of clients by zone and by community cluster was conducted. To determine the total number of unique clients over the full study period, duplicate person identifiers were removed. This enabled analysis of unique clients by gender and age group.

Prescribers were identified by their licence numbers. For physicians, their specialty was determined using the CPSNS registry. The first instance of PrEP prescribing or dispensing for each licence number was used to count the unique providers, both annually and overall. The dataset provided information on their zones and postal codes.

The DIS also included data on the number of prescription refills, which were categorized into the following groups: 1, 2, 3, 4, 5, 6 to 10, and 11 or more refills. This classification enabled an assessment of the frequency with which prescribers and clients continue refilling PrEP prescriptions, as well as typical prescribing patterns. To evaluate duration of protection, clients were further grouped based on the total number of prescriptions dispensed annually: those receiving 27 days and less, those completing a one-month trial, and those receiving one, two, or three full cycles of PrEP. The 28–30 days period corresponds to the standard trial phase at PrEP initiation. It was assumed individuals in this group completed the trial but chose not to continue, possibly due to intolerance, behavioural changes, or financial constraints. The subsequent categories represent extended coverage periods: 31–90 days for one full cycle, 91–180 days for two cycles, 181–270 days for three cycles, and 271 days or more indicating coverage beyond three cycles.

Geographic information for client residences, prescribers, and pharmacies was assigned using the Postal Code Conversion File, which allowed locations to be categorized by health zone and community cluster. To calculate the distance between client residences and prescriber/pharmacy locations, and between provider offices and dispensing pharmacies, the linear distance between postal code centroids was used. The geographic centroid, defined as the geometric centre point of a spatial boundary, was calculated for each postal code using its boundary



latitude and longitude coordinates. Linear (great-circle) distance between postal code centroids was then calculated using the spherical law of cosines, implemented in spreadsheet form as: $\text{distance} = \text{ACOS}(\text{COS}(\text{RADIANS}(90 - \text{latitude}_1)) * \text{COS}(\text{RADIANS}(90 - \text{latitude}_2)) + \text{SIN}(\text{RADIANS}(90 - \text{latitude}_1)) * \text{SIN}(\text{RADIANS}(90 - \text{latitude}_2)) * \text{COS}(\text{RADIANS}(\text{longitude}_1 - \text{longitude}_2))) * 6378$, where latitude and longitude are decimal degrees converted to radians, and 6,378 kilometre (km) is the equatorial radius of the Earth (10,11).

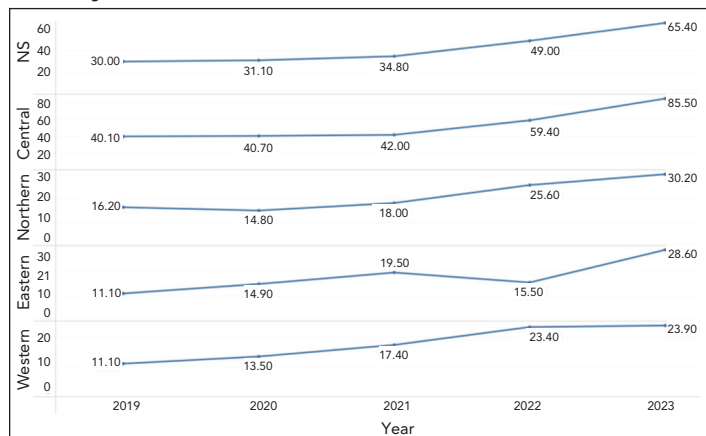
To gain a more detailed understanding of clients and the distances they travelled to access PrEP services by course duration, the mean age of clients and the mean distance to both prescribers and dispensing pharmacies was calculated. Additionally, the distribution of prescriber types across course durations was examined. Microsoft Excel (12), RStudio Team (13), STATA 18 (14), Tableau Desktop (15), were used to conduct the analysis.

Results

HIV pre-exposure prophylaxis clients

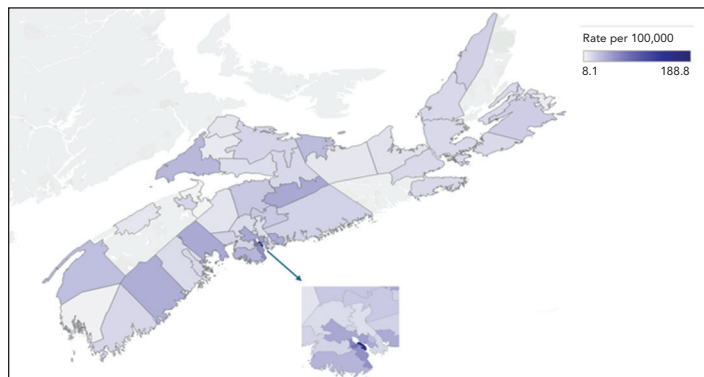
Between January 2019 and December 2023, a total of 955 unique clients residing in NS received PrEP. The majority were in the Central Zone (441 clients, 46.2%), followed by the Eastern (274, 28.7 %), Western (131, 13.7 %), and Northern (109, 11.4%) zones. Provincially, the rate of PrEP clients doubled from 30.0 per 100,000 population in 2019 to 65.4 per 100,000 population in 2023, a trend observed consistently across all health zones (Figure 1). At the community cluster level, Halifax Needham reported the highest rate at 188.8 per 100,000 population, followed by Halifax Citadel with 156.6 per 100,000 population (Figure 2).

Figure 1: Rate of clients dispensed HIV pre-exposure prophylaxis in Nova Scotia, by zone and year, January 2019–December 2023



Abbreviation: NS, Nova Scotia

Figure 2: Average annual rate of clients dispensed HIV pre-exposure prophylaxis per 100,000 population in Nova Scotia, by community cluster, January 2019–December 2023



From 2019 to 2023, 95.7% of clients using PrEP in NS were male. The highest number of PrEP prescriptions was among those 30–34 years old, followed by those 35–39 and 25–29 years of age (Figure 3). The mean age of clients increased with longer course durations (Table 1).

Figure 3: Number of clients dispensed HIV pre-exposure prophylaxis in Nova Scotia by age group and gender, January 2019–December 2023

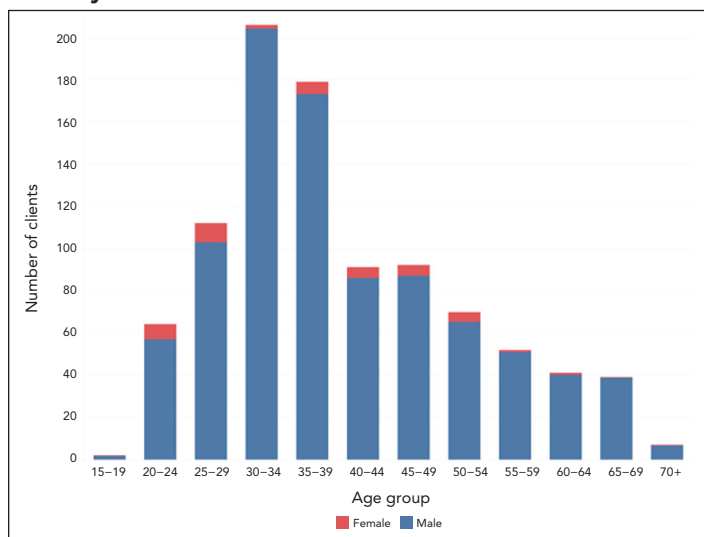


Table 1: Client mean age and travel distance to HIV pre-exposure prophylaxis prescribers and pharmacies by course duration

Days	Mean age (years)	Average distance travelled to access a prescriber (km)	Average distance travelled to access a dispensing pharmacy (km)
0–27	38	29	11.3
28–30	39	30.2	16.6
31–90	44	29.8	14
91–180 ^a	48	10.4	3.4

Abbreviation: km, kilometre

^a The maximum number of dispensed prescriptions was 180 days



HIV pre-exposure prophylaxis prescribers

Three types of healthcare providers have prescribed PrEP in NS: physicians, pharmacists, and registered nurse practitioners (Table 2). The total number of unique PrEP prescribers was 540 (520 with postal codes in NS). The number of prescribers more than doubled over the five-year period of study, rising from 173 in 2019 to 374 in 2023. In that year, physicians made up the largest proportion of prescribers (n=278, 74.3%), followed by pharmacists and registered nurse practitioners (n=48 each) (Figure 4). Among the prescribers, family doctors represented the largest group (n=407, 75.4%). At the zonal level, the Central Zone had the greatest number of unique PrEP prescribers (n=349), followed by the Western (n=66), Eastern (n=64), and Northern (n=41) zones (Figure 5). In 2019, a little over half of prescribers (54.9%) prescribed PrEP one time only, while in 2023, this proportion had reduced to 38.5%. In 2023, 41.4% prescribed two to five times, and 12.0% prescribed six to 10 times (Table 3).

Table 2: Number of unique HIV pre-exposure prophylaxis prescribers in Nova Scotia by provider type and course duration, January 2019–December 2023

Days	Physicians	Pharmacists	Registered nurse practitioners
0–27	150	2	1
28–30	256	7	0
31–90	273	8	1
91–180	9	0	0

HIV pre-exposure prophylaxis dispensers

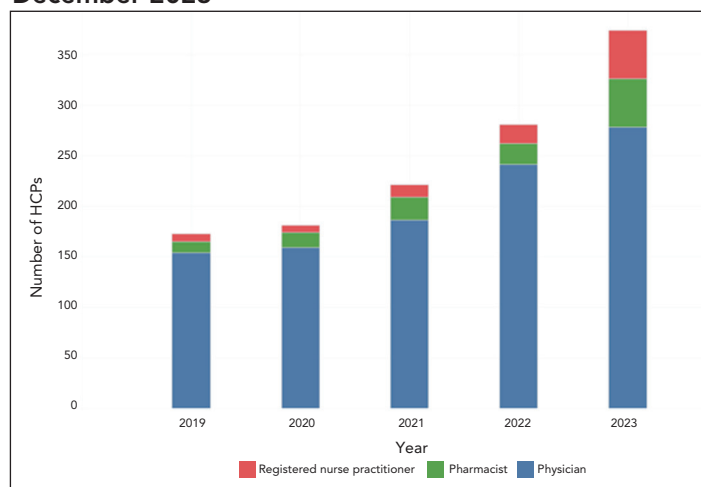
The number of pharmacies dispensing PrEP showed a steady increase, rising from 113 in 2019 to 165 in 2023. From 2019 to 2023, a total of 236 pharmacies in NS dispensed PrEP, representing 75.2% of all pharmacies in the province (314 total) (16). Most of these pharmacies (47.5%) were in the Central Zone. Among community clusters, Sydney and area had the highest number of pharmacies dispensing PrEP (n=15) (Figure 6).

Table 3: Number of HIV pre-exposure prophylaxis prescribers by number of time(s) of prescribing in Nova Scotia, January 2019–December 2023

Number of times of prescribing HIV PrEP	Number of prescribers				
	2019	2020	2021	2022	2023
1	95 (54.9%)	74 (40.9%)	95 (43%)	110 (39.1%)	144 (38.5%)
2–5	61 (35.3%)	70 (38.7%)	92 (41.6%)	115 (40.9%)	155 (41.4%)
6–10	8 (4.6%)	23 (12.7%)	20 (9.0%)	32 (11.4%)	45 (12.0%)
11–25	5 (2.9%)	6 (3.3%)	6 (2.7%)	17 (6.0%)	17 (4.5%)
26–50	3 (1.7%)	6 (3.3%)	7 (3.2%)	4 (1.4%)	8 (2.1%)
51–75	1 (0.6%)	2 (1.1%)	1 (0.5%)	2 (0.7%)	3 (0.8%)
76–100	0	0	0	1 (0.4%)	1 (0.3%)
101+	0	0	0	0	1 (0.3%)
Total	173	181	221	281	374

Abbreviation: PrEP, pre-exposure prophylaxis

Figure 4: Number and type of HIV pre-exposure prophylaxis prescribers in Nova Scotia, January 2019–December 2023



Abbreviation: HCPs, healthcare providers

Figure 5: Number of physicians who prescribed HIV pre-exposure prophylaxis in Nova Scotia by zone and year, January 2019–December 2023

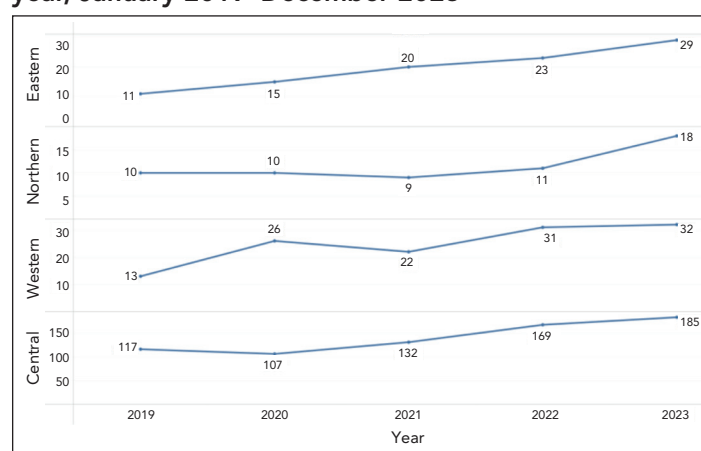
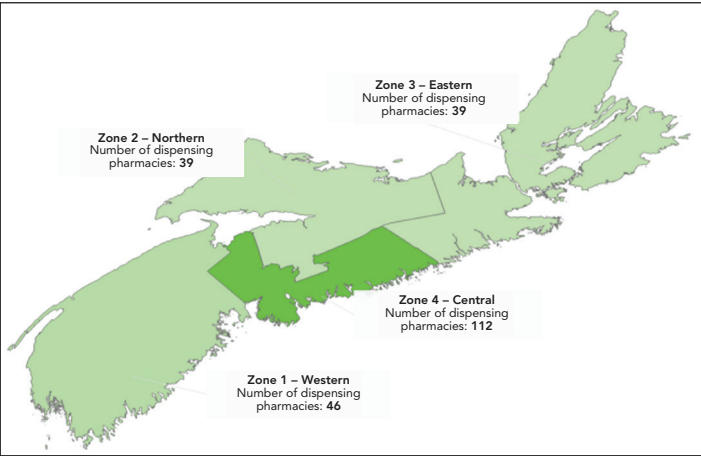


Figure 6: Number of pharmacies dispensed HIV pre-exposure prophylaxis by zone in Nova Scotia, January 2019–December 2023 (n=236)



HIV pre-exposure prophylaxis prescribing patterns

The number of unique PrEP prescriptions rose from 561 in 2019 to 1,346 in 2023 (Figure 7). During the same period, the total number of dispensed prescriptions increased by 101.5%. Out of 935 total dispenses in 2019, 264 prescriptions (28.2%) were dispensed once, a proportion that grew to 42.6% (802) by 2023 (Table 4). Additionally, the duration of coverage per dispensed prescription varied, with the most common coverage range falling between 31–90 days (Table 5).

HIV pre-exposure prophylaxis accessibility

The linear distance between clients, their PrEP prescribers and dispensers, was 20 km or less for most clients. However, 18.9% of clients lived more than 40.01 km from their prescriber, and 7.3% lived more than 40.01 km from their dispensing location. For 15.6% of clients, the linear distance between the PrEP prescriber and dispenser was more than 40.01 km (Figure 8). The median distance was 7.8 km between client residence and prescribing healthcare provider, and 2.7 km between client residence and dispensing pharmacy. The maximum distance between a client’s residence and their healthcare provider or pharmacy was 370 km and 407 km, respectively.

Table 4: Number of HIV pre-exposure prophylaxis prescription dispenses in Nova Scotia, January 2019–December 2023

Number of dispenses	Number of dispensed prescriptions				
	2019	2020	2021	2022	2023
1	264 (28.2%)	209 (22.3%)	329 (34.7%)	453 (35.9%)	802 (42.6%)
2	101 (10.8%)	126 (13.4%)	120 (12.6%)	187 (14.8%)	284 (15.1%)
3	103 (11.0%)	140 (14.9%)	98 (10.3%)	197 (15.6%)	242 (12.8%)
4	256 (27.4%)	245 (26.1%)	220 (23.2%)	256 (20.3%)	324 (17.2%)
5	8 (0.9%)	32 (3.4%)	3 (0.3%)	7 (0.6%)	36 (1.9%)
6–10	110 (11.8%)	87 (9.3%)	51 (5.4%)	66 (5.2%)	86 (4.6%)
11+	93 (9.9%)	98 (10.5%)	128 (13.5%)	97 (7.7%)	110 (5.8%)
Total	935	937	949	1,263	1,884

Figure 7: Number of unique HIV pre-exposure prophylaxis prescriptions in Nova Scotia by year, January 2019–December 2023

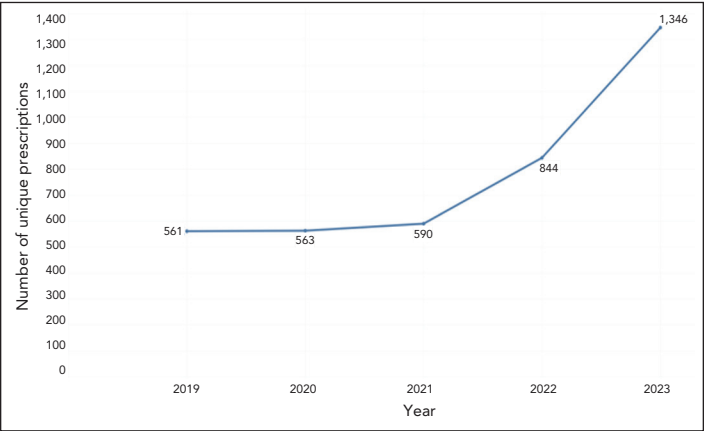


Table 5: Duration of HIV pre-exposure prophylaxis prescriptions by year, Nova Scotia, January 2019–December 2023

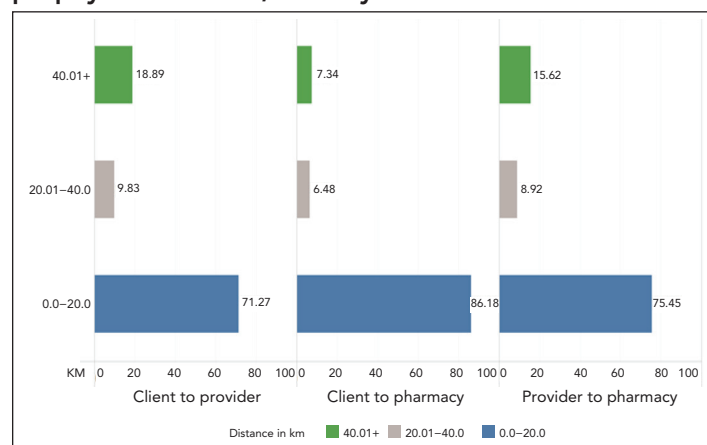
Days	Number of dispensed prescriptions				
	2019	2020	2021	2022	2023
27 and less	38	36	86	77	83
28–30	380	439	360	483	729
31–90	497	449	483	680	1,038
91–180 ^a	20	13	20	23	34
Total	935	937	949	1,263	1,884

^a The maximum number of dispensed prescriptions was 180 days

At the zonal level, most clients travelled less than 20 km to access PrEP services. However, 36.1% of clients in the Western Zone and 35.5% in the Northern Zone travelled 40.01 km–100 km to access the service (Table 6). Travel distance varied among various age groups in accessing a prescriber or a dispensing pharmacy (Figure 9 and Figure 10). Distance travelled also differed by course duration and by direction of travel. Overall, clients travelled farther to access prescribers than to access pharmacies (Table 1).

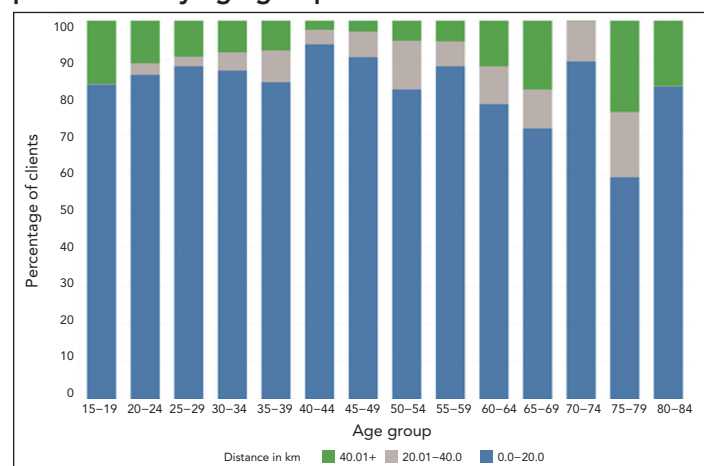


Figure 8: Percentage of clients by the distance travelled in kilometres in Nova Scotia to access HIV pre-exposure prophylaxis services, January 2019–December 2023



Abbreviation: km, kilometre

Figure 10: Percentage of clients travelled in Nova Scotia to access HIV pre-exposure prophylaxis dispensing pharmacies by age group and distance in kilometres

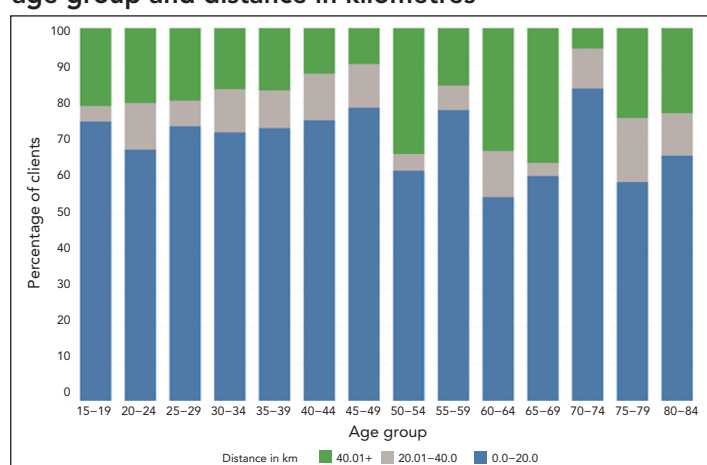


Abbreviation: km, kilometre

Table 6: Percentage of clients commuted to access HIV pre-exposure prophylaxis services in Nova Scotia by zone and distance travelled, January 2019–December 2023

Distance kilometres	Client to provider				Client to pharmacy				Provider to pharmacy			
	Western	Northern	Eastern	Central	Western	Northern	Eastern	Central	Western	Northern	Eastern	Central
0.0–20.0	25.7%	30.3%	42.7%	83.7%	47.4%	55.4%	56.1%	96.9%	38.6%	39.9%	71.5%	83.8%
20.01–40.0	16.3%	12.7%	28.3%	6.9%	27.3%	11.3%	22.2%	1.9%	18.0%	13.8%	10.5%	7.2%
40.01–100.0	36.1%	35.5%	3.9%	5.1%	16.9%	20.7%	4.4%	0.7%	28.8%	19.8%	6.8%	5.2%
100.01–200.0	16.9%	20.7%	9.3%	3.2%	5.0%	12.7%	8.3%	0.1%	10.4%	25.6%	2.4%	2.8%
200.01–300.0	5.0%	0.8%	7.1%	0.5%	1.7%	0.0%	3.9%	0.2%	4.2%	0.8%	3.2%	0.5%
300.01+	0.0%	0.0%	8.8%	0.6%	1.7%	0.0%	5.1%	0.3%	0.0%	0.0%	5.6%	0.5%

Figure 9: Percentage of clients travelled in Nova Scotia to access HIV pre-exposure prophylaxis prescribers by age group and distance in kilometres



Abbreviation: km, kilometre

Uptake was concentrated among middle-aged, male-identifying individuals and in the Central Zone. Despite expanded provider and pharmacy participation, gender- and region-based disparities persisted, and some individuals travelled considerable distances to access services, indicating ongoing inequities in access.

Nationally, new HIV diagnoses rose substantially in 2023, with a 35.2% increase reported in 2023 compared to 2022 (17). According to the World Health Organization (WHO), this surge is partly attributable to enhanced testing efforts, new testing policies, and a rebound in HIV testing and case detection following the COVID-19 pandemic (18).

Although antiviral treatments have proven highly effective (19), HIV remains a public health concern because the infection can remain asymptomatic for years, increasing the likelihood of unrecognized transmission to partners. This highlights the importance of regular testing and PrEP use.

Discussion

In this analysis, PrEP use in NS increased markedly over time, with substantial growth in clients, prescriptions and prescribers.

Between 2019 and 2023, the rate of PrEP use in NS doubled, likely reflecting improved access and affordability through provincial pharmacare programs (20). This trend is consistent with national data, where PrEP use prevalence increased from



61 per 100,000 population in 2019 to 89 per 100,000 population in 2022 (21). Notably, British Columbia reported the highest prevalence of PrEP use, at 132 per 100,000 population in 2022 (21). However, to obtain PrEP, individuals must enroll in the NS Family Pharmacare Program and receive special authorization from a healthcare provider (7). Recently, prescribing authority was expanded to include pharmacists, enhancing accessibility (22).

Client demographics in NS align with national trends, with most PrEP users being male (21), reflecting the higher burden of HIV risk among men, particularly men who have sex with men (3). Across age groups, individuals aged 25–39 demonstrate the highest PrEP utilization, which may be associated with higher levels of sexual activity and a greater number of lifetime partners in this cohort, contributing to increased exposure risk. In Canada, younger adults are more likely than older adults to report two or more sexual partners in the past year, with 25.1% of those aged 20–29 and 9.3% of those aged 30–39 reporting multiple partners (23). Additionally, PrEP is more actively promoted and accessible within this age group, driving increased uptake.

Geographically, the Central Zone had the highest number of PrEP clients, consistent with the Halifax Census Metropolitan Area's status as the province's most populous region (24). Notably, 22.4% of Halifax's population falls within the 25–39 age group (25), further explaining elevated PrEP use in this area. The Central Zone also has the greatest concentration of healthcare providers, influenced by population growth, increased healthcare demand, and the availability of advanced medical services.

Primary care physicians constitute most PrEP prescribers, likely due to easier access through walk-in clinics or established family physician relationships, unlike specialists who require referrals and often involve long wait times. However, only 45.4% of registered Nova Scotian family physicians (including those with dual specialties) have prescribed PrEP, highlighting a need for greater education and promotion of PrEP prescribing among family doctors. According to NS policies, pharmacists and nurse practitioners can prescribe PrEP, but more efforts are needed to expand their prescribing role, especially in medically underserved areas.

Between 2019 and 2023, the average duration of PrEP prescriptions doubled, with most clients receiving a 31- to 90-days supply, necessitating provider visits at least every three months. These regular visits provide opportunities for healthcare providers to conduct HIV testing, aligning with guidelines recommending at least annual testing for high-risk populations (26). The increasing number of refills reflects growing acceptance of PrEP as a preventive tool by both clients and providers.

This study also highlighted geographic accessibility challenges to PrEP services. Most clients travelled 20 km or less for PrEP prescribing or dispensing, but some travelled over 40 km, potentially creating barriers to care and negatively affecting health outcomes. For example, the Eastern Zone had the highest percentage of clients travelling more than 300 km for PrEP access. While there is no universally accepted cut-off distance for distance decay in healthcare utilization, Siegler *et al.* identified substantial geographic barriers to PrEP access among MSM in the United States, with access becoming more limited as travel time to PrEP providers increased (27). Notably, increased challenges in obtaining PrEP, including financial and time-related burdens, tend to occur as travel distances grow longer. Additionally, the distribution of travel distances differs significantly across age groups, indicating a potential relationship with age, while acknowledging that other factors may also influence how far individuals travel for healthcare. Further research is needed to determine whether these travel distances are influenced by the use of virtual care, difficulties accessing local PrEP services, client preferences, such as concerns about privacy or choice of healthcare provider, or if the availability of long-acting injectable PrEP could improve access.

The primary strength of this analysis lies in its comprehensive consideration of clients' demographics, prescriber characteristics, prescribing patterns, pharmacies dispensing PrEP, and linear distance to services. This multifaceted approach deepens our understanding of barriers to PrEP accessibility and generates actionable evidence to guide targeted public health interventions. However, the analysis has a few limitations. First, client postal codes may not reflect current addresses, as individuals may move without updating their information, which limits the accuracy of location data. Additionally, distances were calculated between postal code centroids, which may introduce error, especially in rural areas where postal codes can cover large geographic regions. Linear distance is also an approximation that does not capture actual travel routes and may underestimate travel burden, particularly in areas with complex geography or limited transportation options. However, it remains a practical and consistent measure of accessibility. Moreover, the order of a client travel, use of virtual healthcare services, and prescriptions delivery status were unknown. For readers, these findings highlight areas where interventions could improve PrEP uptake, inform resource allocation, and guide future research to address remaining gaps in accessibility.

Limitations

The low rates of PrEP dispensing among females warrant further investigation to determine whether specific populations, such as individuals who share injection equipment or engage in sex work, face barriers to access. Expanding the capacity of diverse healthcare providers to prescribe PrEP is essential to



improving accessibility across NS. In particular, increasing the involvement of pharmacists and nurse practitioners, especially in rural and remote areas, could significantly benefit underserved communities. Exploring online and virtual platforms for PrEP access may also enhance reach across the province.

Additionally, estimating the size of the population at highest risk for HIV in NS would allow for a calculation of PrEP coverage rates and help identify access gaps. To more effectively curb the spread of HIV, it is critical to identify areas in need of expanded PrEP access. This can be achieved by analyzing community-level HIV testing data and positivity rates to pinpoint regions with elevated risk and inform targeted prevention strategies. Ongoing monitoring of prescribing and dispensing patterns is necessary to track progress and emerging trends.

Future research should explore potential barriers to PrEP access, such as gaps in insurance coverage, lack of access to primary care providers, non-adherence or infrequent medication refills, or the use of on-demand dosing strategies to manage costs.

Conclusion

This analysis described patterns of PrEP utilization, prescribing practices, and service accessibility in NS. The number of clients receiving PrEP in the province doubled between 2019 and 2023, with the largest increase observed among male-identifying individuals aged 30–34. During this period, the total number of healthcare providers prescribing PrEP grew by 116%. Of all prescribers, 70% were based in the Central Zone, and the majority were family physicians. Additionally, 75.6% of pharmacies in NS dispensed PrEP from 2019 to 2023. The total number of PrEP prescriptions filled increased by 101.5% over these years. Most clients travelled 20 km or less to access PrEP services; however, 18.9% and 7.3% of clients travelled more than 40.01 km to reach prescribers and dispensers, respectively. This analysis identifies strategic priorities to strengthen PrEP accessibility, providing a foundation for evidence-informed public health action to expand equitable HIV prevention and accelerate progress toward reducing HIV transmission in NS.

Authors' statement

TW — Conceptualization, methodology, writing—original draft, writing—review & editing

JK — Conceptualization, methodology, writing—review & editing

MN-W — Conceptualization, methodology, writing—review & editing

AR — Methodology, writing—review & editing

DG — Writing—review & editing

KO — Writing—review & editing

Competing interests

None.

ORCID numbers

Tamer Wahba — 0009-0009-4874-263X

Jesse Kancir — 0009-0008-7009-4731

Maria N Wilson — 0000-0003-0187-0713

Alysia Robinson — 0000-0003-4915-8944

Diana Gibson — 0009-0000-6960-7482

Acknowledgements

We would like to thank James Broesch (Director of Science and System Performance, Nova Scotia Health), Mary-Anne Finlayson (Manager Foundations Science and System Performance, Nova Scotia Health), and Jocelyne Galloway (Manager, Canadian Public Health Service, Public Health Agency of Canada), for their valuable support and encouragement throughout the development of this study. We would also like to thank Brittany Peterson (Decision Support Analyst, Nova Scotia Health) for her assistance with data collection. Their help and support contributed significantly to the success of this work.

Funding

This work was supported by the Public Health Agency of Canada via the corresponding author's (TW) salaried appointment. No separate external grant supported this study.

References

1. Canada's Source for HIV and Hepatitis C Information. The Epidemiology of HIV in Canada. Toronto, ON: CATIE; 2025. [Accessed 2025 June 27]. <https://www.catie.ca/the-epidemiology-of-hiv-in-canada>
2. Public Health Agency of Canada. HIV in Canada, Surveillance Report to December 31, 2023. Ottawa, ON: PHAC; 2025. [Accessed 2026 Feb 12]. https://www.canada.ca/en/public-health/services/publications/diseases-conditions/hiv-canada-surveillance-report-december-31-2023.html?utm_source=chatgpt.com
3. Nova Scotia Department of Health and Wellness. 2023 Notifiable Diseases in Nova Scotia Surveillance Report. Halifax, NS: NSDHW; 2023. [Accessed 2025 June 30]. <https://novascotia.ca/dhw/populationhealth/documents/Annual-Notifiable-Disease-Surveillance-Report-2023.pdf>
4. Public Health Agency of Canada. HIV and AIDS: Symptoms and treatment. Ottawa, ON: PHAC; 2025. [Accessed 2025 Oct 3]. <https://www.canada.ca/en/public-health/services/diseases/hiv-aids.html>



5. Public Health Agency of Canada. HIV and AIDS: For health professionals. Ottawa, ON: PHAC; 2024. [Accessed 2025 July 2]. <https://www.canada.ca/en/public-health/services/diseases/hiv-aids/health-professionals.html>
6. Tan D, Hull M, Yoong D, Tremblay C, O'Byrne P, Thomas R, Kille J, Baril J, Cox J, Giguere P, Harris M, Hughes C, MacPherson P, O'Donnell S, Reimer J, Singh A, Barrett L, Bogoch I, Jollimore J, Lambert G, Lebouche B, Metz G, Rogers T, Shafran S. Canadian guideline on HIV pre-exposure prophylaxis and nonoccupational postexposure prophylaxis. CMAJ 2017;189(47):E1448–E1458. DOI PubMed
7. Sexual Health Nova Scotia. PrEP for HIV. Halifax, NS: SHNS; 2018. [Accessed 2026 Feb 13]. <https://shns.ca/prep-for-hiv/>
8. Wang C, Wang F, Onega T. Spatial behavior of cancer care utilization in distance decay in the Northeast region of the US. Travel Behaviour and Society 2021;24:291–302. DOI
9. College of Physicians and Surgeons of Nova Scotia. Physician Registry. Halifax, NS: CPSNS; 2026. [Accessed 2026 Feb 17]. <https://cpsnsphysiciansearch.azurewebsites.net>
10. Aviation Formulary v1.47. Spherical law of cosines formula for distance between two points. [Accessed 2026 Feb 16]. <https://edwilliams.org/avform147.htm>
11. National Aeronautics and Space Administration. Imagine The Universe. Washington, DC: NASA; 2020. [Accessed 2025 July 7]. <https://imagine.gsfc.nasa.gov/>
12. Microsoft Corporation. Microsoft Excel. 2024. <https://www.microsoft.com/>
13. RStudio Team. RStudio: Integrated development environment for R (Version 1.2.5001). RStudio, PBC. 2019. <https://www.rstudio.com/>
14. StataCorp. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC. 2023.
15. Tableau Software. Tableau Desktop (Version 2023.1). 2023. <https://www.tableau.com/>
16. National Association of Pharmacy Regulatory Authorities. National Statistics 2024. Ottawa, ON: NAPRA; 2024. [Accessed 2025 Aug 1]. <https://www.napra.ca/wp-content/uploads/2024/03/2024-NAPRA-National-Statistics-EN.pdf>
17. Public Health Agency of Canada. HIV in Canada: 2023 surveillance highlights. Ottawa, ON: PHAC; 2024. [Accessed 2025 Oct 2]. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/hiv-2023-surveillance-highlights-infographic.html>
18. World Health Organization. Under- and late diagnosis of HIV is holding back progress to end AIDS in the European Region. Geneva, CH: WHO; 2024. [Accessed 2025 Oct 2]. <https://www.who.int/europe/news/item/28-11-2024-under-and-late-diagnosis-of-hiv-is-holding-back-progress-to-end-aids-in-the-european-region#:~:text=Nearly%20113%20000%20HIV%20diagnoses%20were%20reported,of%202.4%20compared%20to%20the%20previous%20year.&text=This%20increase%20can%20partly%20be%20explained%20by,and%20case%20detection%20since%20the%20COVID%2D19%20pandemic>
19. Public Health Agency of Canada. Can't pass it on: HIV treatment prevents transmission (fact sheet). Ottawa, ON: PHAC; 2024. [Accessed 2025 Oct 2]. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/cant-pass-it-on-hiv-treatment-prevents-hiv-transmission-fact-sheet.html>
20. Health Equity Alliance of Nova Scotia. PrEP information and resources. Halifax, NS: HEALNS. [Accessed 2025 Oct 3]. <https://healns.ca/info-resources/prep#:~:text=Government%20Coverage%20of%20PrEP%20in,ca/dhw/pharmacare/>
21. Public Health Agency of Canada. Trends in HIV Pre-Exposure Prophylaxis [HIV-PrEP] use in 9 Canadian provinces, 2019 – 2022. Ottawa, ON: PHAC; 2023. [Accessed 2026 Feb 23]. https://www.canada.ca/en/public-health/services/publications/diseases-conditions/trends-pre-exposure-prophylaxis-use-in-9-canadian-provinces-2019-2022-infographic.html?utm_source=chatgpt.com
22. Dalhousie University. Media Centre. 2024. [Accessed 2025 Oct 3]. https://www.dal.ca/news/media/media-releases/2024/07/26/media_release__nova_scotia_pharmacists_among_canada_s_first_to_prescribe_hiv_prevention_drug_with_help_from_dalhousie_pilot_study.html#:~:text=On%20July%201%2C%202024%2C%20pharmacists%20in%20Nova,has%20enabled%20pharmacists%20to%20prescribe%20for%20PrEP
23. Statistics Canada. Canadian Community Health Survey: Combined data, 2013/2014. Ottawa, ON: StatCan; 2015. [Accessed 2026 Feb 22]. <https://www150.statcan.gc.ca/n1/en/daily-quotidien/150624/dq150624b-eng.pdf?st=nKFSNsWN>



24. Statistics Canada. Focus on Geography Series, 2021 Census of Population Nova Scotia, Province. Ottawa, ON: StatCan; 2025. [Accessed 2025 Oct 3]. <https://www12.statcan.gc.ca/census-recensement/2021/as-sa/fogs-spg/page.cfm?lang=E&topic=1&dguid=2021A000212>
25. Statistics Canada. Census Profile, 2021 Census of Population. Ottawa, ON: StatCan; 2024. [Accessed 2025 Oct 3]. <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=e&SearchText=halifax&DGUIDlist=2013A000412002,2021A00031209&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0>
26. Public Health Agency of Canada. HIV Factsheet Screening and Testing. Ottawa, ON: PHAC; 2019. [Accessed 2025 Oct 3]. <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/hiv-factsheet/hiv-factsheet-screening-testing.pdf>
27. Siegler AJ, Bratcher A, Weiss KM. Geographic access to preexposure prophylaxis clinics among men who have sex with men in the United States. *Am J Public Health* 2019;109(9):1216–23. DOI PubMed



Invasive group A streptococcal disease surveillance in Canada, 2023

Alyssa R Golden^{1*}, Averil Griffith¹, Gregory J Tyrrell², Julianne V Kus^{3,4}, Allison McGeer^{4,5}, Marc-Christian Domingo⁶, Jennifer M Grant⁷, Jessica Minion⁸, Paul Van Caesele⁹, Carole Balthazar¹⁰, David Haldane¹¹, Yang Yu¹², Xiaofeng Ding¹³, Laura Steven¹⁴, Jan McFadzen¹⁵, Courtney Primeau¹⁶, Irene Martin¹

Abstract

Background: Invasive group A streptococcal (iGAS, *Streptococcus pyogenes*) disease has been a nationally notifiable disease in Canada since 2000.

Objective: To summarize the demographics, *emm* types and antimicrobial resistance of iGAS isolates collected in Canada in 2023.

Methods: The Public Health Agency of Canada's National Microbiology Laboratory (Winnipeg, Manitoba) collaborates with provincial and territorial public health laboratories to conduct national surveillance of invasive *Streptococcus pyogenes*. *Emm* types were extracted from whole genome sequencing data and antimicrobial susceptibilities were predicted from the sequencing data based on the presence of resistance determinants.

Results: Overall, the incidence of iGAS disease in Canada was 6.53 cases per 100,000 population in 2022; an increase from the rate of 5.56 cases per 100,000 population in 2021. A total of 5,201 iGAS isolates were collected during 2023, representing a stark increase in comparison to pre-SARS-CoV-2 pandemic disease activity. Of note during 2023 was the increased number of isolates collected from children younger than 15 years of age ($n=577$), over double the total in 2019 (pre-pandemic, $n=254$). The most common *emm* types overall in 2023 were *emm1* (24.2%, $n=1,260$) and *emm12* (16.6%, $n=864$), representing significant increases in prevalence since 2019 ($p<0.0001$); these types were also the most common within all Canadian regions and for both adults and children. Antimicrobial resistance rates in 2023 included 11.0% erythromycin resistance, 2.3% clindamycin resistance and 15.2% tetracycline resistance.

Conclusion: The 5,201 isolates of iGAS collected in Canada in 2023 represent the highest annual total to date. The increase of iGAS experienced in 2023 was a critical public health concern, particularly due to the significant burden of pediatric invasive disease. Continued surveillance is vital to understanding the changing landscape of iGAS disease in Canada, particularly *emm* types and antimicrobial resistance patterns in the post-pandemic period.

Suggested citation: Golden AR, Griffith A, Tyrrell GJ, Kus JV, McGeer A, Domingo M-C, Grant JM, Minion J, Van Caesele P, Balthazar C, Haldane D, Yu Y, Ding X, Steven L, McFadzen J, Primeau C, Martin I. Invasive group A streptococcal disease surveillance in Canada, 2023. *Can Commun Dis Rep* 2026;52(10):427–34. <https://doi.org/10.14745/ccdr.v52i10a06>

Keywords: iGAS, *Streptococcus pyogenes*, Canada, *emm*, surveillance, antimicrobial resistance, group A streptococcus

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Affiliations

[See Appendix](#)

*Correspondence:

alyssa.golden@phac-aspc.gc.ca



Introduction

Group A *Streptococcus* (GAS, *Streptococcus pyogenes*) is responsible for a wide range of human diseases, the most serious of which include bacteraemia, streptococcal toxic shock syndrome, necrotizing fasciitis and endocarditis (1). After steadily increasing in incidence up to 2019, invasive group A streptococcal (iGAS) infections declined considerably in Canada during the SARS-CoV-2 pandemic (COVID-19). In 2022, it was reported an increased number of iGAS isolates submitted to Canada's National Microbiology Laboratory (NML) in comparison to COVID-19 years, particularly in November and December 2022 (2). This coincided with several alerts of increased iGAS disease activity in late 2022 by the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC) and Pan American Health Organization (PAHO) (3–5). This rapid increase in iGAS disease was accompanied by an abrupt shift in the *emm* types associated with infections in Canada, from *emm*49 to *emm*1 and *emm*12 (2). This report provides a summary of iGAS isolates collected in Canada in 2023.

Methods

Surveillance program

As previously described, surveillance of iGAS in Canada consists of a passive, laboratory-based system where invasive *S. pyogenes* isolates from all provincial and territorial public health laboratories (except Alberta) are forwarded to NML in Winnipeg for further testing (2). In 2023, a total of 5,201 iGAS isolates were reported, including 4,308 submitted directly to NML by provincial and territorial public health laboratories and data for a further 893 isolates collected and tested by the Alberta Provincial Laboratory for Public Health (Table 1). Sterile clinical isolation sites include blood, cerebrospinal fluid, deep

tissue, biopsy and surgical samples, bone and any clinical sources associated with necrotizing fasciitis or toxic shock syndrome.

Population-based incidence of iGAS disease up to 2022 were obtained through the Canadian Notifiable Disease Surveillance System (CNDSS). Population data for incidence rates were obtained from Statistics Canada's July 1st annual population estimates.

Isolate testing

All iGAS isolates submitted to NML in 2023 were whole genome sequenced using the Illumina platform. Isolates were confirmed as *S. pyogenes* using 16S ribosomal RNA gene sequence analysis. *Emm* type was identified directly using the WGS Analysis and Detection of Molecular Markers (WADE) pipeline (<https://github.com/phac-nml/wade>) and CDC *emm* database. Antimicrobial resistance interpretation (susceptible, resistant/inducibly-resistant) was also predicted using WADE, based on the presence/absence of resistance markers for macrolides/lincosamides (*ermA*, *ermB*, *ermT*, *mefA/E*), tetracycline (*tetA*, *tetB*, *tetM*, *tetO*, *tetT*) and β -lactams (*pbp2x*).

Supplementary testing was performed on all *emm*1 isolates submitted to NML in 2023 to determine the prevalence of the novel M1_{UK} lineage. The M1_{UK} genotypes were determined by mapping whole genome sequencing reads against reference strain MGAS5005 and identifying 27 characteristic genomic single nucleotide variants, as previously described (6,7).

Data analysis

Demographic data submitted with bacterial isolates included patient age, sex, clinical source, province and date of collection. Multiple isolates with the same *emm* type and collected from the same patient within 21 days were counted once with the most invasive isolation site assigned. Meningitis-related isolates

Table 1: Number of invasive *Streptococcus pyogenes* isolates collected by each Canadian province/region, 2023

Province	Age group (years)						Not given	Total
	Younger than 2	2–4	5–14	15–49	50–64	65 and older		
British Columbia	6	13	26	205	142	176	1	569
Alberta	26	30	60	379	223	165	10	893
Saskatchewan	8	7	16	122	59	57	0	269
Manitoba	8	5	9	120	82	72	0	296
Ontario	49	66	113	561	451	633	11	1,884
Québec	28	28	48	376	231	255	0	966
New Brunswick	5	2	6	42	26	31	2	114
Prince Edward Island	0	0	0	10	7	13	0	30
Nova Scotia	1	4	4	39	25	38	0	111
Newfoundland and Labrador	1	1	3	26	15	10	0	56
Northern ^a	3	0	1	6	1	2	0	13
Canada	135	156	286	1,886	1,262	1,452	24	5,201

^a Includes isolates from Yukon, Northwest Territories and Nunavut

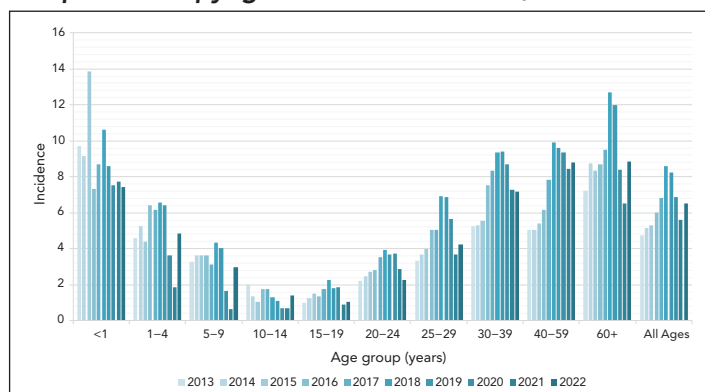


were regarded as most invasive, followed by blood and then other sterile sites. The laboratory data were aggregated by age into younger than two years, 2–4, 5–14, 15–49, 50–64 and 65 years and older old age groups and regionally into Western (British Columbia, Alberta, Saskatchewan, Manitoba), Central (Ontario and Québec), Eastern (New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador) and Northern (Yukon Territories, Northwest Territories and Nunavut) regions of Canada. Statistical significance of trends was assessed using the Cochran Armitage test for trend, with a p -value of <0.05 considered significant.

Results

The overall incidence of iGAS disease in Canada was 6.53 cases per 100,000 population in 2022. Though this represents a decrease from the peak of 8.60 cases per 100,000 population in 2018, it is an increase over the low rate of 5.56 cases per 100,000 population seen during the COVID-19 pandemic in 2021 (Figure 1). There was a startling increase in the number of iGAS isolates submitted in 2023 ($n=5,201$), almost double the submissions received 2022 ($n=2,634$) and the highest annual total in Canada to date. After a sharp increase in isolates collected during 2022–Q4 (October to December), totals continued to increase into 2023 with a peak in 2023–Q2 (April to June) (Figure 2). All quarterly isolate totals in 2023 were considerably higher than the corresponding quarter in 2019 (pre-pandemic iGAS disease activity). Of note during 2023 was the increased number of isolates collected from children less than 15 years of age ($n=577$); over double the total in 2019 (pre-pandemic, $n=254$). Paediatric isolate submissions also peaked in 2023–Q2 (Figure 2).

Figure 1: Annual incidence rates^a of invasive *Streptococcus pyogenes* cases in Canada, 2013–2022^b

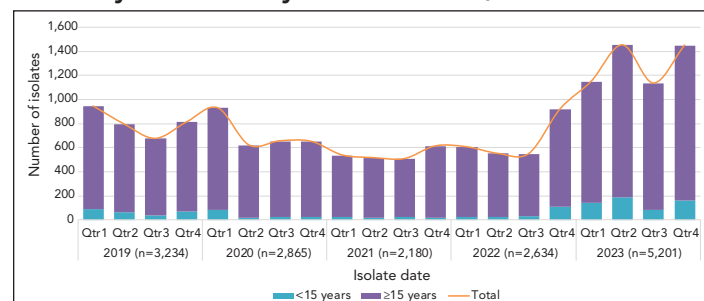


^a Cases per 100,000 population

^b 2023 incidence not available at time of submission

Of the 5,201 iGAS isolates tested in 2023, 5,177 (99.5%) had patient ages. Infants younger than two years of age accounted for 2.6% ($n=135$), toddlers aged 2–4 years for 3.0% ($n=156$), children aged 5–14 years for 5.5% ($n=286$), teens/adults aged

Figure 2: Number of invasive *Streptococcus pyogenes* isolates collected each quarter^a for patients younger than 15 years and 15 years and older^b, 2019–2023



Abbreviation: Qtr, quarter

^a Quarter 1, January to March; Quarter 2, April to June; Quarter 3, July to September; Quarter 4, October to December; all month ranges are inclusive

^b Yearly isolate counts include those where no age was given

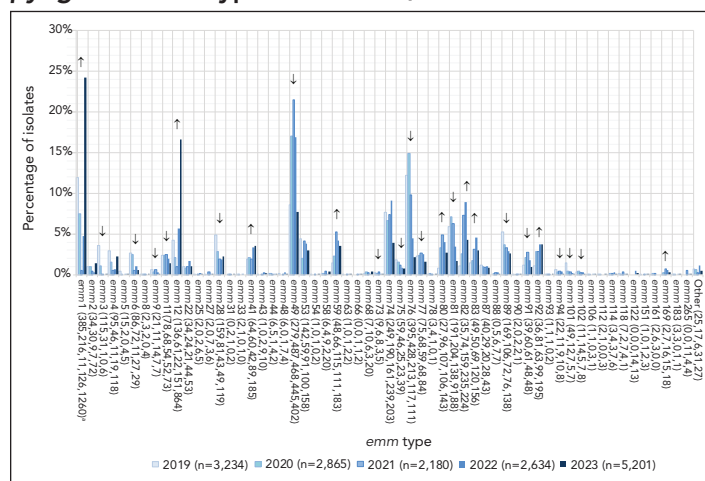
15–49 years for 36.3% ($n=1,886$), adults aged 50–64 years for 24.3% ($n=1,262$) and seniors aged 65 years and older for 27.9% ($n=1,452$). Of the isolates for which sex information was available, isolates from male patients represented 58.3% ($n=2,718$) of isolates. Blood was the main clinical isolation site, accounting for 66.0% ($n=3,434$) of isolates collected.

The most predominant *emm* types overall in 2023 were *emm1* (24.2%, $n=1,260$) and *emm12* (16.6%, $n=864$), representing significant increases in prevalence since 2019 (from 11.9%, $n=385$, $p<0.0001$ and from 4.2%, $n=136$, $p<0.0001$, respectively) (Figure 3). After initially increasing in 2022–Q4, *emm12* counts peaked in 2023–Q1. At 22.1% of isolates ($n=255$), *emm12* was the most common type during Q1 before declining in prevalence throughout the remainder of 2023 (Appendix, Figure S1). *Emm1* increased steadily in prevalence throughout 2023, peaking at 30.7% of isolates ($n=446$) collected during 2023–Q4 (Appendix, Figure S1). Of note, 60.3% ($n=693$) of *emm1* isolates sequenced in 2023 were the novel M1_{UK} lineage, roughly double the prevalence seen in 2019 (30.8%, $n=106$, $p<0.0001$) (Figure 4). Other *emm* types that demonstrated significantly increasing trends from 2019 to 2023 include *emm41* (2.0%–3.6%, $p<0.0001$), *emm59* (1.5%–3.5%, $p<0.0001$), *emm80* (0.8%–2.7%, $p<0.0001$), *emm82* (1.1%–4.3%, $p=0.0097$), *emm83* (1.5%–3.0%, $p<0.0001$) and *emm92* (1.1%–3.7%, $p<0.0001$). Many *emm* types demonstrated significantly decreasing trends (Figure 3).

Emm1 and *emm12* were also the most common types across different age groups and regions. From children younger than 15 years of age, *emm1* and *emm12* represented 49.0% ($n=283$) and 25.8% ($n=149$) of isolates, respectively (Appendix, Figure S2). These types were less dominant for patients 15 years of age and older, representing 21.2% ($n=974$) and 15.5% ($n=713$) of isolates, respectively (Appendix, Figure S3). Regionally *emm1* and *emm12* represented 17.8% ($n=360$) and 14.8% ($n=299$), respectively, of isolates collected from Western Canada, 28.6% ($n=816$) and 16.6% ($n=474$) from Central Canada and 27.0% ($n=84$) (of each type) from Eastern Canada (Figure 5).



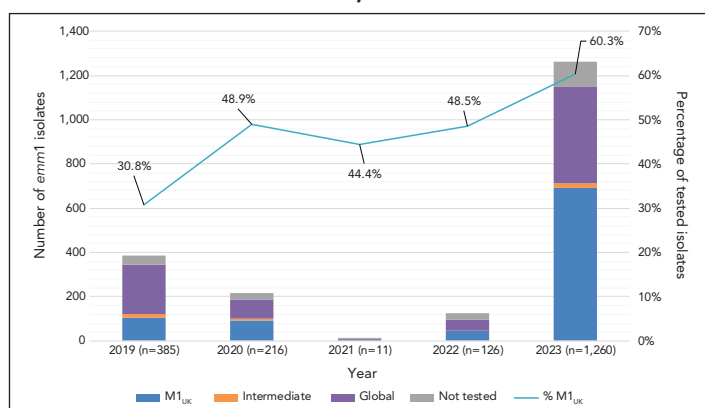
Figure 3: Prevalence of invasive *Streptococcus pyogenes* emm types in Canada, 2019–2023^{a,b}



^a Number of isolates for 2019, 2020, 2021, 2022 and 2023 respectively

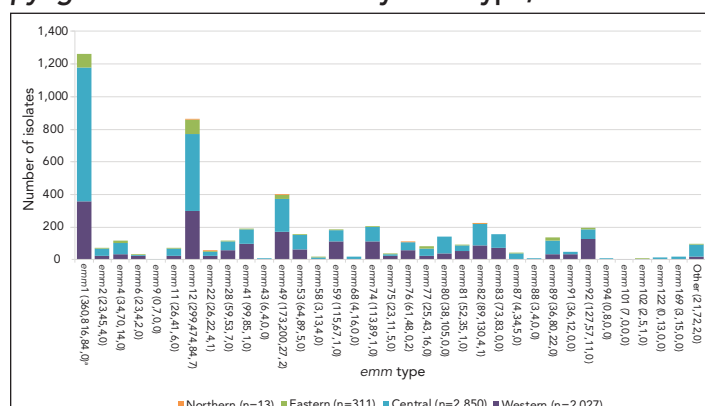
^b For *emm* types with an overall N≥50: up or down arrows indicate statistically significant trends toward increasing or decreasing prevalence for the 2019–2023 timespan, using the chi-squared test for trend. *Emm* types with no arrow either did not demonstrate a statistically significant trend, or did not have an overall N≥50

Figure 4: Percentage of M1_{UK} lineage among *emm*1 isolates collected in Canada, 2018–2023^a



^a M1_{UK} refers to the hypervirulent *emm*1 genotype originally described by Lynskey *et al.* (7). M1_{UK} differs from other *emm*1 isolates by 27 key single nucleotide variants (SNVs). M1_{UK}=all 27 SNVs present; Intermediate=1–26 SNVs; global=0 SNVs; not tested=whole genome sequencing not performed

Figure 5: Regional distribution of invasive *Streptococcus pyogenes* isolates collected by *emm* type, 2023^a



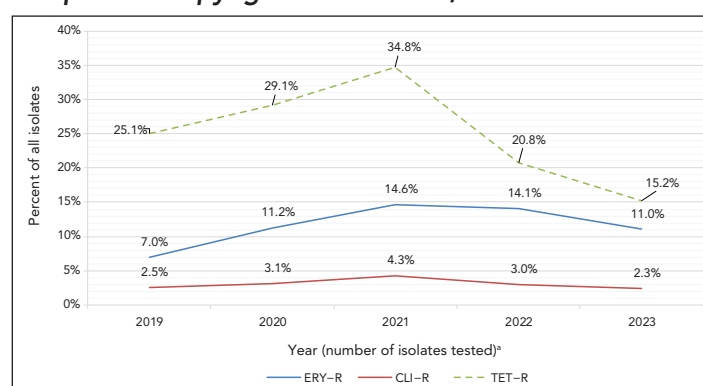
^a Number of isolates in the Western, Central, Eastern and Northern regions of Canada, respectively

Isolates from Northern Canada were highly represented by *emm*12 in 2023 at 53.8% (n=7), though only 13 isolates were submitted from this region.

Upon request, NML provides assistance to provincial and territorial public health laboratories for iGAS outbreak/case cluster investigations (including non-invasive isolates from screening) and jurisdictional *emm* increases. During 2023, NML assisted with a jurisdictional increase (*emm*12) and 11 outbreak investigations from various jurisdictions, including *emm*1 (two outbreaks of n=3 cases), *emm*12 (two outbreaks of n=2, two of n=4), *emm*49 (two outbreaks of n=2 and n=14), *emm*53 (n=14), *emm*80 (n=6), *emm*82 (n=4) and one multi-*emm* type outbreak (*emm*49.2, *emm*83.1 and *emm*87, n=14). This represents an increase from the number of requests in previous years.

Antimicrobial resistance among iGAS isolates is presented in **Figure 6**. Erythromycin resistance increased significantly from 7.0% in 2019 to 11.0% in 2023 ($p<0.0001$), while tetracycline resistance decreased significantly from 25.1% to 15.2% ($p<0.0001$). Clindamycin resistance remained relatively stable over the study period (2.3%–4.3%). There was no resistance observed to penicillin. The *emm* types associated with erythromycin resistance and constitutive and inducible clindamycin resistance included *emm*11 (95.7% erythromycin resistance, n=67; 27.1% constitutive clindamycin resistance, n=19; 45.7% inducible clindamycin resistance, n=32), *emm*53 (13.4%, n=18; 12.7%, n=17; 0.7%, n=1), *emm*77 (91.0%, n=71; 2.6%, n=2; 88.5%, n=69), *emm*83 (43.9%, n=65; 1.4%, n=2; 42.6%, n=63) and *emm*92 (97.5%, n=153; 1.9%, n=3; 94.9%, n=149) (Appendix, Table S1).

Figure 6: Antimicrobial resistance of invasive *Streptococcus pyogenes* in Canada, 2019–2023^a



Abbreviations: CLI-R, constitutively clindamycin-resistant; ERY-R, erythromycin-resistant; TET-R, tetracycline-resistant

^a Total number of isolates tested per year: 2019–ERY/CLI n=2,712, TET n=542; 2020–ERY/CLI n=2,367, TET n=889; 2021–ERY/CLI n=1,771, TET n=764; 2022–ERY/CLI n=2,144, TET n=1,156; 2023–ERY/CLI n=4,779, TET n=4,779



Discussion

In 2022, 2,544 cases of iGAS disease were reported to the CNDSS, with a national incidence rate of 6.53 cases per 100,000 population. This represents a slightly higher rate than was seen in 2021 (5.56 cases per 100,000 population), where COVID-19 pandemic containment measures had a marked effect on the spread of pathogens with respiratory transmission routes, including *S. pyogenes*. Beginning in late 2022, Canada began to see a surge in the number of iGAS isolates submitted for testing, mirroring the concerning worldwide increases noted by WHO, CDC and PAHO (3–5). Isolate submissions continued to increase going into 2023, peaking in Q2 but remaining much higher than pre-pandemic totals. Though 2023 incidence was not available at the time of writing, the sharp increase in the number of isolates submitted for testing in 2023 ($n=5,201$) in comparison to the previous highest annual count reported to the CNDSS in 2018 ($n=3,190$) suggests that 2023 was a record year for iGAS incidence in Canada.

Initial reports on the worldwide iGAS disease increase of late 2022 noted *emm1* and *emm12* as the predominant cause of iGAS infections, a trend which continued into 2023 (8–11). In Canada, *emm12* increased significantly in prevalence at the end of 2022, continuing into early 2023 before decreasing again by the end of the year. *Emm1* also increased in prevalence at the end of 2022; in contrast, it continued to increase into the 2023–2024 respiratory virus season. Recent studies indicate an overrepresentation of *emm1* in critically ill patients, particularly of the hypervirulent M1_{UK} lineage (12,13). A study of patients with *S. pyogenes* infections admitted to Belgian intensive care units found that 73% of isolates collected were *emm1*, of which 83% were M1_{UK} (12). A second study of iGAS meningitis in the Netherlands noted 86% *emm1* during the 2022–2023 season, of which 79% were M1_{UK} (13). The accumulation of single nucleotide variants within M1_{UK} has been suggested to confer a fitness advantage in pathogenicity, transmission and persistence, and the lineage demonstrates higher genome stability than the ancestral M1_{global} lineage (7,14). The M1_{UK} genotype has expanded considerably in Canada, increasing from 48.5% in 2022 to 60.3% in 2023, which is now close to double the pre-COVID-19 pandemic prevalence. The rapid increase over time suggests that the M1_{UK} lineage will soon replace the M1_{global} lineage in Canada. Though the Canadian prevalence is much higher than the most recent published value from the United States (11%) (15), a number of European countries have published M1_{UK} rates ranging from 70% up to 95% (11,14,16).

The rapid increase of *emm1* and *emm12* resulted in a substantial displacement of other *emm* types that were recently common in Canada. In particular, prevalence of *emm49* had been rapidly increasing, peaking in 2021 when *emm1* had all but disappeared. In 2023, NML assisted with three outbreak analyses involving *emm49*; overall, it was found that *emm49* isolates were highly genetically similar across the country. A recent genomic

surveillance study of iGAS disease in Arizona noted a similar clonal expansion of *emm49*, with limited genomic diversity (17). As *emm* types tend to fluctuate with “epidemic behaviour” as populations develop immunity (1), and as *emm49* is so genetically homogenous across Canada, it is likely that it was very easily replaced by *emm1* and *emm12*.

As expected, *S. pyogenes* remained fully susceptible to first-line treatment penicillin. Resistance rates remained high to second-line therapy erythromycin, and commonly collected *emm* types in Canada with high levels (greater than 40%) of resistance were similar to those described in previous 2020 and 2021/2022 reports (2,18). Clindamycin resistance in Canada remained low in 2023 at 2.3%. This is in contrast to reports out of Europe describing rising clindamycin resistance rates following the COVID-19 pandemic, including 17.5% in Spain and 28.2% in Ireland (19,20). The current report also represents the first publication for this surveillance system of resistance data for tetracycline, a Tier 2 antimicrobial agent as defined by the Clinical and Laboratory Standards Institute (21). Though NML did not test tetracycline by the previously utilized disc diffusion method, it is now included in whole genome sequencing-based resistance predictions. The variable number of isolates tested prior to 2023 may have affected the resistance rates presented in Figure 6; however, 2023 represents a complete year of data and a 15.2% rate of resistance. Recent tetracycline resistance rates were variable across different countries, including 43% and 8.3% resistance in Ireland and South Africa, respectively (20,22).

Strengths and limitations

Caution should be exercised when interpreting the data presented in this report as the overall interpretation of the results is limited to only isolates available for testing; provinces and territories may submit only a subset of their isolates to NML for testing. The laboratory-based surveillance system is also limited in that it does not collect enhanced epidemiological data to stratify *emm* typing data by outcome, manifestation or risk factor, which is critical information to help understand the changing landscape of iGAS disease in Canada. To address these surveillance gaps, the Public Health Agency of Canada, in collaboration with provincial and territorial partners, plan to implement a national enhanced iGAS surveillance system as early as 2024.

Conclusion

After several years of below normal iGAS cases due to the COVID-19 pandemic, isolate counts rebounded significantly in 2023, reaching the highest annual Canadian total to date. Of particular concern was the drastic increase in isolates collected from children younger than 15 years of age. *Emm1* and *emm12* represented the most common types overall, by age group and by geographic region, far surpassing the previous most common type, *emm49*. It is unclear whether these *emm* types will continue to dominate moving forward, or if the distribution will level out as Canada moves further into the post-COVID-19



period. It will be critical to maintain comprehensive surveillance, including integration of epidemiological data through the planned national enhanced iGAS surveillance system, to understand the changing landscape of iGAS disease in Canada.

Authors' statement

ARG — Formal analysis, data curation, visualization, writing—original draft, review & editing of final version
 AG — Formal analysis, validation, investigation, data curation, visualization, writing—review & editing
 GJT — Resources, methodology, writing—review & editing
 JVK — Resources, methodology, writing—review & editing
 AM — Resources, methodology, writing—review & editing
 M-CD — Resources, methodology, writing—review & editing
 JMG — Resources, methodology, writing—review & editing
 JMinion — Resources, methodology, writing—review & editing
 PV — Resources, methodology, writing—review & editing
 CB — Resources, methodology, writing—review & editing
 DH — Resources, methodology, writing—review & editing
 YY — Resources, methodology, writing—review & editing
 XD — Resources, methodology, writing—review & editing
 LS — Resources, methodology, writing—review & editing
 JMcFadzen — Resources, methodology, writing—review & editing
 CP — Writing—review & editing
 IM — Conceptualization, validation, methodology, supervision, project administration, writing—review & editing

Competing interests

None.

ORCID numbers

Alyssa R Golden — [0000-0002-1788-1794](https://orcid.org/0000-0002-1788-1794)
 Gregory J Tyrrell — [0000-0002-5276-2416](https://orcid.org/0000-0002-5276-2416)
 Julianne V Kus — [0000-0001-6033-7244](https://orcid.org/0000-0001-6033-7244)
 Allison McGeer — [0000-0001-5647-6137](https://orcid.org/0000-0001-5647-6137)

Acknowledgements

We thank Angela Yuen, Rachel Hink and Anastasia Anistratov from the Invasive Bacterial Diseases Section at the National Microbiology Laboratory for their laboratory technical assistance, and the staff of provincial and public health laboratories in Canada for participating in the national laboratory surveillance program.

Funding

This project was supported by internal funding from the Public Health Agency of Canada.

References

1. Walker MJ, Barnett TC, McArthur JD, Cole JN, Gillen CM, Henningham A, Sriprakash KS, Sanderson-Smith ML, Nizet V. Disease manifestations and pathogenic mechanisms of Group A Streptococcus. *Clin Microbiol Rev* 2014;27(2):264–301. [DOI PubMed](#)
2. Golden AR, Griffith A, Tyrrell GJ, Kus JV, McGeer A, Domingo MC, Hoang L, Minion J, Van Caesele P, Smadi H, Haldane D, Yu Y, Ding X, Steven L, McFadzen J, Primeau C, Franklin K, Martin I. Invasive group A streptococcal disease surveillance in Canada, 2021–2022. *Can Commun Dis Rep* 2024;50(5):135–43. [DOI PubMed](#)
3. World Health Organization. Disease Outbreak News; Increased incidence of scarlet fever and invasive Group A Streptococcus infection - multi-country. Geneva, CH: WHO; 2022. [Accessed 2023 Nov 26]. <https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON429>
4. Centers for Disease Control and Prevention. Health Alert Network. Increase in Pediatric Invasive Group A Streptococcal Infections. Atlanta, GA: CDC; 2022. [Accessed 2023 Nov 26]. <https://dhhs.ne.gov/han%20Documents/ADVISORY12222022.pdf>
5. Pan American Health Organization/World Health Organization. Nota Informativa: Casos de enfermedades causadas por estreptococo del grupo A en Uruguay. Washington, DC/Geneva, CH: PAHO/WHO; 2022. [Accessed 2023 Nov 27]. <https://www.paho.org/es/documentos/nota-informativa-casos-enfermedades-causadas-por-estreptococo-grupo-uruguay>
6. Demczuk W, Martin I, Domingo FR, MacDonald D, Mulvey MR. Identification of Streptococcus pyogenes M1_{UK} clone in Canada. *Lancet Infect Dis* 2019;19(12):1284–5. [DOI PubMed](#)
7. Lynskey NN, Jauneikaite E, Li HK, Zhi X, Turner CE, Mosavie M, Pearson M, Asai M, Lobkowicz L, Chow JY, Parkhill J, Lamagni T, Chalker VJ, Sriskandan S. Emergence of dominant toxigenic M1T1 Streptococcus pyogenes clone during increased scarlet fever activity in England: a population-based molecular epidemiological study. *Lancet Infect Dis* 2019;19(11):1209–18. [DOI PubMed](#)
8. UK Health Security Agency. Group A streptococcal infections: 15th update on seasonal activity in England. London, UK: HAS; 2023. [Accessed 2024 Aug 7]. <https://www.gov.uk/government/publications/group-a-streptococcal-infections-activity-during-the-2022-to-2023-season/group-a-streptococcal-infections-15th-update-on-seasonal-activity-in-england>



9. Valcarcel Salamanca B, Cyr PR, Bentdal YE, Watle SV, Wester AL, Strand ÅM, Bøås H. Increase in invasive group A streptococcal infections (iGAS) in children and older adults, Norway, 2022 to 2024. *Euro Surveill* 2024;29(20):2400242. [DOI PubMed](#)
10. Gouveia C, Bajanca-Lavado MP, Mamede R, Araújo Carvalho A, Rodrigues F, Melo-Cristino J, Ramirez M, Friães A. Sustained increase of paediatric invasive *Streptococcus pyogenes* infections dominated by M1_{UK} and diverse emm12 isolates, Portugal, September 2022 to May 2023. *Euro Surveill* 2023;28(36):2300427. [DOI PubMed](#)
11. Rodriguez-Ruiz JP, Lin Q, Lammens C, Smeesters PR, van Kleef-van Koevinge S, Matheeußen V, Malhotra-Kumar S. Increase in bloodstream infections caused by emm1 group A *Streptococcus* correlates with emergence of toxigenic M1_{UK}, Belgium, May 2022 to August 2023. *Euro Surveill* 2023;28(36):2300422. [DOI PubMed](#)
12. Peetermans M, Matheeußen V, Moerman C, De Rydt F, Thieren S, Pollet E, Casaer M, De Backer B, De Paep R, Debaveye Y, Desmet L, Desmet S, Duval EI, Fraipont V, Geysels D, Hermans G, Lahaye F, Mathy X, Meersseman P, Meex C, Van Herck J, van Kleef-van Koevinge S, Layios N, Wauters J, Jorens PG. Clinical and molecular epidemiological features of critically ill patients with invasive group A *Streptococcus* infections: a Belgian multicenter case-series. *Ann Intensive Care* 2024;14(1):19. [DOI PubMed](#)
13. van der Putten BC, Vlamincx BJ, de Gier B, Freudenburg-de Graaf W, van Sorge NM. Group A streptococcal meningitis with the M1_{UK} variant in the Netherlands. *JAMA* 2023;329(20):1791–2. [DOI PubMed](#)
14. Vieira A, Wan Y, Ryan Y, Li HK, Guy RL, Papangeli M, Huse KK, Reeves LC, Soo VW, Daniel R, Harley A, Broughton K, Dhami C, Ganner M, Ganner MA, Mumin Z, Razaei M, Rundberg E, Mammadov R, Mills EA, Sgro V, Mok KY, Didelot X, Croucher NJ, Jauneikaite E, Lamagni T, Brown CS, Coelho J, Sriskandan S. Rapid expansion and international spread of M1_{UK} in the post-pandemic UK upsurge of *Streptococcus pyogenes*. *Nat Commun* 2024;15(1):3916. [DOI PubMed](#)
15. Li Y, Rivers J, Mathis S, Li Z, Chochua S, Metcalf BJ, Beall B, Onukwube J, Gregory CJ, McGee L. Expansion of Invasive Group A *Streptococcus* M1_{UK} Lineage in Active Bacterial Core Surveillance, United States, 2019–2021. *Emerg Infect Dis* 2023;29(10):2116–20. [DOI PubMed](#)
16. Bertram R, Itzek A, Marr L, Manzke J, Voigt S, Chapot V, van der Linden M, Rath PM, Hitzl W, Steinmann J. Divergent effects of emm types 1 and 12 on invasive group A streptococcal infections-results of a retrospective cohort study, Germany 2023. *J Clin Microbiol* 2024;62(8):e0063724. [DOI PubMed](#)
17. Yaglom HD, Bhattarai R, Lemmer D, Rust L, Ridenour C, Chorbi K, Kim E, Centner H, Sheridan K, Jasso-Selles D, Erickson DE, French C, Bowers JR, Valentine M, Francis D, Hepp CM, Brady S, Komatsu KK, Engelthaler DM. Large clusters of invasive emm49 group A *Streptococcus* identified within Arizona healthcare facilities through statewide genomic surveillance system, 2019–2021. *J Infect Dis* 2024;230(3):598–605. [DOI PubMed](#)
18. Golden A, Griffith A, Demczuk W, Tyrrell G, Kus J, McGeer A, Domingo MC, Hoang L, Minion J, Van Caeseele P, Smadi H, Haldane D, Zahariadis G, Mead K, Steven L, Strudwick L, Li A, Mulvey M, Martin I. Invasive group A streptococcal disease surveillance in Canada, 2020. *Can Commun Dis Rep* 2022;48(9):407–14. [DOI PubMed](#)
19. Marco DN, Canela J, Brey M, Soriano A, Pitart C, Herrera S. Assessing the influence of the COVID-19 pandemic on the incidence, clinical presentation, and clindamycin resistance rates of *Streptococcus pyogenes* infections. *IJID Reg* 2024;11:100349. [DOI PubMed](#)
20. Lapthorne S, McWade R, Scanlon N, Ní Bhaoill S, Page A, O'Donnell C, Dornikova G, Hannan M, Lynch B, Lynch M, Brady D. Rising clindamycin resistance in group A *Streptococcus* in an Irish healthcare institution. *Access Microbiol* 2024;6(6):000772.v4. [DOI PubMed](#)
21. Clinical and Laboratory Standards Institute. CLSI M100 Performance Standards for Antimicrobial Susceptibility Testing. 34th ed. Wayne, PA: CLSI; 2024.
22. Rampersadh K, Engel KC, Engel ME, Moodley C. A survey of antibiotic resistance patterns among Group A *Streptococcus* isolated from invasive and non-invasive infections in Cape Town, South Africa. *Heliyon* 2024;10(13):e33694. [DOI PubMed](#)



Appendix

Supplemental material is available upon request to the author: alyssa.golden@phac-aspc.gc.ca

Emm data can also be viewed in interactive format on the National Laboratory Surveillance of Invasive Streptococcal Disease in Canada (eSTREP) Health Infobase page.

Figure S1: Number of invasive *Streptococcus pyogenes* isolates collected each quarter for *emm1*, *emm12* and all other *emm* types, 2019–2023

Figure S2: Prevalence of invasive *Streptococcus pyogenes* *emm* types isolated from patients less than 15 years old in 2023 (n=577)

Figure S3: Prevalence of invasive *Streptococcus pyogenes* *emm* types isolated from patients 15 years and older in 2023 (n=4,600)

Table S1: Percentage of macrolide and lincosamide resistant *Streptococcus pyogenes* isolates collected in 2023, by *emm* type

Affiliations

¹ National Microbiology Laboratory, Public Health Agency of Canada, Winnipeg, MB

² Provincial Laboratory for Public Health, Edmonton, AB

³ Public Health Ontario, Toronto, ON

⁴ Department of Laboratory Medicine and Pathobiology, University of Toronto, Toronto, ON

⁵ Toronto Invasive Bacterial Diseases Network, Department of Microbiology, Mount Sinai Hospital, Toronto, ON

⁶ Laboratoire de santé publique du Québec, Institut national de santé publique du Québec, Sainte-Anne-de-Bellevue, QC

⁷ Public Health Laboratory, British Columbia Centre for Disease Control, Vancouver, BC

⁸ Roy Romanow Provincial Laboratory, Regina, SK

⁹ Cadham Provincial Laboratory, Winnipeg, MB

¹⁰ Laboratoire de santé publique du New Brunswick, Moncton, NB

¹¹ Queen Elizabeth II Health Sciences Centre, Halifax, NS

¹² Newfoundland and Labrador Public Health Laboratory, St. John's, NL

¹³ Queen Elizabeth Hospital, Charlottetown, PE

¹⁴ Stanton Territorial Hospital Laboratory, Yellowknife, NT

¹⁵ Yukon Communicable Disease Control, Whitehorse, YK

¹⁶ Centre for Emerging and Respiratory Infections and Pandemic Preparedness, Public Health Agency of Canada, Ottawa, ON

CCDR

CANADA COMMUNICABLE DISEASE REPORT

Public Health Agency of Canada
130 Colonnade Road
Address Locator 6503B
Ottawa, Ontario K1A 0K9
ccdr-rmtc@phac-aspc.gc.ca

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

Published by authority of the Minister of Health.

© This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

This publication is also available online at
<https://www.canada.ca/ccdr>

Également disponible en français sous le titre :
Relevé des maladies transmissibles au Canada