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LANGUAGE & THE WEB: TOOLS FOR COMMUNICATION, EDUCATION & HEALTH EQUITY

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LANGUAGE & THE WEB: TOOLS FOR COMMUNICATION, EDUCATION & HEALTH EQUITY

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Summary of approach to inclusive language in vaccine guidance from the National Advisory Committee on Immunization (NACI)

Ana Howarth[1], Matthew Tunis[1], Christina Jensen[1], Stephie Pierre[1], Fiann Crane[1], Winnie Siu[1], Robyn Harrison[1] on behalf of the National Advisory Committee on Immunization (NACI)*

Abstract

Background: The National Advisory Committee on Immunization (NACI) has been working to develop inclusive language for vaccine guidance related to pregnancy and breastfeeding. Starting with early efforts in 2018, NACI sought to update the language approach in 2023 based on the latest available evidence.

Methods: Gender-neutral and gender-additive language approaches were assessed using an equity lens focused on inclusion and representation. Evidence was gathered through a jurisdictional scan of National Immunization Technical Advisory Groups (NITAGs) and government organizations, a literature review, and iterative stakeholder engagement. Draft policy options were developed, translated into French, and reviewed by NACI.

Results: The jurisdictional scan across Canada, the United States, Australia, the United Kingdom, and France showed wide variation, with many sources using gendered terms. The literature review identified little original research on language use in immunization settings. A Canadian research initiative examining inclusive language supported context-specific gender-additive terminology. Stakeholders emphasized the need for inclusive and adaptable language. NACI developed recommendations for a context-dependent gender-additive approach, including French language options.

Conclusion: In February 2024, NACI endorsed an additive language approach, which has been implemented across NACI statements and relevant Canadian Immunization Guide chapters. NACI and the Public Health Agency of Canada will continue adapting to evolving language needs, recognizing that clinical communication should use terminology that best resonates with each individual. When implementing vaccine recommendations in clinical practice, it is important to use whatever language that will resonate best with the individual being immunized.

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Keywords: National Advisory Committee on Immunization, inclusive language, pregnancy, breastfeeding, gender, representation, equity

Introduction

Appropriate descriptions for pregnant women and pregnant individuals have been under consideration for many years by the National Advisory Committee on Immunization (NACI) as the guidelines produced aim to be inclusive of pregnant individuals who may not identify as women, including transgender and non-binary individuals. These discussions initially started in 2018 with NACI's advice on the tetanus, diphtheria and acellular pertussis vaccine in pregnancy (1). At the time, NACI issued a note in the statement to acknowledge the need for inclusion, "NACI recognizes that not all people giving birth will identify

as women or mothers. For the purposes of this statement, the terms "pregnant woman", "mothers" and "maternal" are used, but should be considered to also apply to those individuals who do not specifically identify as female gender but are the parent gestating the fetus." (1).

With several ongoing NACI working groups actively reviewing immunization guidance in pregnancy (COVID-19, influenza, respiratory syncytial virus) and due to the lack of a standard approach to language in pregnancy, NACI working groups were having parallel and similar discussions about appropriate representative terms to foster inclusivity.

To address this issue, in 2023 the NACI Secretariat created a technical group tasked with identifying standardized inclusive language that could meet expectations of diverse stakeholders and be pragmatic to use (i.e., not distracting from the communication goals and overall usability of vaccine guidelines). Research has shown that language is a powerful tool that can be used to improve health outcomes when it replaces existing discriminatory linguistic practices (2). This initiative was launched to develop a language approach to pregnancy and breastfeeding for NACI guidance and communication that best reflects the key concepts of equity, inclusion and representation, which support the NACI mandate (3). More specifically, the aim of this project was to review evidence, consult key stakeholders, including subject matter experts (i.e., as outlined in the sections below), and to establish guidance on language for interim use until a more global consensus is reached. The key deliverables that were created to meet this overall aim were 1) a policy statement on the use of language in clinical guidance about immunization during pregnancy and breastfeeding, 2) notices for publications and 3) a bilingual lexicon with standard terms.

Methods

Gender-neutral language and gender-additive language were assessed as options. Gender-neutral language avoids referencing a specific sex and gender (e.g., pregnant people or pregnant individuals), gender-additive language uses the term "women" alongside gender-neutral language (e.g., pregnant women and pregnant people or pregnant women and pregnant individuals) to achieve both inclusivity (i.e., for those who are pregnant but who do not identify as women) and representation (i.e., for cisgendered women who as an existing equity group still need representation). Use of anatomy-based language was not assessed because of evidence identification of people by their body parts can be dehumanizing (4). Challenges with gender-neutral language have been identified by various equity stakeholders working within research and health care (5–7).

Evidence-gathering activities included a jurisdictional scan of National Immunization Technical Advisory Groups (NITAGs), government organizations (i.e., international, national and provincial) and relevant organizations/societies across jurisdictions, a targeted literature review, and both internal and external stakeholder engagement. Stakeholder engagement was an iterative process of incorporating feedback after each engagement to build on the evidence gathered and allow for subsequent engagement best reflecting real-world feedback.

Based on the combined results of evidence gathering activities, initial draft guidance and a draft policy were developed. French language translation was then undertaken by francophone members of the research group in collaboration with francophone colleagues from the Public Health Agency of Canada (PHAC) and Health Canada who had relevant expertise or lived experience. Following this, a proposed policy statement with recommendations for NACI to adopt and implement was prepared and presented to NACI for approval on February 23, 2024.

Results

Jurisdictional scan

A scan was conducted on approaches to gendered language used in the five key jurisdictions (i.e., Canada, United States [US], Australia, United Kingdom and France) with languages deemed most relevant to the general population of Canada. A further sub-scan of provinces and territories, including *ad hoc* women's health organizations and obstetrics and gynecological societies, was also included. Results across jurisdictions were varied but gendered language (e.g., pregnant women) appeared most commonly and no jurisdictions were found to use gender-neutral language for breastfeeding (e.g., chestfeeding). Several health organizations such as Health Canada, PHAC and the US Centers for Disease Control and Prevention were found to have used gender-neutral language and one organization (i.e., England's National Institute for Health and Care Excellence) used gender-additive language (see **Appendix** for overview). No national agencies or regulatory bodies were found to use gender-neutral language for breastfeeding but a scan of four key lactation associations (within Canada and the US) found that three of the four utilized gender-neutral language.

Three out of the seven agencies reviewed were found to have some version of policy statement or guidance regarding the use of gender-neutral language for the purpose of inclusivity; however, across five key Canadian and US obstetrics and gynecological/midwifery organizations there were many instances of the use of gender-neutral language for pregnancy and one for breastfeeding and all had some form of statement or guidance for inclusive language (see examples below).

Examples from language statements:

"The SOGC [Society of Obstetricians and Gynaecologists of Canada] recognizes the importance to be fully inclusive and when context is appropriate, gender-neutral language will be

used. In other circumstances, we continue to use gendered language because of our mission to advance women's health." – Society of Obstetricians and Gynaecologists of Canada

"To be inclusive of women and all patients in need of obstetric and gynecologic care, ACOG [American College of Obstetricians and Gynecologists] will move beyond the exclusive use of gendered language and definitions." – American College of Obstetricians and Gynecologists

"In our language we will aim to add and not take away, taking into account the importance of preserving women-centred language as well as including language for those who do not identify as a woman." – Royal College of Obstetricians and Gynaecologists

In summary, the jurisdictional scan highlighted several key findings, including the identification of Beyond the Binary BC (BTB BC), which was a provincial research project focused specifically on developing gender equitable language practices within research framed as "women's health". This two-year project involved extensive stakeholder engagement, including collaboration with both a community and research committee, and eventual Canadian Institutes of Health Research funding to scale the work to a national level. Beyond the Binary BC's approach advocated for context-specific language and, where feasible, introduces a gender-additive approach. Most recently (October 2024), the BTB Canada Guide (8) was launched after a pan-Canadian Research Task Force and Community Task Force had been convened. The resulting guide aims to offer "a nationally relevant, and feasible guidance and resource package to support health researchers and health research institutions in their commitments to conducting gender equitable health research for women, trans, and non-binary people". Beyond the Binary BC's work and the BTB Canada Guide provides support and a rationale for an additive language approach, where feasible, as evidenced from those with lived and professional experience in this area.

Literature review findings summary

A targeted literature review was conducted in July 2023, with the inclusion criteria of peer-reviewed articles published from English-speaking high-income countries and France. Articles published five or fewer years ago with a focus on gender and language within a pregnancy and/or lactation context were included. A total of 12 articles were included in the final selection, of which most (including a conference abstract) were commentaries or editorials.

Of the included studies, only one was an original research article, where acceptability (and understanding) of gender-neutral language in a Breastfeeding Attrition Prediction Tool was tested with a sample of 16 participants. Most articles (n=10) aligned with a certain viewpoint or stance in relation to language: half of the studies advocated for an exclusively gender-neutral approach; four articles supported the use of both sexed language and gender-neutral language; one article was specific to a trans/nonbinary population only; and one article did not confirm a language approach but emphasized the importance of considering language use and how it may impact those involved.

Of the seven articles (see **Table 1**) that offered proposed language options, all were gender-neutral recommendations and only one article (9) included mention of women and the issue of representation. Many articles were focused on addressing inclusivity with less than half (n=5) including a discussion of the issue of erasure of women, existing women's inequity within health care or representation of women within the context of using gender-neutral language; however, a key limitation of the literature review was the lack of original research suggesting a gap in the knowledge base of evidence for feasible and acceptable language approaches for those specifically impacted.

Stakeholder engagement findings

Internal engagement within PHAC and Health Canada, external engagement, and consultation with an expert pregnancy immunization group were undertaken to collect real-world information in relation to impacted communities and individuals.

Government of Canada's Internal Stakeholder Engagement: Internal engagement was undertaken with teams from PHAC and Health Canada including the Sex and Gender-Based Analysis Plus team, the Gender and Sexual Diversity Network and subject matter experts from other PHAC and Health Canada teams (e.g., Maternal and Child Health, Sexual and Reproductive Health) who offered both professional and lived experience input. Key takeaways from PHAC internal engagement included the following:

- There is a need for appropriate and inclusive language that would be implementable across a variety of communication contexts (e.g., public facing, scientific reporting, journal/chapter editing).
- Public Health Agency of Canada researchers working with Indigenous women's organizations reported that they had received feedback from an Indigenous women's group who thought the use of gender-neutral language was removing their lived experiences as women from the conversation, something they had worked hard to achieve. The researchers' solution for the research communication being designed was to use "women and people assigned female at birth".
- Some participants expressed concern that additive or sexed language may alienate or "other" gender diverse individuals who can be included in gender-neutral approaches.
- An overall theme was that it is critical to consider context when choosing an approach.

Table 1: Studies with proposed language options and summary of the position they present (n=7)

Primary author, year of publication	Pregnancy and/or lactation language	Mention of women/ representation	Summary of position
Duckett *et al.*, 2019 (10)	Birthing parent Breastfeeding Chestfeeding	No	Some solutions are offered, mostly gender-neutral in nature. Option of having different sets of materials for cisgender parents and those who identify as LGBTQI+ considered.
Parker *et al.*, 2023 (9)	Pregnant or birthing people Breast/chestfeeding	Yes	The critical role of midwifery education/educators in taking up the challenge of inclusion to ensure a workforce skilled and supported in the provision of care to a gender diverse population is affirmed but solutions are not specifically offered.
Dinour, 2019 (11)	Gestational parent Birthing parent Feeding at the breast/chest At-the-breast/chestfeeding	No	Gender-neutral is recommended—several nongendered terms drawn from ILCA guidelines, published research and/or guidance from individuals or groups working with LGBTQIA+ communities.
Dodgson *et al.*, 2022 (12)	Birth parent or mother Self-identified mothers Persons self-identifying as women Persons identifying as the primary caregiver Breastfeeding and lactation	No	Gender inclusivity is recommended—to better align language with "movements towards greater health equity and social and publication ethics."
Kinney *et al.*, 2023 (13)	Pregnant people Chestfeeding Bodyfeeding	No	Language should be revised to be more gender inclusive but also options should be tested with target populations as more research is needed.
Rioux *et al.*, 2022 (14)	Pregnant people Pregnant individuals Chestfeeding Human milk feeding Nursing	No	A shift to gender inclusive language should be seen as a priority for research on pregnant populations.
Roosevelt *et al.*, 2021 (15)	Pregnant people Chestfeeding	No	As focus is specific to the clinical treatment of trans/nonbinary people, recommendations are for individualized care and use of gendered-affirming language.

Abbreviations: ILCA, International Lactation Consultant Association; LGBTQI+, lesbian, gay, bisexual, trans, queer/questioning, intersex, and other; LGBTQIA+, lesbian, gay, bisexual, trans, queer/questioning, intersex, asexual and other

External Stakeholder Engagement: External engagement included representatives from the Campbell and Cochrane Equity Methods Group and co-chairs and leads involved with BTB BC (4) project, which was identified through the jurisdictional scan. Key takeaways from external engagement included the following:

- Co-chairs and leads involved with the BTB BC project have been working intensely for the past few years on producing an inclusive language guide and glossary. By systematically reviewing the literature and working with groups representing community members, clinicians and researchers, they concluded that an additive approach (depending on context) is a valid option for an inclusive strategy. Beyond the Binary Canada (published and available as of October 2024) is conducting ongoing national research with the intention of providing an inclusive language guide in both English and French.
- Using only a gender-neutral approach (e.g., individuals with a cervix, lactating, birthing, etc.) can inadvertently lead to the erasure and exclusion of women and especially subgroups of women, such as Indigenous, Black and other racialized women, who already experience inequity.
- Using a gender-neutral approach can be confusing for some newcomers to Canada when English is not their first language and if they do not see themselves in the gender-neutral language.
- Consistent with internal engagement feedback, context was reported as very important to consider when choosing an approach.

Expert Pregnancy Group Consultation: NACI Working Groups often consult Canadian pregnancy experts when developing guidance on vaccination during pregnancy. In this case, Canadian pregnancy experts were consulted to contextualize language

findings. Based on the available evidence, there was strong support for the use of the additive language approach as presented (with the exception of breastfeeding), as opposed to the gender-neutral approach that could lead to excluding women and their experiences. Consultation identified that:

- Certain terms may be triggering to some populations (e.g., breasts, breastfeeding) and this should be mitigated where possible.
- The importance of scientific accuracy versus the desire to be inclusive through the use of gender-neutral language could lead to uncertainty; for example, the word "chestfeeding" instead of "breastfeeding" may not clearly identify the source of the milk when the transfer of antibodies is an important consideration for passive immunization.
- It is important to include sensitivity statements when using certain terms, particularly where the scientifically accurate term is the most appropriate option.
- Pregnancy experts suggested that it would be appropriate to add a notice in the preamble before certain NACI (or NACI Working Group) meetings/presentations, emphasizing that language using pregnant women and/or breastfeeding may be in reference to those who do not identify as women but are pregnant.

French translation

All NACI guidelines are published in both official languages, so any English language approaches must also be consistent in French. An informal environmental scan of web content in French (e.g., government websites, community and women's health organizations/obstetrics and gynecological societies) and selection of suitable terms for pregnancy and breastfeeding was conducted. Most websites used gendered language (e.g., "femme enceinte"). Some web resources used gender-neutral terms, such as "personne enceinte". Additionally, in French, the term "allaitement" (meaning breastfeeding) is gender-neutral and refers specifically to the act of milk delivery, regardless of gender. Based on these findings and PHAC translation expertise, a translation was developed. Consultation and feedback were then solicited from two French-speaking subject matter experts from Health Canada and PHAC.

Language approach

The language options aimed to ensure that everyone is represented and included in vaccine advice. In this instance, it means applying a gender-additive approach where the term "woman" is used alongside gender-neutral language. This is intended to demonstrate a commitment to redress the historic exclusion of trans and non-binary people, whilst avoiding the risk of marginalizing or erasing the experiences of women within the healthcare environment. Communication must consider the audience being engaged. Different approaches are beneficial across different contexts; therefore, two approaches have been developed: a default approach and a tailored approach.

The default approach is where additive language is universally adopted across all contexts related to pregnancy and breastfeeding to provide accurate and consistent language. In addition, a notice accompanies this approach to explain the definition and rationale of additive language, with the aim of promoting understanding and fostering inclusivity and acceptance. See **Box 1** below for the final NACI policy statement on inclusive language for pregnancy and breastfeeding in immunization.

The tailored approach is ideal for situations where additive language may not be feasible, and a more nuanced strategy is required. With this option, language is tailored to ensure comprehension and accessibility. Sensitivity to diverse experiences remains a priority, even if not explicitly reflected by the language used. These language approaches are detailed in the Appendix, according to context. It is acknowledged that, for knowledge translation and communication materials for the general public, use of second person language may be most appropriate to ensure clarity. As an example: "If you are pregnant or are planning to become pregnant, this guide is for you! Having a baby can be a wonderful experience…".

Conclusion

In February 2024, an additive language approach was proposed to NACI and was approved by the committee. Following this, the draft guidance and policy statement were finalized and have been implemented across recent NACI statements, recently updated Canadian Immunization Guide chapters and other NACI-related content.

It is hoped that the development of this pragmatic approach for interim use, in the absence of global consensus, will continue to advance key concepts of equity, inclusion and representation that support the NACI mandate. This dedicated evidence review and stakeholder consultation, together with the resultant policy statement, also facilitated current NACI goals for efficient, evidence based and timely publications with clear communication and harmonized publication products (such as the Canadian Immunization Guide). The products serve diverse stakeholder groups, all with the shared aim of improving health outcomes.

One challenge is the inevitable reliance of NACI content on scientific evidence, where inclusive language cannot be consistently applied. Current research practice, which has a history of focusing on cisgender men, has tended towards a binary approach with sex being reported but not gender. Innovators in this area will hopefully move forward with options for health researchers that adapt to context and equity considerations such as intersectionality, allowing for all individuals, communities and stakeholders to see themselves reflected in language and research findings.

Box 1: National Advisory Committee on Immunization policy statement on inclusive language approach to pregnancy and breastfeeding in immunization

NACI approach to language in pregnancy and breastfeeding: Gender-additive language policy statement

Appropriate descriptions for individuals who are pregnant or breastfeeding have been under consideration for many years within the NACI Secretariat and NACI working groups where the vaccine guidelines need to be inclusive of individuals who may not identify as women, including transgender, non-binary and gender fluid individuals.

Research has shown that language is a powerful tool that can be used to improve health outcomes if designed to address existing discriminatory linguistic practices.

Following a comprehensive approach to gather information including a jurisdictional scan, literature review, stakeholder engagement and expert consultation, NACI concluded that the adoption of gender-additive language best reflects the key concepts of equity, inclusion and representation at this time. Gender-additive language is language that uses the term "women" along with gender-neutral language (e.g., pregnant women and pregnant individuals). Unlike gender-neutral language, gender-additive language does not inadvertently perpetuate the erasure and exclusion of women. Certain groups of women (e.g., Indigenous, Black and other racialized women) already experience health inequities and gender-neutral language may exacerbate such inequities by impacting communication around issues affecting them. Gender-neutral language may also be confusing for newcomers to Canada, who may not see themselves represented in the gender-neutral language.

Moving forward, NACI's guidance, CIG and other resources and communications from the NACI Secretariat will use gender-additive language where possible to recognize and affirm all people who seek information on immunization, whether that be for themselves, their clients or their communities.

NACI recognizes the limitations of applying gender-additive language when source material, such as published primary research studies, use gender-binary terms to describe data. NACI's guidance will continue to describe data based on the terms reported by study investigators and researchers. In these contexts, when using gender-additive language is not accurate, a notice will preface the statement, literature review or CIG chapter, to address the topic of language inclusivity and provide an explanation for the lack of gender-additive language (i.e., that gender-additive language would not be reflective of the language of the study). Additionally, a message at the beginning of publications may be added to introduce the concept of additive language where appropriate. Some healthcare providers may not be familiar with additive language and the importance of inclusion of trans and non-binary populations.

NACI and PHAC acknowledge the dynamic nature of language in society, and the fact that appropriate representations will likely change and evolve over coming years.

Abbreviations: CIG, Canadian Immunization Guide; NACI, National Advisory Committee on Immunization; PHAC, Public Health Agency of Canada

NACI and PHAC will continue to strive to bridge research, public health, clinical practice and collective experiences in ways that best serve and care for all individuals and communities in Canada. It is acknowledged that language, like culture, evolves, and understanding context (i.e., audience, setting and purpose) is key. With the next iteration in refining this language, there may be opportunities to explore novel methods to engage effectively with key populations such as individuals from First Nations, Inuit, and Métis communities and individuals from 2SLGBTQI+ (two-spirit, lesbian, gay, bisexual, trans, queer. intersex, and additional people who identify as part of sexual and gender diverse communities) and other communities. When implementing vaccine recommendations in clinical practice, it is important to use whatever language that will resonate best with the individual seeking immunization.

Authors' statement

AH — Writing, original draft, review & editing
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CJ — Writing, review & editing
SP — Writing, review & editing
FC — Writing, review & editing
WS — Writing, review & editing
RH — Review & editing

The summary of approach to inclusive language in vaccine guidance from the National Advisory Committee on Immunization (NACI) was prepared by: A Howarth, M Tunis, C Jensen, S Pierre, F Crane, W Siu and R Harrison on behalf of the National Advisory Committee on Immunization (NACI).

Competing interests

None.

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Appendix

Table A1: Language approaches according to context

<table>
<tr><td colspan="3">Default Approach: Use of gender-additive language with a notice that introduces additive language and rationale; notes the dynamic nature of language and exceptions for instances where primary research is reported.</td></tr>
<tr><td colspan="3">WHEN TO USE… NACI Statements, Canada Communicable Disease Report (CCDR) articles or CIG chapters</td></tr>
<tr><td>Try this…</td><td>Instead of this…</td><td>Because…</td></tr>
<tr><td rowspan="2">Pregnant women and pregnant people
Pregnant women and pregnant individuals</td><td>Pregnant women
Pregnant people
Pregnant persons
Pregnant individuals</td><td>A move to the additive use of gender-additive language (i.e., where gender-neutral language is used alongside the language of womanhood) ensures that everyone is represented and included.
The use of "pregnant" prior to each group/person mentioned is necessary to avoid confusion.</td></tr>
<tr><td colspan="2">As an example:
"This statement addresses Tdap immunization of pregnant women and pregnant people in Canada with the aim of protecting newborn infants in Canada from severe outcomes of pertussis infection".</td></tr>
<tr><td colspan="3">Breastfeeding and maternal
It is acknowledged that sometimes there is no general consensus or appropriate language option currently available, and that this terminology requires more development.
In English, for breastfeeding, the option of "chestfeeding" is one possible proposed term for those (e.g., trans people or nonbinary people) who may feel words like breastfeeding or nursing are not the right fit because the language does not align with their gender or how they identify their anatomy. However, when discussing breastfeeding or breastmilk specifically in terms of antibody transfer or the transfer of a pathogen via breastmilk, it may not be appropriate to use the term "chestfeeding" as the biological basis may be unclear. As the word for breastfeeding in French is considered gender-neutral, an alternative has not been suggested at this point.
The word perinatal is sometimes used, but definitions of maternal health are often considered to encompass the time from conception to 42 days postpartum (WHO, 1992a) whereas perinatal tends to be limited to 22 completed weeks of gestation to 7 days post-birth.</td></tr>
<tr><td colspan="3">Notice for NACI publications with use of additive language
A note on language:
NACI recognizes that not all people giving birth or breastfeeding will identify as women or mothers. The writing in this statement uses a gender-additive approach where the term "woman" is used alongside gender-neutral language. This is intended to demonstrate a commitment to redress the historic exclusion of trans and non-binary people, whilst avoiding the risk of marginalizing or erasing the experience of women within the healthcare environment. Finally, NACI acknowledges the dynamic nature of language. It is likely that language deemed to be suitable or affirming in one context may not translate across others, and over the coming years will likely change and evolve with respect to appropriate representations.
Notice for NACI publications with use of additive language and where primary research is reported
A note on language:
NACI recognizes that not all people giving birth or breastfeeding will identify as women or mothers. The writing in this statement uses a gender-additive approach where the term "woman" is used alongside gender-neutral language. This is intended to demonstrate a commitment to redress the historic exclusion of trans and non-binary people, whilst avoiding the risk of marginalizing or erasing the experience of women within the healthcare environment. In addition, much of the research available currently refers only to "women" when discussing pregnancy. When citing research, NACI refers to the language used in the study. In these cases, "woman" refers to someone who was assigned female at birth. For the purposes of this statement, the terms "woman," "women," should be considered to also apply to those individuals who do not specifically identify as female gender but are the parent gestating the fetus or breastfeeding or chestfeeding the infant.
Finally, NACI acknowledges the dynamic nature of language. It is likely that language deemed to be suitable or affirming in one context may not translate across others, and over the coming years will likely change and evolve with respect to appropriate representations.</td></tr>
</table>

Table A1: Language approaches according to context (English version) (*continued*)

Notice for CIG chapters with use of additive language and emphasis on language respecting client's self-identification Please note: PHAC recognizes that not all people giving birth or breastfeeding will identify as women or mothers. The writing in this chapter uses a gender-additive approach where the term "woman" is used alongside gender-neutral language. This is intended to demonstrate a commitment to redress the historic exclusion of trans and non-binary people, whilst avoiding the risk of marginalizing or erasing the experience of women within the healthcare environment. However, in line with best practice, it is recognized that when discussing or caring for individuals in a one-on-one capacity, language and documentation should reflect the gender identity of the individual. Finally, PHAC acknowledges the dynamic nature of language. It is likely that language deemed to be suitable or affirming in one context may not translate across others, and over the coming years will likely change and evolve with respect to appropriate representations.		
Tailored Approach: To convey the importance of inclusivity and representation while not using gender-additive language.		
WHEN TO USE… NACI publications that mainly include primary research content or CIG chapters that do not include additive language.		
Try this… (selection of examples)	Instead of this…	Because…
Notice for publications without use of additive language and where primary research is reported A note on language: NACI recognizes that not all people giving birth or breastfeeding will identify as women or mothers. Much of the research available currently refers only to "women" when discussing pregnancy. When citing research, NACI refers to the language used in the study. In these cases, "woman" refers to someone who was assigned female at birth. For the purposes of this statement, the terms "woman," and "women," should be considered to also apply to those individuals who do not specifically identify as female gender but are the parent gestating the fetus or breastfeeding or chestfeeding the infant. Finally, NACI acknowledges the dynamic nature of language. It is likely that language deemed to be suitable or affirming in one context may not translate across others, and over the coming years will likely change and evolve with respect to appropriate representations. Notice for publications without use of additive language and where emphasis is on the healthcare provider's use of language that respects a client's self-identification (e.g., CIG chapters without the use of additive language). Please note: PHAC recognizes that not all people giving birth or breastfeeding will identify as women or mothers. For the purposes of this chapter, the terms "woman", "women" and "mother" are used but should be considered to also apply to those individuals who do not specifically identify as female gender but are the parent gestating the fetus or breastfeeding or chestfeeding the infant. However, in line with best practice it is recognized that when discussing or caring for individuals in a one-on-one capacity language and documentation should reflect the gender identity of the individual. Finally, PHAC acknowledges the dynamic nature of language. It is likely that language deemed to be suitable or affirming in one context may not translate across others, and over the coming years will likely change and evolve with respect to appropriate representations.	Use of gender-neutral language to replace sexed language.	Depending on the nature and context of the publication it may be most appropriate to include a notice acknowledging the key relevant language issues. For publications where additive language is not yet feasible or in the case of research, not accurately reflective of the language of the study, a clear notice can be used to preface the content with the relevant explanation. In some instances, it may be important to add the recognition that in line with best practices when discussing or caring for individuals in a one-on-one capacity language and documentation should reflect the gender identity of the individual. The aim of this notice is to address inclusivity and, in some cases, to acknowledge an ongoing commitment to finding equitable language solutions.

Abbreviations: CIG, Canadian Immunization Guide; NACI, National Advisory Committee on Immunization; PHAC, Public Health Agency of Canada; Tdap, tetanus, diphtheria, and pertussis; WHO, World Health Organization

Summary of the National Advisory Committee on Immunization (NACI) rapid response: Updated guidance on the use of Imvamune® for the prevention of mpox

Joshua Montroy[1], Marina Salvadori[1,2], Nicole Forbes[1], Kristin Klein[3] on behalf of the National Advisory Committee on Immunization (NACI)*

Abstract

Background: The National Advisory Committee on Immunization (NACI) previously released guidance in May of 2024 regarding the use of Imvamune® for the prevention of mpox in the context of a routine immunization program. Since the release of this guidance, the emergence of a novel subclade of mpox (clade Ib) has led to a shifting epidemiological landscape and several international jurisdictions have, therefore, revised their Imvamune guidance.

Objective: To summarize the updated NACI guidance on the use of Imvamune for the prevention of mpox.

Methods: NACI reviewed data on the current epidemiology of mpox, both in Canada and internationally, current evidence on Imvamune vaccination coverage in Canada, and published scientific literature regarding the effectiveness, immunogenicity and safety of Imvamune. NACI has also considered additional factors including ethics, equity, feasibility and acceptability. Guidance on the use of Imvamune in the context of international travel was developed in collaboration with the Canadian Committee to Advise on Tropical Medicine and Travel.

Results: NACI concluded that available evidence supports the limited expansion of groups considered at high risk of mpox.

Conclusion: NACI now recommends that in addition to previously identified groups at high risk of mpox, certain travellers to areas with ongoing community transmission of mpox virus clade I should receive Imvamune. Healthcare workers travelling internationally to support mpox outbreaks should also receive Imvamune, and domestic healthcare workers with a high risk of frequent exposure may consider vaccination with Imvamune on an individual basis.

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Keywords: National Advisory Committee on Immunization, NACI, mpox, guidance, Imvamune

Introduction

Mpox is caused by the monkeypox virus (MPXV), a mammalian *Orthopoxvirus*, and is transmitted either by zoonotic (animal-to-human) contact or by person-to-person contact with bodily fluids, lesions on the skin or mucosal surfaces (e.g., mouth, throat, anogenital region) (1). The MPXV is subclassified into two distinct clades (clades I and II) and further classified into subclades (subclades Ia and Ib, and subclades IIa and IIb), with clade IIb causing the 2022 global outbreak. Mpox is typically a mild and self-limited disease; however, it can lead to severe disease in specific populations, including young children (2),

individuals who are pregnant (3) and individuals who are immunocompromised (4).

In August 2024, the World Health Organization (WHO) declared mpox a public health emergency of international concern for the second time (5), following a rapid increase in cases linked to a novel subclade (clade Ib) in the Democratic Republic of the Congo. Between January 1, 2024, and January 26, 2025, a total of 19,837 confirmed mpox cases and 93 deaths have been reported in Africa (6). The number of suspected mpox cases and mpox-related deaths was considerably higher. Travel-related cases of mpox clade Ib have since been reported in numerous countries outside of Africa, including in Canada.

As of September 26, 2025, ten Canadian provinces and territories have publicly reported 2,236 cases of mpox, with the majority of cases occurring in Ontario (52.2%), Québec (27.6%) and British Columbia (16.4%) (7). Two cases of mpox clade I (clade Ib) have been reported in Canada (as of September 26, 2025), both travel-related. In Canada, gay, bisexual and other men who have sex with men (GBMSM) continue to experience the largest disease burden, with over 95% of mpox cases reported. The majority of mpox cases observed in Canada occurred during the initial outbreak in 2022 (approximately 66%, n=1,477 cases), with most cases having been reported in Ontario, Québec and British Columbia. There have been 677 mpox cases reported in Canada since the start of 2024 (as of September 26, 2025). Severe disease remains relatively rare, with 53 hospitalizations (seven since the start of 2024), three intensive care unit admissions (none since the start of 2024) and no deaths recorded to date in Canada.

The National Advisory Committee on Immunization (NACI) previously provided interim guidance on the use of Imvamune (Modified vaccinia Ankara-Bavarian Nordic [MVA-BN]) on May 24, 2024 (8), in the context of a routine immunization program. Given the evolving global mpox outbreak and emerging evidence on vaccine effectiveness, NACI issued updated guidance on the use of Imvamune for the prevention of mpox in May of 2025, and this updated guidance is summarized below.

Methods

For this rapid response, NACI reviewed key questions as proposed for the NACI mpox Working Group regarding the use of Imvamune, considering reports of ongoing mpox clade I outbreaks globally. Data on the current epidemiology of mpox, both in Canada and internationally, current evidence on Imvamune vaccination coverage in Canada, and published scientific literature regarding the effectiveness, immunogenicity and safety of Imvamune were reviewed. Knowledge synthesis was performed by the NACI Secretariat and supervised by the NACI mpox Working Group. Following critical appraisal of individual studies, summary tables with risk of bias ratings informed by Cochrane 2.0 or ROBINS-I, as appropriate, were prepared. Stakeholders that provided feedback included a Canadian group representing GBMSM communities, the National Emergency Strategic Stockpile, the Canadian Immunization Committee and the Committee to Advise on Tropical Medicine and Travel (collaborated on guidance related to international travel). NACI reviewed the available evidence and approved the updated recommendations on February 18, 2025. Further information on NACI's evidence-based methodology is available online.

Results

Evolving mpox epidemiology

Evidence directly comparing the severity of MPXV clades and subclades, including any data stratified by age, sex or other risk factors (i.e., immunocompromised status) are still emerging (9–13). In non-endemic areas, clade IIb transmission continues to largely occur in high-contact sexual networks, primarily the GBMSM community and, therefore, the majority of cases reported have been amongst adult males. Unlike clade IIb, the strain responsible for the 2022 global outbreak, there is considerable transmission of both MPXV clade Ia and Ib outside of GBMSM sexual networks. In mpox clade Ia affected regions, there is a large disease burden in heterosexual males and females, as well as children (9–14). Of the two clade I subclades, clade Ia appears to be associated with greater disease severity and a higher mortality rate compared to clade Ib (15–17). Given the limitations of available data from MPXV endemic countries, it is also possible that observed differences between MPXV clades and subclades are driven by differences in demographic variables (including the populations affected, access to healthcare, nutrition, etc.) between infected individuals.

Vaccine immunogenicity

Recent data have suggested that the antibody titres produced by Imvamune vaccination in mpox-naive individuals wane over time, usually within six to 12 months (18–20). The clinical significance of declining antibody levels over time remains unclear due to the lack of a defined correlate of protection for Imvamune. It is possible that there are non-antibody markers of protection, as the role of innate and cell-mediated immunity is not currently fully understood. In addition, the robustness of memory responses may potentially influence the disease outcome. The disparate time intervals observed between vaccination and breakthrough infection among fully vaccinated individuals supports this theory (21).

Vaccine effectiveness against mpox infection and severe disease

Imvamune administered as a single dose or two-dose schedule for the prevention of mpox infection continues to demonstrate

a high degree of effectiveness. A recent systematic review and meta-analysis (22) reported one-dose vaccine effectiveness was 76% (95% CI: 64%–88%) and two-dose vaccine effectiveness was 82% (95% CI: 72%–92%).

Data on the effectiveness of Imvamune against moderate to severe mpox infection (including hospitalization) is less robust, but encouraging. In studies providing estimates of effect, even a single dose of Imvamune was effective at reducing moderate to severe mpox infection (vaccine effectiveness: 82%; 95% CI: −50%–98%) (23) and at reducing the odds of hospitalization due to mpox (odds ratio [OR]: 0.27; 95% CI: 0.08–0.65) (24). Similarly, a two-dose schedule was also associated with a significant decrease in the odds of hospitalization due to mpox (OR: 0.20; 95% CI: 0.01–0.90 and OR: 0.20; 95% CI: 0.0–0.5) (21,24). Several additional studies have demonstrated the rarity of hospitalizations due to mpox in individuals who have been vaccinated with Imvamune®, even with a single dose (25–28). When breakthrough infection does occur, the severity of infection appears considerably reduced following vaccination with Imvamune, with fewer lesions, less mucosal involvement, and fewer systemic symptoms (21,25,27).

At the time of NACI guidance development, available vaccine effectiveness data comes from studies conducted in countries where mpox is non-endemic, where MPXV clade IIb is responsible for virtually all mpox cases and therefore the effectiveness of Imvamune against MPXV clade Ia and Ib is unclear at this time. Unpublished data from a Centers for Disease Control and Prevention study in the Democratic Republic of the Congo that began in 2017 and vaccinated approximately 1,600 healthcare workers with two doses of Imvamune, observed only one laboratory-confirmed infection, indicating significant effectiveness against mpox in an area of high clade I transmission (29,30). In addition, several challenge studies in non-human primates have demonstrated significant protection against MPXV clade I associated with MVA-BN vaccination (31–34). There is currently no evidence and no biological rationale to suggest a decrease in vaccine effectiveness against MPXV clade Ia or Ib.

Vaccine safety

Available post-marketing safety surveillance data on Imvamune suggests that the vaccine is well-tolerated. The most common adverse events reported by adults following one and/or two doses were non-serious injection-site and systemic reactions, consistent with clinical trial findings. Generally, the second dose was slightly better tolerated than the first. No serious adverse events were reported after either dose, including no signals for increased risks of myocarditis/pericarditis following vaccination.

Data regarding the safety and tolerability of a third dose of Imvamune are limited to two small clinical trials. A randomized, phase II trial in adults living with HIV administered a booster dose of Imvamune to 31 participants, 12 weeks following the second dose (35). Compared to a group of participants receiving the standard two-dose regimen, those receiving a booster dose reported a higher incidence of solicited local adverse events; however, no serious adverse events or adverse events of special interest related to study vaccine were reported. Unpublished results from a phase II clinical trial in Germany (36) reported similar results, with no serious adverse events related to the vaccine being observed following a third dose two years after completion of the two-dose series (n=75 participants). One participant (1.3%) reported an unsolicited grade three or higher adverse event within 29 days of vaccination. A recent study of healthcare workers from the Democratic Republic of the Congo, who received a third dose five years after completion of the primary series, demonstrated elevated rates of local and systemic reactions following the administration of the third dose, compared to the first or second dose of the primary series. However, no severe adverse events were observed (37).

Ethics, equity, feasibility and acceptability considerations

During the development of initial recommendations for Imvamune use for the prevention of mpox, Public Health Agency of Canada consulted with stakeholder groups representing impacted communities. Overall, GBMSM communities communicated positive attitudes towards mpox vaccination; however, since 2022, the majority of Imvamune recipients have only had their first dose. This could potentially be due to factors such as perceived lower risk of infection compared to the spring/summer of 2022 when case numbers were high across many Canadian urban centers, or perceived risk of adverse events following immunization after the first dose of Imvamune (38–40).

All Canadian provinces and territories continue to offer Imvamune to individuals considered at high risk of mpox; however, understanding potential barriers and challenges to vaccination from the end-user perspective is critical to improving vaccine uptake (41). It has been noted that identification of travel-associated risks (i.e., sex tourism) presents feasibility and equity challenges. Travel-associated risks are difficult to identify through public health clinics in some jurisdictions, and this impacts feasibility of operationalizing recommendations relating to travel risk. It has also been identified that vaccine programs administered in travel clinics based on travel risk assessment can incur individual costs, which can create inequities. Despite feasibility and potential equity challenges, NACI and Committee to Advise on Tropical Medicine and Travel considered it important to support vaccine access to travelers who may be at increased risk of mpox due to the evolving global situation. An additional barrier to access for those seeking vaccination includes the fact that due to the regulatory status of this vaccine in Canada, and because the main supply is held federally, Imvamune cannot be purchased by individuals on the private market and can only be accessed through provincial, territorial or federal programs for recommended populations.

NACI recommendations

Recommendation 1: NACI continues to recommend that individuals at high risk of mpox should receive two doses of Imvamune administered at least 28 days (four weeks) apart. (***Strong NACI recommendation***)

- At this time individuals considered at high risk of mpox in Canada include the following:
  - Men who have sex with men (MSM) who:
    - Have more than one partner
    - Are in a relationship where at least one of the partners has other sexual partners
    - Have had a confirmed sexually transmitted infection acquired in the last year
    - Have engaged in sexual contact in sex-on-premises venues
  - Sexual partners of individuals who meet the criteria above
  - Sex workers regardless of gender, sex assigned at birth or sexual orientation
  - Staff or volunteers in sex-on-premises venues where workers may have contact with fomites potentially contaminated with mpox
  - Individuals who anticipate experiencing any of the above scenarios, including during travel outside of Canada

Also at high risk are individuals who are travelling to an area with ongoing community transmission of MPXV clade I (see mpox: Advice for travellers for a list of countries meeting this criteria) and anticipate either of the following:

- Prolonged close contact (e.g., sharing accommodation), with people who reside in the area of active transmission
- Sexual contact with people who reside in, or spend extended time in, the area of active transmission

Note: NACI guidance related to international travel has been updated above, in collaboration with Committee to Advise on Tropical Medicine and Travel, to reflect current mpox epidemiology worldwide.

Recommendation 2: At this time, Imvamune is not routinely recommended for healthcare workers, with the exception of post-exposure vaccination. However, it may be considered on an individual basis, based on a high risk of frequent exposure (e.g., healthcare workers who work at clinics that are frequently involved in the diagnosis and management of mpox). (***Discretionary NACI recommendation***)

Recommendation 3: NACI recommends that healthcare workers who are travelling internationally to support mpox outbreaks should be vaccinated with Imvamune ahead of deployment. (***Strong NACI recommendation***)

Recommendation 4A: NACI continues to recommend that personnel who work in research laboratory settings and who are at high risk of occupational exposure to replicating orthopoxviruses that pose a risk to human health should receive two doses of Imvamune administered at least 28 days (four weeks) apart. (***Strong NACI recommendation***)

Recommendation 4B: NACI recommends that additional doses of Imvamune may be offered for personnel who work in a research laboratory setting and who remain at high risk of occupational exposure to replicating orthopoxviruses that pose a risk to human health, with a minimum interval of two years. (***Discretionary NACI recommendation***)

Recommendation 5: NACI continues to recommend the use of Imvamune as post-exposure vaccination (also known and referred to as post-exposure prophylaxis) to individuals who have had high risk exposure(s) to a probable or confirmed case of mpox, or within a setting where transmission is happening, if they have not received both doses of pre-exposure vaccination. (***Strong NACI recommendation***)

Conclusion

Considering the evolving mpox epidemiology and emerging data regarding the vaccine effectiveness of Imvamune, NACI has provided updated guidance on the use of Imvamune for the prevention of mpox. Updates include the addition of travellers to areas of with ongoing community transmission of MPXV clade I circulation to the groups recommended to receive Imvamune, as well updated recommendations for healthcare workers. NACI recommendations on the use of Imvamune are based on available clinical evidence and current mpox epidemiology and may be re-evaluated if additional evidence emerges.

Authors' statement

JM — Writing–original draft, writing–reviewing & editing
MS — Writing–reviewing & editing
NF — Writing–reviewing & editing
KK — Writing–reviewing & editing

The *NACI Rapid Response: Updated guidance on the use of Imvamune® for the prevention of mpox* was prepared by J Montroy, K Klein, M Salvadori, N Forbes, C Yan, V Dubey, R Harrison, and MC Tunis on behalf of the NACI mpox Working Group and was approved by NACI.

Competing interests

None.

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EPIDEMIOLOGIC STUDY

A descriptive analysis of multi-jurisdictional enteric illness messaging web analytics data, 2020–2022

Vayshali Patel[1,2], Jennifer McWhirter[1], Melissa MacKay[1], Leslie Cheng[2], Melissa Phypers[2], Andrew Papadopoulos[1], Lauren Grant[1]*

Abstract

Background: Effective online communication is important for disseminating information during multi-jurisdictional enteric illness outbreaks in Canada. The Public Health Agency of Canada (PHAC) uses web-based Public Health Notices (PHNs) to communicate outbreak information and prevention measures. Despite this communication's importance, no study has examined online engagement with PHAC's PHNs.

Objective: To assess access to and engagement with online information on multi-jurisdictional enteric illness outbreaks by analyzing website traffic and engagement metrics for PHAC's PHNs.

Methods: Data on page and screen metrics, geographic location, device and browser types, and traffic source metrics for PHAC's PHN webpages (2020–2022) were obtained. Descriptive statistics were calculated for page and screen metrics data. Proportional frequencies were calculated for geographic location, device type, and traffic source metrics. Data were tabulated and visualized using R Studio.

Results: Public Health Notice webpages had an average of 2,729±16,685 page views and 2,490±15,201 visits; decreasing (but not significantly) over the study period. Average session duration was 165±124 seconds; increasing (but not significantly) over time. Most visits originated in Canada (89.0%±4.2%) and were from mobile devices (74.6%±3.3%). Traffic sources were primarily search (49.1%±13.0%), followed by direct (23.9%±6.7%), social media (21.2%±8.4%), and referral (5.7%±2.5%). The geographic location, device type, and traffic source changed significantly year by year.

Conclusion: Engagement with PHAC's PHN webpages declined over the three years of the study, while mobile and search-driven access dominated and levels remained consistent over time. Social media generated comparatively little traffic. These findings suggest opportunities to enhance search optimization and social media amplification to improve outbreak communication.

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Keywords: online communication, user experience, health communication, risk communication, enteric illness

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Introduction

As of January 2024, nearly 37 million Canadians were Internet users (1). With two-thirds of Canadians searching for health information online (2), the Internet has increasingly become a source of such information (3–5), including for topics such as disease diagnosis (6), decisions about seeking medical care (7), and updates on current events, such as outbreaks (8). This makes the Internet a valuable communication tool for information dissemination, including during multi-jurisdictional enteric illness outbreaks.

Enteric illnesses, primarily caused by pathogens affecting the gastrointestinal system, are a serious concern in Canada (9). Each year, there are an estimated four million cases of foodborne illness, leading to over 11,000 hospitalizations and

200 deaths (9). The Public Health Agency of Canada (PHAC) is responsible for communicating during multi-jurisdictional enteric illness outbreaks in Canada, defined as when two or more persons become ill from a common source and reside in two or more provinces/territories or Canada and another country. During an outbreak, public health authorities are expected to communicate timely and accurate information to the public (10). Public Health Agency of Canada uses Public Health Notices (PHNs), posted to the Government of Canada's website, to share outbreak and health protection information with Canadians. These online information notices include key outbreak investigation details such as the number of cases per province/territory, the timeline, and health protection information. As new information becomes available, PHNs are updated accordingly to ideally prevent additional enteric illness.

Reputable organizations, such as government agencies, are often trusted as reliable sources of online information (11–14). This trust is a key component of credibility (15), which, in turn, influences how the public accepts and uses health information (16). If these organizations fail to develop user-friendly and credible websites, it can negatively impact users' attitudes, lower their satisfaction, and increase concerns about the reliability of the information presented (17). To address these issues and enhance user experience, website traffic and engagement metrics offer valuable insights that are accurate, objective, and real-time, enabling organizations to optimize website performance and better meet user needs (18). In the context of public health communication, meeting user needs translates to ensuring the public can access, understand, and use health information, including in the context of multi-jurisdictional enteric illness outbreaks. Understanding web analytics for PHNs may offer clues for how well PHNs are meeting the health information needs of Canadians.

Previous studies have used website analytics to examine user behaviours on government websites (19–21). For instance, Begany *et al*. (20) investigated the relationship between website traffic and engagement with demographic characteristics in the context of open government data in the United States (US). Cheng and Chen (21) analyzed user behaviour on government websites during the COVID-19 pandemic, utilizing website traffic, engagement data, and focus groups to explore changes in engagement over time, as well as the impact of website characteristics and user experience. Tian *et al*. (19) used website traffic and engagement metrics to measure awareness of a specific health condition on the Centers for Disease Control and Prevention's (CDC) website; however, no previous study has used web analytics data to describe government website use for multi-jurisdictional enteric illness outbreaks in Canada. The following engagement metrics were used because they are consistently reported in website analytics literature, and together, provide an overall view of how visitors access and engage with PHN webpages. This study uses website traffic and engagement data to quantify 1) page and screen metrics, 2) geographic location visits, 3) device and browser metrics, and 4) traffic sources for PHAC's PHN webpages on the Government of Canada's website over a three-year study period (2020–2022).

Methods

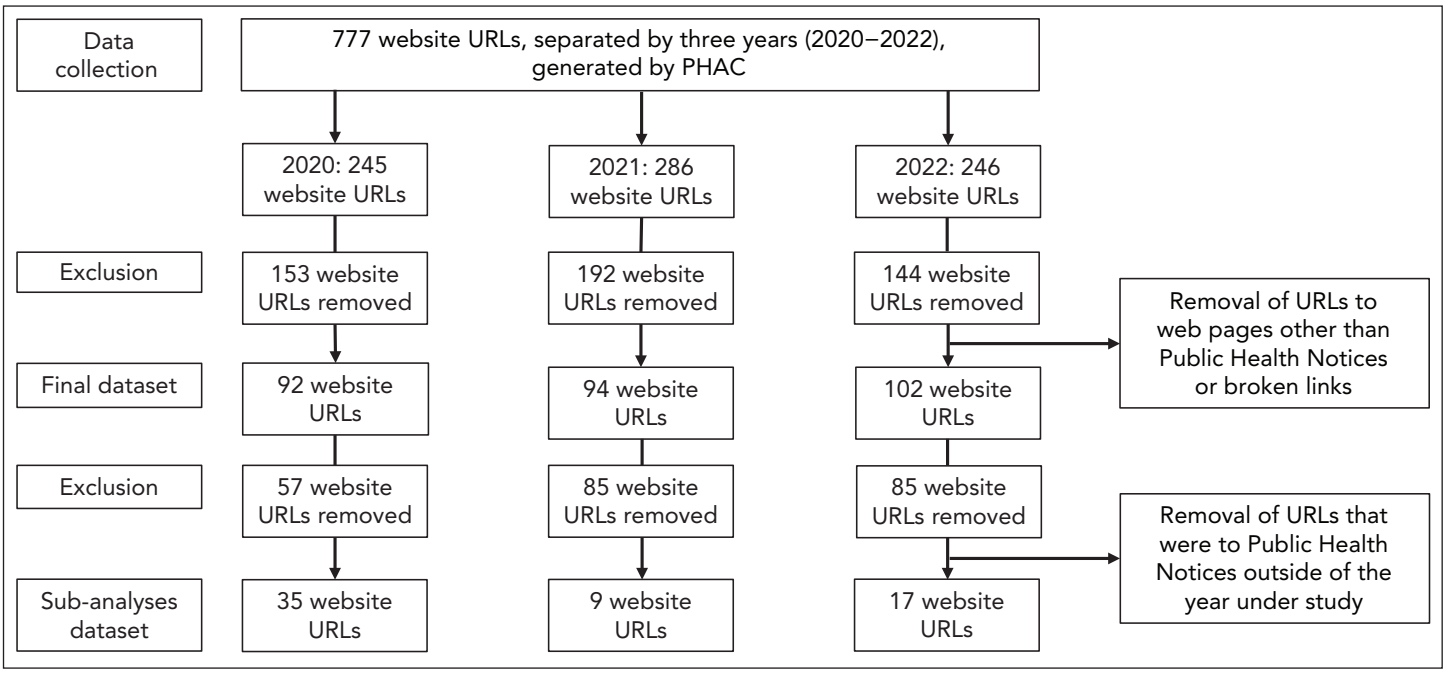
Data collection

Web traffic and engagement data were obtained from PHAC's Adobe Analytics system from January 1, 2020 to December 31, 2022 and filtered for inclusion (**Figure 1**). Several indicators were used to assess visitor behaviour, including page and screen metrics, geographic location, and device and traffic source metrics (**Table 1**). Data included number of visits, page views, page views per visit, average time on site, and outbound clicks for each PHN webpage Uniform Resource Locator (URL). Information associated with pages other than PHNs and broken links were removed. Visits to PHN webpages outside the study years (2020–2022) were initially included in the dataset but were removed and examined separately in a sub-analysis. The study period was chosen to reflect the most recent communication practices, focusing on PHNs published and updated within these years. Public Health Notices from outside this timeframe were not relevant, as the objective was to analyze traffic specific

Table 1: Description of metrics (page and screen, device, geographic location, and traffic source)

Metric	Metric description
Page and screen metrics	Not applicable
Visits	Number of times a user first arrives on the site The visit ends when any of the following criteria are met: 30 minutes of inactivity; 12 hours of activity; 2,500 hits; or 100 hits in 100 seconds
Page views	Number of times a visitor views a page
Average page views/visit	Average number of page views per visit
Average time on site	Average length of time visitors spends per session in seconds
Outbound clicks	Number of times a link is used to enter another website
Geographic location	Country (and province/territory or state for Canada and the United States) from which the webpage visit originated
Device type	Device used to access the webpage (mobile, desktop, or unspecified) during a visit
Traffic source	Source from which a visitor accesses the webpage
Search	Access from a search engine (e.g., Bing, Yahoo, Google)
Direct	Access via a bookmark or direct Uniform Resource Locator (URL)
Social media	Access via social media websites (e.g., X [formerly Twitter], Facebook, LinkedIn)
Referrals	Access via links on an external website

Figure 1: A step-by-step flowchart of URL selection criteria for analyses of data collection and filtering process for Public Health Notice URLs, 2020–2022



Abbreviations: PHAC, Public Health Agency of Canada; URL, Uniform Resource Locator

to PHNs published and updated during the study years. The number of PHN webpages does not reflect the unique number of multi-jurisdictional enteric illness outbreaks. The number of PHN webpages is higher because each PHN is available in English and French, and periodic updates to PHNs result in new versions stored as separate URLs. In aggregate, geographic location, visits per device type, and traffic source metrics were provided for all PHN webpages by year. Traffic source metrics were in the form of referring URL domains. Each URL domain was examined and grouped into four common traffic sources: direct, search, social media, and referral. Each common traffic source, except for direct, was further categorized into appropriate subcategories; for example, social media was grouped into type: Facebook, X (formerly Twitter), Reddit, LinkedIn, and Instagram.

Statistical analysis

Descriptive statistics (mean, standard deviation, and maximum and minimum values) were calculated for all continuous variables (page and screen metrics). A sub-analysis of page and screen metrics was performed to include only those PHNs that were posted or updated within the study period. This sub-analysis ensures that only PHN webpages relevant to the study period were included, while PHN webpages from earlier years, which were expected to have low traffic and engagement due to their outdated content, were excluded. This filtering process helped to more accurately capture the traffic and engagement patterns of webpages relevant to the study period. The year in which outbreaks occurred was classified according to the start date. A three-year average and standard deviation were also calculated for these variables to account for variations across the study period. The top 5% of visits, referring to the webpages that ranked within the highest 5% of total visits, were analyzed to identify trends in traffic and outbreak characteristics associated with heightened activity. The top 5% of outbound link clicks, representing the links that received the highest frequency of interactions, were examined to determine the types of information that users sought after visiting a PHN webpage. For geographic location, device type, and traffic source metrics, proportional frequencies were calculated for each respective year, in addition to a three-year average. An analysis of variance (ANOVA) test was performed to detect significant differences (α=0.05) between the annual average page and screen metrics and year. A chi-square test of independence was performed to detect significant differences (α=0.05) between years and geographic location, device type, and traffic source metrics. Data were tabulated and visualized using R Studio version base packages (22) and readxl (23), dplyr (24), openxlsx (25), rnaturalearth (26), rnaturalearthdata (27), rnaturalearthhires (28), tidyverse (29), cowplot (30), ggspatial (31), sf (32), png (33), grid (34), gridExtra (35), raster (36) and devtools packages (37).

Ethics

Institutional ethics approval was not required as the data provided by PHAC were anonymized and derived from publicly accessible PHN webpages that do not require a login, password, or other restrictions to access.

Results

Page and screen metrics

A decreasing trend in page views and visits from 2020 to 2022 was observed (**Table 2**). Page views averaged 2,729±16,685 views while visits averaged 2,490±15,201 visits over the three years. In contrast, average session duration showed an increasing trend, rising from 148.9±108.0 seconds in 2020 to 183.8±157.1 seconds in 2022. While page views and visits trended downward, no statistically significant differences were found in page views (F[2,285]=0.49, *p*=0.61), visits (F[2,285]=0.49, *p*=0.61), session duration (F[2,285]=2.01, *p*=0.14), or page views per visit (F[2,285]=0.03, *p*=0.97) over time.

The top 5% of visits averaged 36,637±55,515 visits. The top 5% of visits were associated with *Salmonella*, Hepatitis A and norovirus outbreaks involving produce, shellfish, and eggs. The top 5% of visits were for outbreak sizes ranging from three to 515 cases over the study period (**Table 3**).

The top 5% of outbound clicks consistently directed visitors to recall and safety alerts on the Government of Canada's website (n=983). Additionally, in 2020, these clicks led users to the CDC outbreak information (n=420) and travel health notices on the Government of Canada's website (n=412). In 2021, most outbound clicks were to recall and safety alerts (n=363) but also included contact information on the Government of Canada's website (n=82). In 2022, clicks were to specific recall dates and safety alerts on the Government of Canada's website (n=1,716).

Table 2: Descriptive statistics of page and screen metrics for Public Health Notice webpages on the Government of Canada's website, 2020–2022

Variable	2020[a]			2021[b]			2022[c]		
	Mean	Standard deviation	Range	Mean	Standard deviation	Range	Mean	Standard deviation	Range
Average page views	4,122	26,914	1–257,256	2,346	9,500	1–74,415	1,826	7,251	1–55,747
Average visits	3,758	24,448	1–233,603	2,139	8,778	1–70,165	1,670	6,697	1–52,055
Average page views per visit	1.1	0.2	1–2	1.1	0.1	1–1.5	1.1	0.2	1–2
Average session duration(s)	148.9	108.0	0–575	161.1	92.9	0–401.6	183.8	157.1	0–1,054.5

[a] n=92 Public Health Notice webpages
[b] n=94 Public Health Notice webpages
[c] n=102 Public Health Notice webpages

Table 3: Top 5% of visits to Public Health Notice webpages and their associated pathogen, implicated source and outbreak size, 2020–2022

Year	Number of visits	Pathogen	Implicated source	Outbreak size (number of cases)
2020	233,603	*Salmonella*	Produce	515
	19,560	*Vibrio parahaemolyticus*	Shellfish	23
	16,450	*Salmonella*	Produce	57
	12,123[a]	*Salmonella*	Produce	515
	9,093	*Cyclospora*	Produce	370
2021	70,165	*Salmonella*	Eggs	70
	40,066	Hepatitis A	Produce	3
	22,003	*Salmonella*	Produce	118
	20,020[a]	*Salmonella*	Eggs	70
	9,687[a]	Hepatitis A	Produce	3
2022	52,055	Hepatitis A	Produce	10
	36,049	Norovirus	Shellfish	339
	24,104	Norovirus	Shellfish	60
	7,995	*Salmonella*	Produce	118
	7,919[a]	*Salmonella*	Eggs	70

[a] Public Health Notice webpages communicated in French

Page and screen metrics (sub-analysis)

A decreasing trend in page views and visits from 2020 to 2022 was observed. Across the study period, page views averaged 11,002±35,087 views while visits averaged 10,057±31,954 visits. In contrast, average session duration showed an increasing trend, rising from 94.6±77.3 seconds in 2020 to 184.2±238.7 seconds in 2022 (**Table 4**). While page views and visits trended downward, results indicated no statistically significant differences in page views (F[2,58]=0.17, *p*=0.84), visits (F[2,58]=0.17, *p*=0.84), session duration (F[2,58]=2.39, *p*=0.10), or page views per visit (F[2,58]=0.13, *p*=0.88) over time.

The top 5% of visits averaged 93,846±95,495 visits. Common pathogens included *Salmonella*, *Vibrio parahaemolyticus* and Hepatitis A, with produce, shellfish and eggs being frequently implicated sources. Outbreak sizes ranged from 10 to 515 cases (**Table 5**).

Geographic location metric

Most PHN webpage visits originated from Canada, representing 89.0%±4.2% across the study period. A smaller percentage of visits came from the US (5.5%±1.7%). To a lesser extent, visitors accessed PHNs from outside of North America, including Asia, Africa, South America, Europe, and Oceania (0.1%±0.4%) (**Figure 2**). Geographic visits significantly differed by country and year (X^2=30,606 degrees of freedom=116, *p*<0.001).

Table 4: A sub-analysis and descriptive statistics for Public Health Notices[a] and screen metrics on the Government of Canada's website, 2020–2022

Variable	2020[b]			2021[c]			2022[d]		
	Mean	Standard deviation	Range	Mean	Standard deviation	Range	Mean	Standard deviation	Range
Average page views	10,475	43,260	1–257,256	17,148	26,415	1–74,415	8,832	16,249	1–55,747
Average visits	9,559	39,289	1–233,603	15,713	24,501	1–70,165	8,087	15,028	1–52,055
Average page views/visit	1.1	0.2	1–2	1.1	0.2	1–1.5	1.2	0.2	1–2
Average session duration(s)	94.6	77.3	0–265.3	101.8	75.6	0–194.0	184.2	238.7	0–1,032

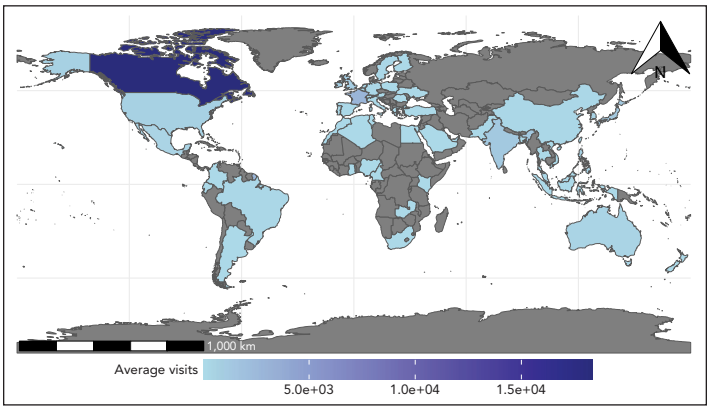
[a] Public Health Notices posted and updated in their respective calendar year
[b] n=35 Public Health Notice webpages
[c] n=9 Public Health Notice webpages
[d] n=17 Public Health Notice webpages

Table 5: A sub-analysis for the top 5% of visits to Public Health Notices[a] webpages and their associated pathogen, implicated source and outbreak size, 2020–2022

Year	Number of visits	Pathogen	Implicated source	Outbreak size (number of cases)
2020	233,603	*Salmonella*	Produce	515
	19,560	*Vibrio parahaemolyticus*	Shellfish	23
2021	70,165	*Salmonella*	Eggs	70
2022	52,055	Hepatitis A	Produce	10

[a] Public Health Notices posted and updated in their respective calendar year

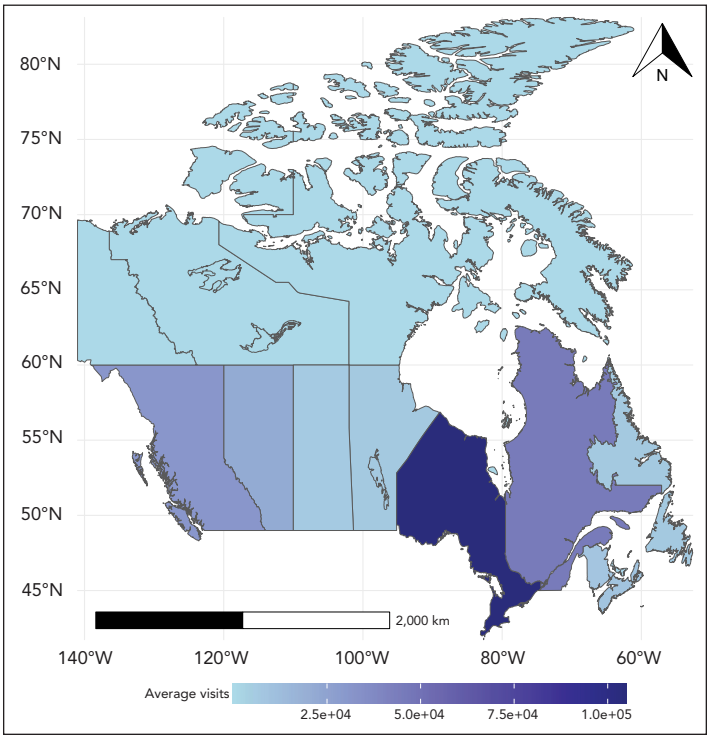
Figure 2: A choropleth map visualizing the three-year average visits from web traffic origins to Public Health Notice webpages on the Government of Canada's website for the World[a], 2020–2022



[a] Areas shaded grey represent areas from which no visits were recorded

In Canada, Ontario had the highest proportion of visits each year, declining from 46.5% in 2020 to 40.1% in 2022, while Québec's share increased from 14.7% to 21.8% over the same period. The territories, including Yukon, Northwest Territories and Nunavut, consistently accounted for less than 1% of visits throughout the study period. These percentages represent the proportion of visits to the webpages originating from different provinces and territories in Canada (**Table 6**, **Figure 3**). Geographic visits significantly differed by Canadian provinces and territories between years (X^2=38,433, degrees of freedom=26, p<0.001).

Figure 3: A choropleth map visualizing the three-year average visits from web traffic origins to Public Health Notice webpages on the Government of Canada's website for Canada, 2020–2022



In the US, California consistently had the highest proportion of visits each year, ranging from 22.9% in 2020 to 16.3% in 2022. The second largest contributor to visits varied, with Texas in 2020 (7.7%), Virginia in 2021 (12.3%), and New York in 2022 (10.6%) (**Figure 4**). Geographic visits significantly differed by state and year (X^2=5,083.5, degrees of freedom=54, p<0.001).

Device and browser metrics

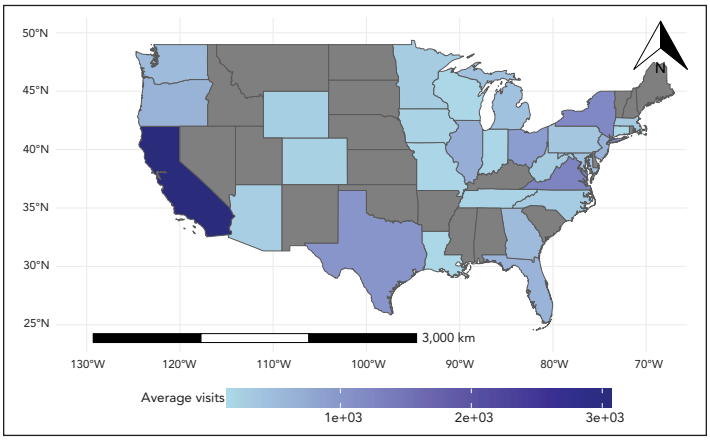
The largest number of visits came from mobile devices (74.6%±3.3%), on average, over the three-year period. Although desktop visits were fewer, their proportion increased from 21.7% in 2020 to 29.5% in 2022 (**Table 7**). Device type significantly differed between years (X^2=9,524.8, degrees of freedom=4, p<0.001).

Table 6: Number and proportion of visits from the United States, Canada, and Canadian provinces/territories to Public Health Notice webpages, 2020–2022

Country/province/territory	Number of visits to PHN webpages (% of total)		
	2020	2021	2022
United States	19,386 (5.4%)	8,441 (3.8%)	17,232 (7.1%)
Canada	328,436 (91.4%)	202,071 (90.6%)	202,078 (83.8%)
Ontario	152,796 (46.5%)	81,067 (40.1%)	81,067 (40.1%)
Québec	48,402 (14.7%)	43,969 (21.8%)	43,969 (21.8%)
British Columbia	58,166 (17.7%)	17,964 (8.9%)	17,964 (8.9%)
Alberta	34,565 (10.5%)	16,066 (8.0%)	16,066 (8.0%)
Nova Scotia	6,839 (2.1%)	10,763 (5.3%)	10,763 (5.3%)
New Brunswick	5,243 (1.6%)	9,993 (5.0%)	9,993 (5.0%)
Newfoundland and Labrador	2,909 (0.9%)	9,402 (4.7%)	9,402 (4.7%)
Manitoba	9,357 (2.9%)	5,843 (2.9%)	5,843 (2.9%)
Saskatchewan	8,105 (2.47%)	5,713 (2.8%)	5,713 (2.8%)
Prince Edward Island	1,619 (0.5%)	1,019 (0.5%)	1,019 (0.5%)
Yukon	223 (0.1%)	130 (0.1%)	130 (0.1%)
Northwest Territories	184 (0.1%)	116 (0.1%)	116 (0.1%)
Nunavut	28 (0.0%)	26 (0.0%)	26 (0.0%)
Unspecified	0 (0.0%)	0 (0.0%)	7 (0.0%)

Abbreviation: PHN, Public Health Notice

Figure 4: A choropleth map visualizing the three-year average visits from web traffic origins to Public Health Notice webpages on the Government of Canada's website for United States[a], 2020–2022



[a] Areas shaded grey represent areas from which no visits were recorded

Table 7: Device type trends (mobile, desktop, and unspecified) while accessing Public Health Notice webpages on the Government of Canada's website over three years, 2020–2022

Device type	n (%)		
	2020	2021	2022
Mobile	282,761 (77.0%)	167,460 (74.3%)	133,958 (70.5%)
Desktop	79,541 (21.7%)	58,060 (25.7%)	56,002 (29.5%)
Unspecified	5,002 (1.4%)	13 (0%)	10 (0%)

Traffic source metrics

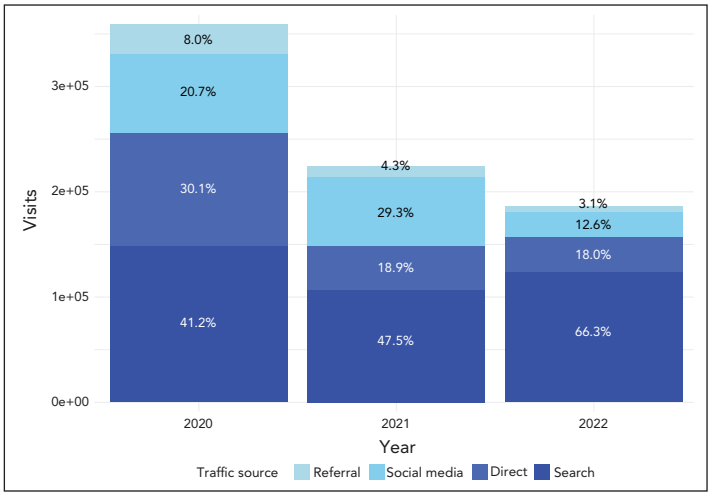
Search traffic remained the primary source of PHN visits (49.1%±13.0%), on average, over the three years, with Google dominating search traffic (97.0%±0.4%). Direct traffic was the second largest contributor (23.9%±6.7%), on average, showing a decline from 30.1% in 2020 to 18.0% in 2022. Social media, the third largest source (21.2%±8.4%), on average, peaked at 29.3% in 2021 before decreasing to 12.6% in 2022, with Facebook as the leading platform (73.1%±2.0%), followed by X (formerly Twitter) (25.1%±1.5%). Referral traffic, the smallest source, declined from 8.0% in 2020 to 3.1% in 2022. Government agencies (38.2%±6.4%) and news websites (40.7%±11.1%) were the main contributors to referral traffic over the period (**Figure 5**). Traffic sources significantly differed over the years (X^2=46,097, degrees of freedom=6, p<0.001), with search traffic increasing while direct, social media, and referral sources declined.

Discussion

Principal findings

This study used descriptive analysis to quantify and describe website traffic and engagement data to PHN webpages on the Government of Canada's website from 2020 to 2022 inclusive. Page and screen metrics, including visits and page views, showed decreasing traffic and engagement during this period, although average session duration remained consistently ideal (two to three minutes or longer). Most visits to PHN webpages originated from Canada, with a small proportion

Figure 5: Traffic source distribution (search, direct, social media and referral) trends to Public Health Notice webpages on the Government of Canada's website, 2020–2022



from international visitors. Despite fluctuations over the three years of the study, mobile devices constituted the majority of visits to PHN webpages overall, with a slight decline in mobile use and increase in desktop use. Google search emerged as the primary contributor to PHN webpage traffic, followed by direct, Facebook social media, and referral sources, in decreasing order.

Page and screen metrics

The page and screen metrics (page views, visits, page views per visit, and average session duration) helped to understand user experience and navigation to aid in content creation (38). Public Health Notice webpages in 2020 demonstrated the largest engagement, marked by increased page views and visits, likely due to the relatively large number of outbreaks (11) and the scope of these outbreaks. From 2020 to 2022, the largest outbreaks regarding the number of cases occurred in 2020. For example, a *Salmonella* outbreak related to red onions was international in scope and resulted in 515 Canadian cases. In 2022, despite experiencing a higher number of outbreaks compared to 2021, there was a notable decrease in engagement, marking the lowest level of engagement observed throughout the study period. Given that the top 5% of visits over the study period varied by outbreak size, pathogen, and implicated sources, conclusive relationships to explain why some PHN webpages experienced higher visits cannot be determined.

Decreased PHN traffic may correlate with the COVID-19 pandemic, influencing Canadians' online behaviours (39). During the pandemic, there was an increase in Internet-related activities (40), helping to explain the PHN webpages traffic peak in 2020; however, awareness of communicable diseases tends to wane during the resolution of a pandemic (41), which may explain why PHN webpage traffic decreased over the study period. Additionally, amid the COVID-19 pandemic, governments were placed in an unprecedented position—challenged by an ever-evolving situation to curb the spread of disease (42). During this time, Canadians' trust in the government was challenged (43). A previous study surveying adults from the US found that government website use was positively associated with website satisfaction, which included accessible and complete information, and influenced citizen trust in government (44). Additionally, citizen trust in government influenced website satisfaction and, consequently, government website use (44). Similarly, in Canada, distrust in the government throughout the study period may have contributed to decreased access to PHN webpages. As the ease of access to government information is crucial to fostering transparency (45), the decline in trust may reflect a broader perception that information from public health authorities, including PHN webpages, was not readily accessible or adequately transparent (46). Ensuring information is readily accessible and available to the public through channels and formats tailored to their needs helps foster transparency (47), and when governments fail to meet these standards, it can erode trust.

During the pandemic, many Canadians used social media as a source of information (48). While social media can increase the perceived transparency of government actions, simply posting on social media is not enough to build trust (46). Increasing interactions with government information and ensuring information transparency are necessary (46). Ultimately, using social media to improve transparency can positively influence trust, which, in turn, can enhance PHN webpage use (44). Alternatively, the decreased access to PHN webpages may have been linked to the reduced reporting of communicable diseases to public health officials early in the COVID-19 pandemic (2019–2020) (49), including enteric illnesses in Canada (50). The cause of decreased enteric illness reporting is complex, and whether there was a true decrease in enteric illnesses due to eating habits or lockdown measures rather than a lack of reporting due to healthcare-seeking behaviour change is unclear (50). Nonetheless, the reduction in enteric illness reporting likely contributed to the decline in multi-jurisdictional enteric illness outbreaks and updates; therefore, the decrease in PHN webpage traffic could be explained by a reduced need to access the PHN website due to a lower frequency of multi-jurisdictional enteric illness outbreaks and updates.

In alignment with the general guideline recognizing that session lengths can vary depending on factors such as website type, industry, and user behaviour, PHAC webpages maintained an ideal average session duration of two to three minutes or longer, which may indicate the webpage captures users' attention and keeps them engaged (51). Webpage factors that contribute to average session duration include webpage design, layout, and format (52). A content analysis of PHNs found that their design, layout, and format mostly aligned with the CDC's Clear Communication Index best practices, which may have contributed to the webpages' ideal average session length (53).

Alternatively, the COVID-19 pandemic caused people to excessively search for health information on the Internet to relieve their health anxiety (54), which may explain the sustained engagement among users who did access PHN webpages. Despite declining engagement, as shown by decreasing page views and visits, those who access PHN webpages appear more engaged, as evidenced by the ideal average session duration.

Geographic location metric

The geographic location metric offers insights into the demographic profile of website visitors by providing a broad overview of audience distribution, which can be used to help improve user experience for individuals of varying geographic areas (38). This includes the number of website visits from each country and a breakdown per region within North America. Considering PHN's emphasis on sharing information about multi-jurisdictional enteric illness outbreaks in Canada, a high number of webpage visitors from Canada is expected. Most multi-jurisdictional enteric illness outbreaks during the study period occurred in Central Canada, the West Coast, and the Prairie provinces, which may explain the high number of webpage visitors from these regions. Ensuring those in affected areas are accessing the information they need has proven to have a positive effect on curbing the spread of communicable diseases (55).

Despite the localized nature of the outbreaks in Canada and the US, there was a small international viewership. Due to many cross-border outbreaks, website visits from Americans are expected. For example, in 2020 alone, there was a 515-case outbreak linked to red onions from the US (56) and a 57-case outbreak linked to peaches from the US (57). Visitors may have been redirected to PHN webpages via the CDC website, which routinely posts about foodborne outbreaks and links directly to PHAC's PHNs when an outbreak has cross-border relevance. The small international presence could be explained by Canadian users accessing PHN webpages using virtual private networks to preserve their privacy (58) or Canadians travelling or living abroad who maintain their usual online activities. Alternatively, the small international presence (outside of both Canada and the US) may reflect travellers to Canada seeking information to protect themselves from foodborne illness (59) or the impact of public health digital surveillance abroad (60). Acknowledging PHAC's guiding principles as part of the Government of Canada to prioritize communication with Canadians (61), it is not recommended to direct efforts to communicate with individuals residing in other countries.

Device and browser metrics

Despite increased mobile device use during the COVID-19 pandemic (62), PHN webpages experienced a decline in mobile visits and an increase in desktop visits from 2020 to 2022, though mobile devices still constituted the majority. The COVID-19 pandemic and response caused a shift in digital use, thrusting both individuals and organizations online (63). In general, for those who used multiple devices to access the Internet, their choice of device varied depending on several factors, including the complexity and length of the task, time of day, or whether they were at home or work (64). While younger users tend to favour mobile devices to access information on the Internet, older adults prefer the computer (65). Additionally, the most noticeable shift in Internet use was amongst Canadians aged 50 to 64 years and aged 65 years or older (63). The observed increase in desktop use to access PHN webpages is consistent with shifts in digital behaviour seen during the COVID-19 pandemic response, likely influenced by factors such as stay-at-home orders, changes in work environment, the complexity of PHN webpages, and user demographics.

Although desktop use increased during this period, mobile devices still constituted the majority of visits to PHN webpages, highlighting the importance of optimizing webpages for seamless user interaction on mobile devices. Mobile optimization involves designing webpages specifically for mobile devices or adapting desktop layouts for mobile compatibility without altering the original structure (66). For tasks requiring cognitive processing, for example, reading information about multi-jurisdictional enteric illness outbreaks in Canada, younger adult users prefer simple, intuitive designs such as single-page scrolling (sliding vertically) or multi-page navigation (tapping through different pages) rather than zooming (two fingers moving in opposite directions) to accomplish tasks efficiently (67). However, these may pose usability challenges for older adults (68). Further, younger adults prefer a homepage with a thumbnail design that allows for quick content recognition and minimizes reliance on text-based titles (67). While older adults experience usability challenges while navigating different webpages, a thumbnail design was found to promote understanding, navigation, and interaction with online content (68). Currently, PHN webpages feature single-page scrolling and do not incorporate a thumbnail design, which could enhance useability and navigation. Understanding the demographic differences in device use and preferences can help to tailor PHN webpage design and optimization strategies to enhance user experience.

Traffic source metrics

Traffic source metrics are used to track and analyze the source of traffic or channels visitors use to access a website, which can help understand how users discover and arrive at websites, aiding in marketing efforts (38). In agreement with literature emphasizing the importance of Google searches in driving website traffic (69), PHN webpages relied on Google searches as the primary traffic source. Search engine optimization is the practice of improving webpages to enhance their ranking in search results (70). To be specific, search engines use algorithms to match searched keywords with website content. The closer the match between the content and search queries, the higher the number of website visits. Search engine optimization can positively influence the usability (71) and the accessibility of websites (72); however,

this study did not collect and analyze search terms to provide insight into search engine optimization.

Direct traffic represented the second largest channel for visitors, indicating a level of awareness or affinity for PHN pages (73). Visitors from direct channels are typically loyal and engaged users of the website (73), highlighting the affinity to and demand for PHN webpages.

Social media, particularly Facebook, emerged as the third largest channel. In Canada, Facebook is the largest social media network with an estimated 29.44 million monthly active users (74) and is popular among multiple demographic groups (75). This widespread use may contribute to increased PHN webpage traffic compared to other social media platforms. Previous research found a positive correlation between followership and predicted website traffic (76); however, our results contradict these findings. In November 2023, despite PHAC's X followership (n=450,000) exceeding Facebook's followership (n=433,000), the latter dominated as a social media traffic source. The COVID-19 pandemic spurred the use of social media as a crucial communication tool (48), with more people using Facebook than X for health information during the COVID-19 lockdown (77). Additionally, our previous study examining PHAC's social media posts during multi-jurisdictional enteric illness outbreaks found that engagement was higher among Facebook posts compared to X, which could explain why Facebook remains the predominant social media traffic source (78). While PHAC has used X to disseminate information during multi-jurisdictional enteric illness outbreaks (61) and often provides links to corresponding PHNs (78), X contributed only about a quarter of social media search traffic. Given that X is predominantly used by younger adults (79) for health information (77), tailoring content to their preferences and needs could enhance X's traffic volume to PHN webpages.

Overall, social media remains an underused traffic source, despite efforts during multi-jurisdictional enteric illness outbreaks to communicate through this channel and its importance in health information dissemination (80). A previous content analysis found that PHAC's social media posts during multi-jurisdictional enteric illness outbreaks almost always used links; however, the study did not assess whether these links were incorporated according to best practices for clear links and to bolster engagement (78). The PHAC's past social media posts on Facebook included phrases like "For more info" (81), "Additional details on recalled products, the outbreak investigation, and the latest food safety advice are here" (82) and "More information and health advice here" (83), followed by the URL to the corresponding PHN webpage. Similarly, posts on X (formerly Twitter) included phrases such as "more advice" (84), "more info" (85) and "get more information here" (86), also followed by a URL to the corresponding PHN webpage. However, according to the Web Content Accessibility Guidelines, links should be preceded by sufficient context for users to understand the purpose of the link without additional explanation (87). Phrases such as "more information" or "click here" are too vague and should be avoided (88). Additionally, URLs should not be included as link text, as they express little meaning to users (89). Instead, the text should be presented as descriptive and hyperlinked (89). Incorporating best practices, such as providing clear links to PHN webpages and encouraging engagement, could help bolster traffic and improve user interaction with PHAC's PHN webpages.

Referral traffic remained a low contributor to website traffic, which may indicate low affiliate amplification and media coverage during multi-jurisdictional enteric illness outbreaks. In another study, it was found that although provincial and territorial partners had low amplification, the media communicated information during multi-jurisdictional enteric illness outbreaks, but at a low frequency (90). Furthermore, Canadian journalists are not legally mandated to cite their sources; they are only ethically encouraged to do so (91). This combination of low frequency of media coverage and the potential lack of citations to PHN webpages may contribute to the overall low levels of referral traffic. Given the importance that news media plays in communicating public health information (92), encouraging provincial, territorial, and media partners to share information and provide clear links to PHN webpages could help bolster referral traffic.

Limitations

This descriptive analysis of website traffic and engagement on the Government of Canada's website from 2020 to 2022 provided insights into visitor engagement as a proxy for awareness of PHN webpages; however, it has several limitations. First, the dataset used had deficiencies, particularly the absence of demographic information of users. This limitation hindered the ability to make associations between engagement metrics and demographic information, thereby precluding recommendations for content optimization tailored to specific demographics to enhance traffic and engagement. Second, aggregate data were used, as opposed to raw data, for the geographic location, device, and browser and traffic source metrics, posing limitations. Visits exclusively to PHN webpages within these metrics could not be confirmed, potentially including visits to other pages; however, visits to other pages are expected to comprise a small subset of the dataset. To contextualize social media traffic, PHAC's recorded followership from November 2023 was used; however, this was from outside the study period of this article. Yet, the overall trend of greater followership on X compared to Facebook was not expected to change notably. Third, the absence of search terms restricted the ability to make recommendations regarding search engine optimization to enhance search as a traffic channel. Further, Adobe Analytics does not have available benchmarks to compare traffic and engagement metrics on PHN webpages to other government webpages. This made it difficult to effectively assess traffic to and engagement with PHN webpages. Additionally, the

scope of the study was limited: inferences about whether visitors who accessed and engaged with the PHN webpages could understand and use the information to prevent enteric illnesses could not be made. Data was limited to a three-year period, which coincided with the COVID-19 pandemic (2020–2022), making it challenging to disentangle the pandemic's impact and its influence on health information-seeking behaviours on government websites, particularly concerning multi-jurisdictional enteric illness outbreaks. Lastly, this analysis was descriptive and thus could only describe results without making associations or explaining relationships.

Future research

This research quantified and described website traffic and engagement metrics as a proxy for audience awareness. Future research should explore relationships between traffic and engagement metrics, website design, and content to optimize engagement with information over a longer period for more reliable patterns of findings. Linking user engagement with website design and content can allow for designing more effective communications. Further, qualitative data should be collected to understand visitor traffic and engagement quantitative data, aiding in website optimization.

Conclusion

As Internet use for accessing health-related information continues to rise, understanding website traffic and engagement becomes even more important. The PHAC uses PHNs posted on the Government of Canada's website to disseminate outbreak investigation details and health protection information during multi-jurisdictional enteric illness outbreaks; however, traffic to and engagement with these webpages had previously been unexplored. While the average session duration remained optimal, there was decreasing engagement over the study period (2020–2022). Additionally, PHN webpages effectively attracted audiences from the affected provinces/territories. Visitors primarily used mobile devices to access PHN webpages, which are optimized for mobile web browsing, contributing to enhanced user experience. Google search emerged as the primary traffic source for accessing PHN webpages followed by direct, Facebook social media, and referral. Despite efforts used to communicate with individuals through social media, this traffic source remains underused. Website traffic and engagement analysis is a useful tool to assess and support visitor access to and engagement with PHN webpages. Continued monitoring and optimization efforts are essential to ensure effective communication of multi-jurisdictional enteric illness outbreaks to the public.

Authors' statement

VP — Formal analysis, investigation, methodology, visualization, writing–original draft
JM — Conceptualization, methodology, supervision, writing–review & editing
MM — Methodology, writing–review & editing
LC — Conceptualization, methodology, writing–review & editing
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Competing interests

None.

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SURVEY REPORT

Out-of-pocket costs for people with tuberculosis disease in Toronto, Canada: A web-based survey at two tuberculosis treatment centres, April 2023–April 2025

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Abstract

Background: In Ontario, over 600 cases of tuberculosis (TB) have been reported annually since 2015. Despite publicly funded health care, the direct and indirect costs to individuals have not been well studied and may be substantial.

Objective: To assess the economic and social impacts of TB among individuals undergoing treatment at specialized TB care centers in Toronto, Canada.

Methods: Patient-reported costs, work disruptions, social consequences and changes in household financial status were evaluated. A cross-sectional web-based survey was conducted among adults (18 years and older) receiving TB treatment at West Park Healthcare Centre and the Toronto Western Hospital TB clinic between April 2023 and April 2025. Respondents completed a modified version of the World Health Organization's Tuberculosis patient cost survey, which collected data on out-of-pocket costs, work loss and social outcomes. Descriptive statistics were used to summarize key findings and reported costs in 2025 Canadian dollars.

Results: A total of 42 people with TB disease completed the survey (mean age=36.7 years; 38% female). The mean cost of a TB-related appointment was $42.82 (standard deviation [SD]=$47.89), with variation by treatment center, hospitalization status and transportation method to appointments. More than half (61.9%) of respondents reported missing work due to treatment, with a mean loss of 130 hours (SD=141). Following diagnosis with TB, 28.6% of respondents experienced job loss, and 45.3% of respondents experienced a worsening of their household financial situation, with 16.7% reporting that it had become much worse.

Conclusion: Despite publicly funded health care, people with TB face economic and social challenges. These findings will contribute to a deeper understanding of the financial challenges faced by people with TB and may be useful in informing public health policy.

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Introduction

Despite advances in prevention and treatment, tuberculosis (TB) continues to pose a significant public health burden globally. In Ontario, over 600 cases have been reported annually since 2015 (1). In Toronto, 375 people were diagnosed with TB in 2024; the highest number since 2002 (2). Toronto regularly records a rate of TB nearly double the provincial average. This is likely because of a higher proportion of people born outside of Canada than other parts of the province (2). In addition to the health consequences, people with TB often experience financial costs and adverse social outcomes, including job loss, food insecurity and housing instability, especially during the isolation period required during treatment for some people (3).

Canada has a publicly-funded health insurance system. In Ontario, TB-related healthcare costs are covered by provincial programs, including those not otherwise eligible for government-funded care, such as international students or visitors, via the Tuberculosis Diagnostic and Treatment Services for Uninsured Persons (TB-UP) Program (4); however, the financial burden experienced by individuals has not been well studied and may still be substantial.

Canada is a signatory to the United Nations Political Declaration on the Fight Against Tuberculosis, committing to eliminate catastrophic costs for all people with TB (5). There is a notable gap in Canadian data on individual-level TB costs; to the authors' knowledge, no other patient cost survey has been conducted for people with TB in Canada. A survey in the Netherlands was conducted with immigrants with TB and found that patients incurred out-of-pocket costs, as well as lost days of work, despite public health insurance (6). Understanding patient costs related to TB is important because these costs can impede treatment adherence and are often incurred to protect public health (e.g., isolation), underscoring the societal imperative to alleviate them.

The objective of this research was to characterize out-of-pocket costs incurred by people with TB in Toronto, Ontario, Canada. This study aimed to capture patient-reported costs, including direct healthcare expenses and out-of-pocket costs as well as indirect costs such as productivity loss. The study's findings can contribute to a deeper understanding of the financial challenges faced by people with TB and may be useful for public health policy.

Methods

This study used a cross-sectional web-based survey between April 2023 and April 2025 to collect information from adults (18 years of age and older) undergoing treatment for TB disease. Respondents were recruited from two TB treatment centres in Toronto: West Park Healthcare Centre (WPHC) and the Toronto Western Hospital (TWH). The WPHC is a rehabilitation and complex care facility with a dedicated inpatient TB unit and outpatient clinic and is recognized as a referral centre for patients with complex TB (7). The WPHC became a part of the University Health Network (UHN) in April 2024, but TB program operations did not change. The TWH TB clinic is an outpatient clinic operating at the TWH, also part of UHN (8). The annual number of eligible patients was estimated to be approximately 85 from WPHC and 50 from TWH. This research was approved by the Research Ethics Boards at UHN (REB #22–5400) and WPHC (REB #23–001–WP).

Survey instrument development

This study used a modified version of the World Health Organization (WHO)'s Tuberculosis patient cost survey (9). This standardized tool was designed to capture the economic burden experienced by people with TB and their households. Modifications were made to tailor the survey to the Ontario health care context, focusing on relevant costs and health service utilization. Key domains included in the survey instrument were direct medical costs (e.g., expenses related to hospitalization, outpatient visits, and medications), direct non-medical costs (e.g., transportation, food and accommodation related to TB care), amount of missed work, and socioeconomic and demographic characteristics.

Study data were collected and managed using REDCap electronic data capture tools hosted at UHN. The survey was offered with interpretation services in any language required by interested respondents and offered in multiple formats (in-person, online and phone) to improve survey accessibility.

Sampling and recruitment

Clinic staff approached adults undergoing treatment for TB at the identified clinics requesting their participation in the study. Recruitment strategies were integrated into routine clinical interactions with healthcare providers. Interested respondents received detailed information about the study's objectives, procedures and potential risks during the informed consent process prior to participation. Upon referral to the study team, contact via phone was attempted three times before assuming that the individual was no longer interested in participating in the study. The questionnaire was designed to take approximately 45 minutes to complete, and respondents were provided a $25 gift card for their participation.

Measurement

The primary outcome measures were patient-reported costs and productivity loss associated with paid employment. Additionally, the survey instrument collected data on social outcomes based on peoples' experiences during their treatment for TB. These outcomes included social exclusion, food insecurity, employment status and household financial security. Respondents were not provided with formal definitions for these outcomes; thus, responses reflect respondents' personal experiences and interpretation.

Analysis

Descriptive statistics were used to summarize respondent demographics, socioeconomic characteristics, TB-related costs, and TB-related social outcomes. Measures of central tendency (mean, median) and variability (standard deviation [SD], interquartile range [IQR]) were calculated for continuous variables, while categorical variables were summarized using frequencies and percentages.

Results

Between the two treatment centres, 61 people were referred to the study team by their clinic staff. By April 30, 2025, 42 respondents completed the survey, representing a response rate of 68.9%.

Baseline characteristics

The survey sample consisted of 42 respondents with a mean age of 36.7 years (SD=14.95), with a majority identifying as men (61.9%). All respondents reported being born outside of Canada (57.1% with citizenship or permanent resident status; 40.5% non-permanent residents). Over half of respondents were recruited at WPHC (57.1%). The majority had completed trade school, college, a bachelor's degree or higher (76.1%), and approximately 75% were employed either full-time or part-time. Household income was most frequently reported in the two lowest quintiles in Canada, with over half (52.4%) of respondents' households earning $57,700 CAD or less prior to their TB diagnosis. Almost all respondents reported some form of health insurance (including Ontario Health Insurance Plan [OHIP], TB-UP). Over half of respondents had pulmonary TB (57.1%). Characteristics of respondents are reported in **Table 1**.

Outcomes

Each TB-related clinical appointment had a mean total cost of $42.82 (SD=$47.89) (**Table 2**). Costs included those related to transportation, parking and food. No respondents required childcare or accommodation to attend their routine appointments. Transportation costs for each appointment varied by mode of transportation, with the highest cost associated with respondents who traveled by taxi or rideshare at their own expense (n=17; mean cost=$70.24 per appointment) and the lowest for respondents who traveled by public transit (n=15; mean cost=$19.87 per appointment). No respondents reported any direct medical costs (e.g., medicines, appointment fees, imaging) associated with their TB care.

When stratified by immigration status, permanent residents, citizens born outside of Canada and non-permanent residents had similar costs. Costs varied by treatment centre; respondents receiving care at WPHC had a mean cost of $50.92 (SD=$57.09). Respondents receiving care at TWH had a mean cost of $32.03 (SD=$30.10). More people being treated at WPHC drove or took a taxi or rideshare to their appointments

Table 1: Baseline characteristics of survey respondents

Characteristic	n[a]	%
Sample size	42	100
Age, mean (SD) (years)	36.7 (14.95)	range: 20–71
Gender identity		
Man	26	61.9
Woman	16	38.1
Other[b]	0	0
Immigration status		
Citizen, immigrant or permanent resident	24	57.1
Citizen, born in Canada	0	0
Non-permanent resident	17	40.5
Information missing	1	2.4
Treatment location		
West Park Healthcare Centre	24	57.1
Toronto Western Hospital	18	42.9
Education		
Not completed high school or completed high school	10	23.8
Completed trade school or college	8	19.0
Bachelor's degree	10	23.8
Post secondary above bachelor's degree	14	33.3
Employment status at baseline		
Full-time	20	47.6
Part-time, casual or flex	11	26.2
Student or unemployed	11	26.2
Household income prior to TB ($)		
0–34,400	11	26.2
34,401–57,700	11	26.2
57,701 or higher	9	21.4
Don't know or prefer not to answer	11	26.2
Location of TB in body		
Lungs	24	57.1
Outside lungs	13	31.0
Did not know	5	11.9
Insurance status[c]		
Provincial or federal health insurance	32	76.2
Private insurance	7	16.7
TB-UP	6	14.3
Uninsured	fewer than 6	fewer than 14.3
Hospitalized during TB treatment		
Yes (previously or currently)	20	47.6
No	22	52.4

Abbreviations: SD, standard deviation; TB, tuberculosis; TB-UP, treatment services for uninsured person program

[a] Small cells (<5) were supressed throughout this table to minimize reidentification risk

[b] This survey question also included responses for transgender man, transgender woman, non-binary or gender diverse and two spirit; however, no respondents identified these ways

[c] Total selections can add up to more than 100% for insurance status if participants reported having more than one type of insurance coverage (e.g., private insurance and provincial health insurance). Provincial or federal health insurance included Ontario Health Insurance Plan, another provincial health insurance plan or the Interim Federal Health Program

Table 2: Out-of-pocket costs (CAD) associated with one tuberculosis appointment

Sample	n	Mean (SD) ($)	Median (IQR) ($)
Overall	42	42.82 ($47.89)	29.50 ($11.25–$49.00)
By immigration status			
Born outside of Canada, citizen/ permanent resident	24	43.65 ($49.46)	30.00 ($10.13–$44.00)
Born outside of Canada, non-permanent resident	17	43.48 ($47.96)	29.00 ($15.00–$55.00)
By treatment centre			
West Park Healthcare Centre	24	50.92 ($57.09)	37.00 ($10.75–$56.25)
Toronto Western Hospital	18	32.03 ($30.10)	21.75 ($12.25–$32.25)
By travel method			
Car	8	33.75 ($17.97)	36.00 ($27.50–$43.00)
Public transit	15	19.87 ($14.75)	16.00 ($9.00–$21.75)
Taxi or rideshare	17	70.24 ($64.21)	50.00 ($25.00–$110.00)
By hospitalization status			
Yes (previously or currently)	20	57.26 ($60.93)	35.00 ($6.90–$77.50)
No	22	29.71 ($27.21)	23.50 ($12.75–$7.00)

Abbreviations: CAD, Canadian dollars; IQR, interquartile range; SD, standard deviation

Table 3: Social and financial outcomes reported by people with tuberculosis

Social outcome	n[a]	%
Number of participants	42	100
Experienced job loss	12	28.6
Missed work for treatment	26	61.9
Experienced social exclusion	23	54.8
Experienced food insecurity	8	19.0
Change in household financial status		
Much worse	7	16.7
Somewhat worse	12	28.6
No change	more than 10	more than 23.8
Somewhat better	fewer than 6	fewer than 14.3
Much better	fewer than 6	fewer than 14.3
Missing	fewer than 6	fewer than 14.3

[a] Small cells (<5) were supressed throughout this table to minimize reidentification risk

(n=18 of 24; 75.0%) compared to UHN (n=7 of 18; 38.9%). Twenty-one respondents (50.0%) indicated that they completed directly observed therapy; none reported any costs associated with this.

As a result of their TB diagnosis, 30 people (71.4%) indicated that they isolated for at least a day. Of those individuals, the IQR of number of days spent isolating was 7.8 to 30.0 days (mean=35 days; median=16.5 days).

Changes in work and household financial status following TB diagnosis varied among respondents (**Table 3**). Almost two-thirds (61.9%) missed work due to TB treatment and 28.6% experienced job loss (Table 3). Among those who lost their jobs, half were employed full-time at baseline and half were in part-time, casual or flexible roles; 66.7% were in the lowest two income quintiles. Of the 26 individuals who missed work related to their diagnosis, hours missed ranged from 6 to 480 hours, with a mean of 130 hours (SD=140.7 hours; median=80.0 hours; IQR=30.0–192.0 hours). Nearly half (45.3%) of respondent's financial situation became somewhat or much worse, and 19.0% experienced food insecurity.

Discussion

This study examined the out-of-pocket costs and social impacts of TB among people receiving treatment at two specialized TB care centres in Toronto, Canada. Key findings indicate that TB-related appointments were associated with a mean cost of $42.82 per visit. If people with TB attend 8–12 routine appointments on average, this amounts to a mean cost of $343 to $514. This study identified a difference in costs by TB treatment centre, with higher costs for WPHC compared to TWH. As a specialist referral centre, WPHC serves the Greater Toronto Area, a wide geography, and is not well served by public transit; in contrast, the TWH clinic is in downtown Toronto and has multiple transit connections.

This study also identified that 45.3% of respondents reported a decline in their household financial status following their TB diagnosis, with 16.7% indicating a substantial worsening. Among those who reported missing work, the mean hours missed was 130, which, assuming no paid leave and using the 2023 Ontario average hourly wage ($34.63), corresponds to approximately $4,502 in lost income per person. This estimate likely underrepresents the impact for individuals who lost employment entirely. Notably, nearly one-third of participants in this study reported job loss, a disproportionate share of whom (66.7%) were in the lowest two income quintiles prior to diagnosis. These findings suggest that the financial impact of job loss may be more substantial for individuals in lower-wage or precarious employment, where even short absences or disclosure of a TB diagnosis may lead to job loss.

The Canadian TB Standards provide up-to-date practical management information for the care of patients with TB including information and guidance on aspects of pathogenesis, epidemiology and TB management in Canada. It includes a practice statement that reads: "People with TB disease should be provided all medications and services required to successfully complete TB therapy free of charge, regardless of their insurance coverage or residency status in Canada," (10). In this study, respondents did not report direct medical costs associated with

their TB disease which is consistent with the public funding structure for TB care in Ontario (4). In addition to treatment and TB-related clinical care being free to people with TB in Toronto, Toronto Public Health also provides services and limited financial support to alleviate the economic burden of TB (11). These additional services may include social work assistance, food vouchers, paying for taxis to attend appointments and providing emergency accommodation during the mandatory isolation period. The findings of this study highlight the importance of such public health supports.

These findings align with prior research demonstrating that TB is associated with direct and indirect (productivity) costs, even in settings where most direct medical expenses are covered by publicly funded healthcare systems (6). While no respondents in the current survey reported direct medical costs associated with their TB care, non-medical expenses, such as transportation and productivity losses contributed to their financial burden.

Strengths and limitations

Several limitations should be considered when interpreting these findings. The small sample size (n=42) limits the generalizability and transferability of results to other populations and settings, and the recruitment of respondents from only Toronto, an urban centre, may not be representative of the broader population of individuals with TB in Ontario or representative of the specific experiences of all migrant populations or key vulnerable populations (in 2023, 37.7% of people with TB disease in Ontario were reported by Toronto Public Health, 94% of whom were foreign-born) (12). The small sample size also prevented us from making associations between respondent characteristics and cost outcomes. This includes the inability to compare cost and productivity related outcomes by location of TB in the body (i.e., pulmonary or extra-pulmonary), which may impact costs due to different isolation requirements. Additionally, self-reported data on costs, work disruptions and social outcomes (which were not defined) may be subject to recall bias or social desirability bias (13). The cross-sectional and descriptive approach of this analysis limits the ability to determine causation between TB and patient costs. Additionally, this study was unable to compare complete responses to those who did not complete the survey. Finally, the WHO TB patient cost survey has not been formally validated in this study's setting, and definitions for social outcomes were not provided to respondents which may reduce the reliability of responses.

Despite these limitations, this study has several strengths. The use of a modified WHO TB patient cost survey allowed for a comprehensive assessment of the financial and social impacts of TB in the Ontario health care context. Additionally, recruiting respondents from both WPHC and TWH allowed the incorporation of both complex and more standard TB care settings, improving the relevance of findings across different treatment pathways. These results contribute to a growing body of evidence on the economic and social consequences of TB and highlight the need for policies that mitigate financial hardship and support individuals affected by TB.

Conclusion

This study found that people receiving treatment for TB in Toronto faced out-of-pocket costs and social challenges, despite publicly funded health care. These findings will contribute to a deeper understanding of the financial challenges faced by people with TB and may be useful in informing public health policy.

Authors' statement

LR — Conceptualization, survey development, analysis, interpretation, writing–original draft, writing–review & editing
EN — Survey development, data collection, writing–review & editing
ER — Conceptualization, data interpretation, writing–review & editing
AA — Patient recruitment, writing–review & editing
JM — Patient recruitment, writing–review & editing
TN — Patient recruitment, writing–review & editing
MH — Project administration, data collection, writing–review & editing
NY — Project administration, data collection, writing–review & editing
AD — Survey development, writing–review & editing
KO — Survey development, writing–review & editing
CP — Survey development, writing–review & editing
YS — Data analysis, writing–review & editing
SB — Conceptualization, participant recruitment, data interpretation, writing–review & editing
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The content and view expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

Competing interests

None.

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SURVEY REPORT

Impact of language concordant care on comprehension and adherence to infection prevention protocols among hospitalized patients: A multicentre survey

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Abstract

Background: Language concordant care can influence patient outcomes. The level of language concordant care and its impact on adherence to infection prevention protocols has not been well described.

Objective: To assess whether patients' preferred language impacts their ability to follow infection prevention protocols.

Methods: A multicentre survey was performed to assess understanding and self-reported adherence to two different sets of infection prevention instructions: preoperative chlorhexidine bathing before cardiac surgery and central line care during chemotherapy for hematologic malignancy. Standardized interviews were conducted following cardiac surgery or central vascular catheter insertion. Preferred language was defined by patient's stated preference, with professional hospital-based interpretation used for patients with non-English language preference.

Results: Among 238 eligible patients, 222 (93%) completed the interview across both sites, including 179 (81%) with English preference and 43 (19%) with non-English preference. Comprehension of infection prevention instructions among English-preferred and non-English-preferred groups was no different (97.2% vs 93.0%; p=0.19), and similar for reported adherence (97.8% vs 97.7%; p=0.97). Among 26 (65%) non-English-preferred patients, instructions were reported to be interpreted by family rather than by hospital-based interpretation services. Qualitative themes included reliance on family for interpretation or other informal solutions, patient frustration with language barrier and expressed desire for improved language services.

Conclusion: No significant difference was identified in comprehension or adherence to infection prevention protocols based on language preference; however, closing this gap relied on family members or other informal solutions. Given the risks and inequity of such workarounds, improved use of hospital-based interpretation services is needed.

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Introduction

Roughly one in five Canadians report that their first language is a language other than French or English (1). Language barriers during a hospital stay are associated with reduced satisfaction of patients and providers as well as inferior patient outcomes (2–4).

Language discordant care may also be a risk factor for development of some healthcare-associated infections. In a recent large retrospective cohort study in the United States, speaking a language other than English was associated with a 60% higher risk of central-line associated bloodstream infection (5).

In Canada, there is a paucity of data regarding whether patients receive language concordant care related to protocols intended to mitigate their risk of healthcare-associated infection (6–8). A multicentre survey was performed to assess whether there was a difference in comprehension and/or adherence to two infection prevention protocols based on a patient's reported preferred language.

Methods

This study was conducted at two large academic hospitals in Toronto among two distinct patient populations that receive standardized instructions to mitigate risk of infection. The first population included patients undergoing cardiac surgery and receiving instructions on preoperative bathing with chlorhexidine. The second population included patients with hematologic malignancies who receive instructions on how to reduce their risk of infection following outpatient central-line insertion.

Eligible participants from the cardiac surgery group were admitted patients who underwent elective cardiac surgery within the previous 14 days and had received preoperative instructions in the outpatient clinic. Eligible participants from the malignant hematology population included patients who had their first central-line inserted within the previous 60 days and had spent at least 24 hours at home since insertion. Those declining to be interviewed, or with cognitive impairment, or speaking an unavailable language for interpretation, or reporting never having received infection prevention instructions were excluded from both groups.

Between June 1, 2024 and October 31, 2024, eligible participants were approached by infection prevention and control professionals. Those consenting to participate underwent anonymous semi-structured interviews lasting 5–10 minutes. The interview first confirmed their preferred language and verified their understanding and reported adherence to specific infection prevention protocols (**Table 1**). If a patient identified a non-English language as their preferred language, the remainder of the interview was conducted using the hospital provided

Table 1: Standardized interview questions to determine comprehension and reported adherence to infection prevention instructions

Cardiac surgery questions	Malignant hematology questions
Quantitative questions	
1. What is your preferred language? 2. Please describe the instructions you were given: What were you told about bathing/cleaning protocols when at home before your surgery? (can describe bathing with general details=1; otherwise=0)	1. What is your preferred language? 2. Please describe the instructions you were given: What were you told about how to care for your line while at home? (can describe at least two—e.g., keep dry, keep clean/covered, no pets, no underwater=1; fewer than two=0)
3. Prompts, only if scored zero: a. Were you told to use the yellow soap for five days prior to surgery? (yes with prompting=1; no with prompting=0)	3. Prompts, only if scored zero: a. Do you know if you are allowed to submerse your line in water? (neither PICC nor Hickman line can be fully submerged, yes=1; otherwise=0) b. Were you asked to keep your dressing dry? (yes with prompting=1; no with prompting=0)
4. (For patients with non-English preferred language) How were these instructions given to you? (no interpreter; interpretation by third party; interpretation by family/friend)	4. (For patients with non-English preferred language) How were these instructions given to you? (no interpreter; interpretation by third party; interpretation by family/friend)
5. Adherence to recommendations: Did you perform bathing before your surgery? (yes=1; no=0)	5. Adherence to recommendations: Did you keep your line clean, covered, and away from water? (yes=1; no=0)
Qualitative questions	
6. (For patients with non-English preferred language) During your interactions with the healthcare team, did you feel your ability to communicate in English influenced your ability to follow the recommendations?	6. (For patients with non-English preferred language) During your interactions with the healthcare team, did you feel your ability to communicate in English influenced your ability to follow the recommendations?
7. (For patients with non-English preferred language) Are there any other ways in which your ability to communicate in English affected your health in the hospital?	7. (For patients with non-English preferred language) Are there any other ways in which your ability to communicate in English affected your health in the hospital?

Abbreviation: PICC, peripherally inserted central catheter

interpretation service using a speaker phone or in-person interpretation. An interview tool contained standardized prompts to assist patients with understanding the question as needed. A second interviewer was present for the first six non-English interviews (24 questions) to independently validate the quantitative responses across both patient populations (Kappa=1.0).

The primary outcome of the study was the proportion of patients that could demonstrate understanding of infection prevention instructions. The secondary outcome was the proportion of patients that adhered to infection prevention instructions. Patients were categorized based on self-reported preferred language (English or non-English language). This categorization was used as English is the language used routinely in the two participating hospitals. French preference was analyzed with the non-English preference group as too few patients preferred French. If present, the type of method of interpretation used by non-English preferred patients was recorded. The differences in group proportions were compared using chi-square tests. Responses to open-ended interview questions (questions 6, 7) were summarized and reviewed for emerging qualitative themes using grounded theory methodology (9). Research ethics review was not required because the project met criteria for exemption based on institutional process for quality improvement.

Results

Among 238 eligible patients across both sites, 222 (93.3%) consented to participate while 11 (4.6%) declined and five (2.2%) were excluded due to confusion (n=2), lack of available interpreter for language (n=1) and reporting not receiving infection prevention instructions (n=2). There were 179 (80.6%) participants with English language preference and 43 (19.4%) with non-English language preference.

The proportion of patients who confirmed comprehension and reported adherence to infection prevention protocols are summarized in **Table 2**. Overall, no significant difference was identified between English-preferred and non-English-preferred groups for either comprehension (97.2% vs 93.0%; p=0.19) or adherence (97.8% vs 97.7%; p=0.97). Among 26 (65%) non-English preferred patients, instructions were interpreted for them by a family member or other informal means, rather than by hospital-based interpretation service (**Table 3**). All three patients who did not comprehend the instructions had neither assistance from family nor informal means nor use of hospital-based interpretation.

Table 3: Comprehension of instructions by method of interpretation

Method of interpretation	Patient comprehended (n=40)	Patient did not comprehend (n=3)
Family/friend provided interpretation	26 (65%)	0 (0%)
Interpretation services used	3 (8%)	0 (0%)
No interpreter used	11 (27%)	3 (100%)

Four qualitative themes were identified among those with non-English preference as summarized in **Table 4**. These included the use of workarounds to access interpretation using family or other just-in-time solutions, frustration about language barriers, and calling for the need for improved access to healthcare services in their language.

Discussion

In this Canadian study examining the effect of language preference on understanding and adhering to hospital infection prevention protocols, we identified no significant difference among non-English preferred patients; however, addressing this gap relied on family members or other informal solutions. This finding is supported by both the quantitative and qualitative data, suggesting that existing hospital-based interpretation services were infrequently used in these situations.

Disparities in access to language concordant care exist across Canada and have been shown to influence patient outcomes, including repeat hospital visits, readmissions and in-hospital death (7,8). In a retrospective cohort study of homecare recipients admitted to hospital in Ontario, Canada, those who received over 50% of their care from physicians who spoke the patients' primary language had better in-hospital outcomes (8).

The effect of language concordant care on development of healthcare-associated infection in Canadian hospitals is far less

Table 2: Proportion of patients confirming comprehension of and adherence to infection prevention instructions based on language preference

Outcome	Language preference	Hospital A	Hospital B	Combined	p-value
Comprehension	English	90 (98%)	84 (97%)	174 (97%)	0.19
	Non-English	20 (87%)	20 (100%)	40 (93%)	
Adherence	English	90 (98%)	85 (98%)	175 (98%)	0.97
	Non-English	23 (100%)	19 (95%)	42 (98%)	

Table 4: Emergent qualitative themes among interviews of non-English preferred patients

Theme	Description	Participant quotes
Family member interpretation support	Family members and friends provided significant support assisting non-English speaking patients with understanding and adhering to instructions	"If (the patient) didn't have someone to help him, he would not be able to understand the instructions as his comprehension in English is not good enough to understand medical terms". "If patients don't have family around, understanding and following instructions would be challenging for them".
Just-in-time solutions	Translation was often accessed via non-hospital provided services (e.g., Google translate, a healthcare worker who speaks the patient's language, etc.)	"Some nurses were using Google translate with me, which was helpful".
Patient frustration with language barrier	Patients expressed communication challenges with their care teams despite availability and use of existing hospital-provided translation services	"If I was able to speak English, my experience would have been better". "I was very upset because I couldn't communicate how I was feeling until the nurse who spoke my language came to help".
Patient and family ideas for improvement	Suggested services and options to enhance the experience of patients who prefer non-English languages	"I would like to see written documentation given to [non-English speaking] patients in their primary languages, as is done in the local school system for parents". "If family members are not here, it would be helpful for patients to know what options exist for translation and how to access those services".

clear. One important barrier is that data related to patients' preferred language and data related to health equity are not routinely recorded on admission to hospital or linked to hospital infection surveillance, as practiced in other countries (3). Self-care of vascular catheters and preoperative bathing before cardiac surgery are both essential practices that have been shown to reduce the risk of healthcare-associated infection (10,11). These practices were therefore well suited to systematically assess the impact of language preference on implementing these critical infection prevention instructions in Canadian hospitals.

While an overall difference was not identified in comprehension or adherence, language concordant delivery of infection prevention protocols frequently relied on workarounds in our hospitals. Despite the small number (n=3), 100% of those who did not comprehend instructions had no interpretation provided, which provides a glimpse into the inequity that exists if family or other informal means of interpretation is not present to fill this gap. In addition, relying on family or other informal solutions for interpretation of critical information for patients is associated with potential risks of misinterpretation due to the lack of formal training (4). The qualitative data in our study supports the idea that patients and family members expressed frustration with having to fulfill this role and wished for improved hospital-based interpretation services. In response to these and other patient experience data, the two organizations capture language preference on admission and have increased utilization of hospital-based interpretation via a mobile system.

The study has several important strengths. It was conducted across two acute care hospitals which improves the external validity of these findings. A validation of the questionnaire was performed to ensure that it was reliable between interviewers and assessed for confounders including use of informal interpretation solutions. Both closed and open-ended questions were included to fully explore patient and family views. Finally, patients were surveyed in two different patient populations receiving different types of infection prevention protocols.

Limitations

Several important limitations should be noted. First, the study relied on self-reported adherence to infection prevention protocols, which may overestimate actual adherence due to recall bias. Second, a small number of interviews could not be completed due to unavailability of specific language interpreters, which could have differentially excluded non-English preference participants. Third, both participating hospitals are located in a predominantly English speaking region, whereas results may differ in other parts of Canada where French or Indigenous languages are more prevalent. In addition, the large urban setting has a large variety of non-English languages that has likely prompted increased focus on language concordant care compared to other Canadian hospitals in smaller or non-urban settings.

Conclusion

Although the study did not detect a significant difference in understanding and reported adherence based on language preference, it highlighted the risks and inequity of having to rely on family members or other informal solutions. Hospitals should focus on encouraging the use of formal interpretation services when delivering critical infection prevention instruction.

Authors' statement

PR — Acquisition, analysis or interpretation of data, supervision, statistical analysis, drafting the manuscript
AR — Acquisition, analysis or interpretation of data, critical revision of manuscript
RC — Acquisition, analysis or interpretation of data, critical revision of manuscript

SL-A — Acquisition, analysis or interpretation of data, critical revision of manuscript
VA — Acquisition, analysis or interpretation of data, critical revision of manuscript
HN — Acquisition, analysis or interpretation of data, critical revision of manuscript
AV — Concept and design, administrative support, statistical analysis, supervision, critical revision of manuscript
JL — Concept and design, administrative support, statistical analysis, supervision, critical revision of manuscript

The content and view expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

Competing interests

Dr. Jerome Leis has provided expert testimony requested by hospitals of the Ontario Hospital Association. None of the other authors have conflicts of interests to declare.

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Canadian nurses' perspectives on challenges to antimicrobial stewardship in long-term care homes

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Abstract

Background: The World Health Organization recognizes antimicrobial resistance (AMR) as a top global health threat. Antimicrobial resistance-related deaths in Canada are projected to exceed 13,500 annually by 2050. In long-term care homes (LTCH), 40% to 75% of antimicrobial prescriptions are inappropriate or unnecessary. Nurses are well-positioned to lead in antimicrobial stewardship (AMS) initiatives; however, it is unclear what challenges LTCH nurses face in participating in AMS activities. This study aims to provide insights into barriers and facilitators influencing nurses' engagement in AMS within Canadian LTCHs.

Methods: A survey was developed using literature and an AMS working group assessing AMS knowledge (10 questions), confidence, barriers and facilitators. The survey targeted nurses working in Canadian LTCHs and was administered through Qualtrics online from January 20, 2023 to April 10, 2023 by distribution partners to obtain a convenience sample. Open-coding thematic analysis was used to describe quantitative data and analyze qualitative responses.

Results: A total of 346 complete responses were recorded. The mean knowledge score was 71% (standard deviation [SD]=15%). Most respondents perceived infection prevention and control measures, and monitoring changes in the health of residents to be part of the duties of nurses within AMS. However, making recommendations about antimicrobials was the least cited nursing responsibility. This suggests a lack of clarity around the role of nurses in AMS. Barriers to AMS activities included pressure to treat and lack of meaningful interprofessional communication, while AMS education and senior management support were drivers for AMS engagement.

Conclusion: Education, senior-level support, and formal recognition of nurses in AMS programming represent key facilitators to effectively engage LTCH nurses in AMS best practices.

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Introduction

Antimicrobial resistance (AMR) is recognized as a public health risk globally (1) and in Canada (2). According to the Council of Canadian Academies by 2050, deaths in Canada attributable to AMR is predicted to reach over 13,500 per year (3). In long-term care home (LTCH) settings, 40% to 75% of antimicrobial prescriptions are inappropriate or unnecessary (4–7). Antimicrobial stewardship (AMS) programs use a systematic approach to improve judicious antimicrobial use (AMU) and promote behavioural changes, commonly focusing on the beliefs and motivations of prescribers (8,9).

Long-term care home physicians often oversee over 50 residents (10) and, in turn, rely on nurses, who interact frequently with residents and their caregivers, to monitor and contribute to residents' care plans (11). Recognizing the potential for nurses to lead AMS, the Canadian Nurses Association (CNA) Antimicrobial Stewardship Competencies: A Pan-Canadian Framework for Nurses identified seven AMS domains to effectively promote and participate in AMS in nurse practice settings (12). While nurses have been identified as important and successful AMS stewards, and some research focuses on the roles, perspectives, and challenges for nurses around AMR and AMS (13–15), there is no clear literature focusing on the Canadian LTCH context specifically targeting nurses working in these settings. This study aims to describe the current landscape, based on the perspectives of nurses in Canadian LTCH settings, to identify the barriers and facilitators that influence their engagement in AMS, thereby informing future initiatives and enhancing their contributions to AMS activities.

Methods

Survey design

Survey development involved an informal literature review on AMS initiatives that include nursing staff and was overseen by a working group of infectious disease physicians, behavioural scientists and infection prevention and control (IPC) experts. For face validity, appropriate length and clarity, the survey was piloted by four LTCH nurses.

The anonymous 15 minute online survey (**Appendix**, Table S1) ran from January 20, 2023 to April 10, 2023, targeting Canadian LTCH nurses via convenience sampling through distribution partners (Appendix, Table S2). Informed consent was obtained, with no incentives, and data privacy followed the *Canadian Privacy Act*.

The survey consisted of four sections: participant demographics, knowledge, perspectives, and barriers and facilitators. Two open-ended questions were included for additional comments.

Demographics

Demographics included educational background, work experience, certifications and previous AMS/AMR training.

Knowledge

Eighteen knowledge questions were adapted from the literature to determine each respondent's knowledge of AMS practices (16–20). Topics included defining relevant concepts (AMR, AMS, IPC, judicious AMU), and identification and testing for respiratory tract infections (RTIs), and urinary tract infections (UTIs) (16–25) (Appendix, Table S1). Ten of 18 questions were randomly displayed to respondents.

Perspectives

Respondents were asked about their perspectives on AMU (8), influence on prescribing antimicrobials, responsibilities related to AMS, and their self-reported behaviours around AMR (22,24). Confidence related to performing AMS-related tasks was assessed using Likert scales (25) (Appendix, Table S1).

Barriers and facilitators

Twelve barrier indicators and ten facilitator indicators for AMS activities were identified through literature (26) and examined using Likert scales.

Descriptive analysis was conducted using R software (27) and Microsoft Excel (28), as well as open-ended thematic coding to analyze qualitative responses. Due to a low response rate, no sub-group analyses were conducted.

Results

The survey was completed by 346 LTCH nurses (326 female, 94%), and 106 (31%) of the respondents were 45–54 years old) (**Table 1**). One quarter (92/346, 27%) of respondents were from Alberta, followed by Manitoba (79/346, 23%), New Brunswick (66/346, 19%), and Ontario (61/346, 18%). Over half (195/346, 56%) of respondents had more than 10 years of experience working in LTCHs, 57% worked full-time, and most were registered nurses (64%). Respondents also included eleven (3%) nurses who were directors of care or in manager positions.

Antimicrobial stewardship knowledge

The mean score for the knowledge questions was 71% (7/10) (standard deviation [SD]=15%) with a range of 1/10 to 10/10 (**Figure 1**). The highest scores were reported for IPC questions (86%, SD=28%), followed by AMS knowledge questions (75%, SD=24%). The lowest scores were for RTI-related questions (62%, SD=43%). Forty-two percent (146/346) of respondents indicated awareness of an AMR or AMS policy at their LTCH. Thirty-three percent (114/346) of respondents reported not receiving AMR training in the past twelve months.

Perspectives

Eighty-one percent (281/346) of respondents reported that AMU is a problem in Canada, however, only 41% (143/346) indicated that antimicrobial overuse is a problem at their LTCH. Most respondents felt physicians (335/346, 97%) and pharmacists (308/346, 89%) were highly responsible for AMS, while 87% felt nurses were highly responsible for AMS activities.

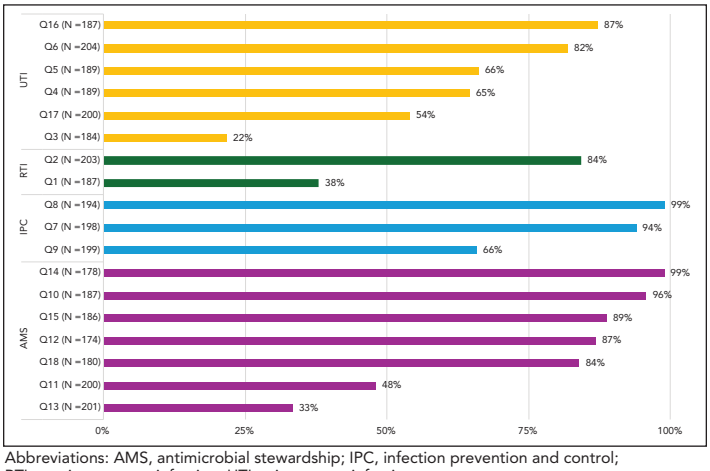
Most respondents perceived the following stewardship activities to be part of their responsibilities: IPC measures (340/346, 98%), monitoring changes in resident health status, with certain signs and symptoms that would indicate the need for testing and

Table 1: Demographics

Respondent characteristics (n=346)	Number (%)
Age	
<35	47 (14%)
35–44	98 (28%)
45–54	106 (31%)
55–64	82 (24%)
65+	13 (4%)
Gender	
Woman	326 (94%)
Man	16 (4.6%)
Other/undeclared	2 (0.6%)
Prefer not to say	1 (0.3%)
No response	1 (0.3%)
Experience	
>10 years LTCH nursing	195 (56%)
>10 years total nursing experience	259 (75%)
Employment type	
Full-time	197 (57%)
Part-time	112 (32%)
Casual	30 (9%)
Nursing title	
Nurse practitioner (NP)	4 (1%)
Registered nurse (RN)	217 (61%)
Licensed practical nurse (LPN)/Registered practical nurse (RPN)	101 (30%)
Other	15 (4%)
Certification	
Gerontology	151 (44%)
Infection prevention and control	64 (19%)
Wound, ostomy, and continence	33 (10%)
Hospice	19 (6%)
Psychiatric	18 (5%)
Other	26 (8%)
None	117 (34%)
Type of LTCH	
Public	166 (48%)
Private non-profit/for-profit	139 (40%)
Don't know/unsure	41 (12%)
Province of practice[a]	
Alberta	92 (27%)
Saskatchewan	20 (6%)
Manitoba	79 (23%)
Ontario	61 (18%)
New Brunswick	66 (19%)
Nova Scotia	25 (7%)
Prince Edward Island	3 (1%)

Abbreviation: LTCH, long-term care home
[a] No responses were received from Québec, British Columbia, Newfoundland and the territories

Figure 1: Knowledge questions



Abbreviations: AMS, antimicrobial stewardship; IPC, infection prevention and control; RTI, respiratory tract infection; UTI, urinary tract infection

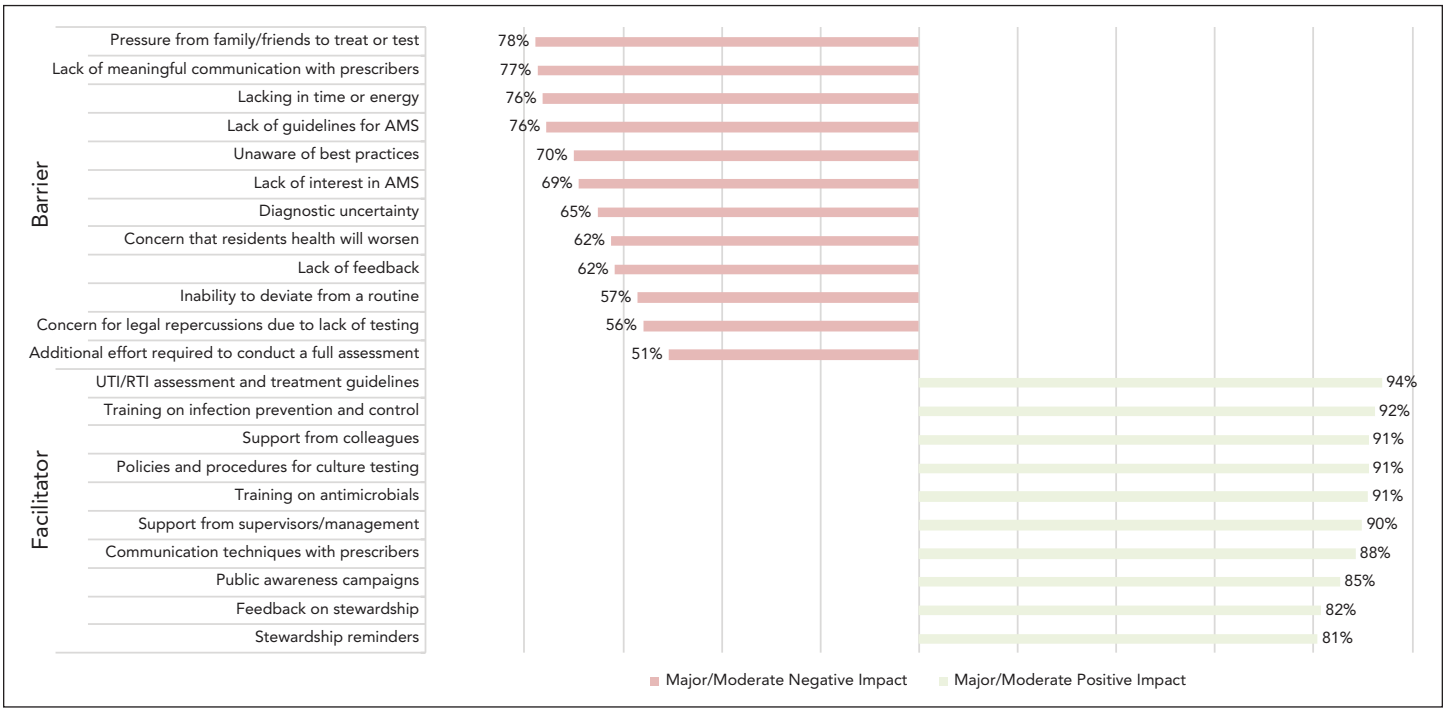
potential treatment (337/346, 97%), and monitoring side effects of medication (318/346, 92%). Providing recommendations on appropriate dosage and duration (148/346, 43%), discontinuation of antimicrobials (134/346, 39%), and use of narrow-spectrum antimicrobials (127/346, 37%) were activities least identified to be responsibilities of nurses. Over half of respondents (199/346, 58%) reported that when testing for UTIs, they always or often consider AMR. In practice, 53% (184/346) report administering or overseeing two or fewer urine cultures per month. Most respondents (282/346, 82%) felt at least somewhat comfortable raising concerns about antimicrobials to physicians, and 75% of respondents believe their interdisciplinary communication with physicians and pharmacists can influence antimicrobial prescribing. However, 46% (159/346) of respondents believed that they sometimes or often gave antimicrobials that they thought were inappropriate.

Respondents had high overall confidence in performing AMS tasks (average 4.1/5, SD=0.6). Respondents felt least confident identifying an incorrectly prescribed antimicrobial class (3.3/5) and felt most confident recognizing signs and symptoms of UTI in residents (4.5/5). High confidence was not statistically significantly correlated with knowledge score.

Barrier and facilitator indicators

Responses ranged widely on how each barrier affected nurses' ability to practice AMS at their LTCH (**Figure 2**). The most prevalent barriers were pressure from a resident's family and friends to treat or test (269/346, 78%), lack of meaningful communication with prescribers (268/346, 77%), lack of time or energy (264/346, 76%), and lack of guidelines for AMS in the LTCH setting (261/346, 76%). The least cited barrier was having to conduct a full assessment, making antibiotics the easiest course of action (176/346, 51%).

Figure 2: Barriers and facilitators



Abbreviations: AMS, antimicrobial stewardship; RTI, respiratory tract infection; UTI, urinary tract infection

For facilitators, UTI or RTI assessment and treatment guidelines (324/346, 94%) were perceived to positively influence the practice of AMS among nurses, followed by IPC training (320/346, 92%), policies and procedures for specimen testing (315/346, 91%), and support from colleagues (315/346, 91%). The lowest response was for stewardship reminders, such as AMR posters in the halls (280/346, 81%). It was unknown whether respondents had access to all facilitators, however, all facilitators were perceived to be beneficial in promoting AMS practices. There were no significant differences in facilitators or barrier ranking when comparing nurses with over 10 years and less than 10 years of experience in LTCHs.

Qualitative analysis

Of the 346 respondents, 159 (46%) provided open-ended responses. Key facilitators included education, workplace guidelines, advocacy, and provincial/national AMS guidelines. Responses highlighted successful implementation, adequate staffing, and management endorsement and participation. One noted the influence of culture and collaboration: "It is an antibiotic first culture. We need to focus on other non-pharmaceutical interventions to... maintain health and prevent infection are the key, the challenge is to have adequate staffing to achieve this. This is a systemic problem and requires the financial support of the government and the local leadership team."

Respondents noted that everyone had a role in AMS and desired accessible training and inclusion of other healthcare staff and residents and their caregivers in AMS education. Improved interdisciplinary communication, collaboration and building a preventive culture were needed. Workload, staff shortages, and staff burnout were persistent barriers.

Discussion

There is growing international interest in implementing and evaluating AMS in community settings (29). Internationally, the focus has been on nursing home staff (which often includes less clinically complex residents), however, LTCH nurses have not been well-studied in the context of AMS. It is necessary to understand the perspectives and knowledge of LTCH nurses to understand barriers and facilitators to AMS engagement.

Respondents felt highly responsible for many AMS activities. Nearly all respondents identified AMR as an issue and believe they can contribute positively to AMS at their workplace. Respondents performed best on IPC and AMS knowledge questions, suggesting familiarity with AMS practices. The widely ranging overall scores suggest variations in knowledge of AMS, including lack of AMS guidelines, lack of awareness of best practices, insufficient training, and low awareness of existing AMS policies. Furthermore, qualitative responses supported tailored education, AMS-specific training and specific guidelines to promote the involvement of nurses.

Respondents were confident in their abilities to perform AMS tasks, specifically those related to education on AMU, recognizing signs of infection, and performing tests in line

with IPC practices. However, confidence did not correlate with better knowledge scores as noted among other healthcare professionals (30). High confidence reinforced the suggestion that many nurses are familiar with AMS tasks and frequently perform them. Formally recognizing their roles and supplying the appropriate training and support can address gaps in stewardship knowledge (9,15,29).

Interprofessional communication is critical for combatting AMR in LTCHs (29,31–33). While most nurses felt comfortable raising concerns to physicians about antimicrobial therapy, almost half felt they may be administering inappropriate antimicrobials. A lack of meaningful communication suggests nurses' concerns are not taken into consideration by other health professionals. The framework (published after survey distribution) identifies timely communication and discussion on antimicrobial therapy as core competencies (12), however, survey findings suggest current lines of communication may not be sufficient for effective interprofessional collaboration and thus should be prioritized.

Over three quarters of respondents identified seven of the eleven stewardship activities to be part of a nurse's responsibility in LTCHs, confirming that nurses already take on stewardship roles (34–37). However, less than half perceived recommendations on antimicrobial therapy as their responsibility, highlighting a discrepancy in AMS involvement for these activities. While most LTCH physicians are the prescribers, LTCH nurses are the most present regulated healthcare professionals and significantly influence residents' care plans, including decision-support for antimicrobial therapy (11,13). Notably, the framework and AMS best practices highlight two competencies: appropriate use of antimicrobial agents and interprofessional collaborative practice, which can involve recommendations from nurses on antimicrobial therapy (12,13). Potential reasoning for the gap in nurses' perspectives include unclear AMS responsibilities, a lack of confidence in their AMS knowledge, and a lack of interprofessional relationships that foster collaborative AMS discussions. The framework also promotes clear role definition, interprofessional collaboration, and ongoing education (12). Formal inclusion of nurses in AMS activities acknowledges their significant contributions, strengthens their role in antimicrobial decision-making, and empowers them to actively participate and lead in AMS initiatives within their organizations (38).

All listed facilitators were well-received by respondents, indicating implementing any of them could be beneficial (Figure 2). Respondents specifically mentioned buy in from senior management and other healthcare professionals would be extremely beneficial to their AMS activities, partly because they perceive that they are working in an "antimicrobials-first culture" with little senior leadership that encourages AMS. The listed facilitators can be used to identify optimal strategies for incorporating nurses in AMS activities in their local context. The listed barriers had greater variability in perceived negative effect, suggesting they may be more context specific.

Limitations

This first national AMS survey of Canadian LTCH nurses was timely amid growing interest in disease prevention and AMS. Use of open-ended responses enabled respondents to provide clarity and voice concerns. The results relied on convenience sampling, introducing selection bias. Survey distribution in a post-COVID-19 pandemic context may have reduced response rate, representativeness and generalizability, as only those with strong interest in AMS may have participated.

Conclusion

Canadian nurses in LTCHs perceive AMS as an important part of their responsibilities, and many already include AMS activities in their routines. The AMS knowledge and responsibilities of nurses vary. Key challenges include interprofessional communication, inconsistent AMS roles, and an antimicrobials-first culture. Leading facilitators include having AMS guidelines, tailored education, senior-level endorsement, and formalized AMS roles. Future representative sample studies should identify core AMS competencies relevant to LTCH nurses. Local nuances can be identified through replicating this study locally in consideration of local or province-specific AMS policies and guidelines.

Authors' statement

AV — Conceptualization, methodology, investigation, data curation & analysis, project administration
KQ — Data analysis, writing–original draft, writing–review & editing
JC — Conceptualization, methodology, writing–review & editing
GB — Conceptualization, methodology, writing–review & editing
KP — Conceptualization, methodology, writing–review & editing
TG — Conceptualization, methodology, writing–review & editing
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Competing interests

Authors have no conflict of interest to disclose.

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Appendix

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

Table S1: Survey questions
Table S2: Survey recruitment and distribution process

The National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) Statement: Chlamydia and Gonorrhea screening recommendations for non-pregnant adults and adolescents

Housne Begum[1]*, Dominique Basque[1], Holly Sullivan[1], Michelle Haavaldsrud[1], Jennifer Gratrix[2], Petra Smycek[2], Annie-Claude Labbé[2], Stephan Gadient[1], Annie Fleurant-Ceelen[1]

Abstract

Background: The National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) undertook a review to adopt, or adapt, the 2021 recommendation for chlamydia and gonorrhea screening issued by the Canadian Task Force on Preventive Health Care (CTFPHC).

Methods: The NAC-STBBI adapted the guideline following the 2014 World Health Organization (WHO) handbook. The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) and GRADE-ADOLOPMENT methods were also applied to determine the certainty of evidence and strength of the recommendations. The guideline question was "should any screening vs no screening/usual care/any other screening be used for non-pregnant people?". Conflicts of interest were managed according to the Public Health Agency of Canada guidelines.

Results: An environmental scan found 17 guidelines published between 2015 and 2023. Five systematic reviews and 32 original articles were identified and included, addressing screening types, patient values, preferences, feasibility, equity and cost and cost-effectiveness of chlamydia and gonorrhea screening. The search was conducted between October 1, 2019, to May 19, 2023. The certainty of evidence was very low.

Conclusion: The NAC-STBBI suggests universal annual screening for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in all sexually active persons under the age of 30 years (conditional recommendation; very low-certainty evidence). The NAC-STBBI also suggests screening every three to six months for adults and adolescents with multiple sexual partners or a new partner since last tested and "opt-out" screening as frequently as every three months for high prevalence populations or communities (conditional recommendation; very low-certainty evidence).

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Keywords: chlamydia, gonorrhea, screening recommendations, non-pregnant adults/adolescents

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Introduction

Chlamydia trachomatis (CT) and *Neisseria gonorrhoeae* (NG) were the two most frequently reported bacterial sexually transmitted infections (STIs) in Canada in 2021, with rates increasing steadily over the previous decade. Between 2011 and 2019, rates of CT and NG increased by 26% and 171%, respectively (1). An exception to this trend was observed in 2020 and 2021 during the COVID-19 pandemic, where rates of CT and NG decreased due to changes in the demand for, and a lack of access to, STI-related services across Canada (2). In 2021, the national rate of reported CT cases was 273.2 per 100,000 population, with the highest rates among females aged 15–29 years old and males aged 20–29 years old. The 2021 nationally reported rate of NG cases was 84.2 per 100,000 population, with the highest rates among females aged 15–29 years old and males aged 20–39 years old (3). Although many CT and NG infections are asymptomatic, untreated infections can lead to serious complications, such as chronic pelvic pain, pelvic inflammatory disease (PID), infertility, ectopic pregnancy, epididymo-orchitis and reactive arthritis. Screening is an approach used to detect and treat asymptomatic infections, prevent complications, and reduce transmission. Although findings on the impact of screening on prevalence rates are mixed (4), evidence suggests that screening is effective in increasing testing rates of CT and NG and reducing healthcare costs (5,6).

Chlamydia trachomatis and NG screening is a critical component of an effective STI control program (7). Screening for these infections is beneficial in that it stops the spread of infection (8), prevents serious complications (9,10), and helps an individual maintain good sexual and reproductive health (11). However, potential negative effects and the necessity of a universal screening program have been called into question. Firstly, some individuals may experience harms of screening, such as stigmatization and anxiety (12). Nonetheless, research shows that young adults would still accept screening despite these concerns (12). Secondly, spontaneous clearance of CT and NG infections has been observed in some cases (13,14), and is a potential argument against the necessity of a universal screening program for asymptomatic individuals. Given that factors such as bacterial load are associated with the odds of clearance, and that infection transmission can still occur, the possibility of clearance should not hinder screening efforts (13,14). Ultimately, screening programs should be implemented if the benefits outweigh the harms and resource use is justifiable.

The main rationale for CT and NG screening is to detect asymptomatic infections in females before they cause PID or other serious reproductive complications (15). As well, gay, bisexual and other men who have sex with men (GBMSM) individuals may be at increased risk due to asymptomatic CT and NG infections, especially at the rectal and pharyngeal sites (16). The National Advisory Committee on Sexually Transmitted and Blood-Borne Infections (NAC-STBBI) defines screening as a process aimed at detecting a condition in an asymptomatic person. There are several approaches to screening: universal (screening in all sexually active persons with a new or multiple partners, and/or upon request of the individual) (17); opportunistic (offering screening when an individual accesses health services and has not undergone recent STBBI testing) (18); targeted (screening based on a characteristic associated with increased risk of the condition being detected) (19) and systematic (as part of a program in which invitations for screening are sent to all eligible participants and then evaluated for uptake and results) (20).

Many countries are assessing their CT and NG screening programs to ensure they are based on the best available evidence. For example, in 2021, the National Chlamydia Screening Programme in the United Kingdom narrowed its focus to only offer screening to females in order to prevent serious consequences of untreated CT infection, rather than focusing on the transmission of infections (18). In Australia, universal screening for CT and NG was expanded to individuals aged 15 to 29 due to the higher rates of infections in that age range (19).

This guideline focuses on CT and NG screening for asymptomatic sexually active non-pregnant adults and adolescents. In 2021, the Canadian Task Force on Preventive Health Care (CTFPHC) published a guideline on screening for CT and NG in primary care for individuals not known to be at high risk of infection (20). The CTFPHC is an independent panel of health professionals that develops guidelines for primary care practitioners, along with related tools and resources, with the aim of improving the health of Canadians (21).

The 2021 CTFPHC guideline recommendation to screen for CT and NG differed from the existing screening recommendations issued by the Public Health Agency of Canada (PHAC) (22). In response, the NAC-STBBI initiated a review of the guideline. The NAC-STBBI provides PHAC with ongoing, timely advice and recommendations for the development of public health guidance related to STBBI, in support of its mandate to prevent and control infectious diseases in Canada (23). The PHAC CT and NG screening recommendations that existed at the time of the 2021 CTFPHC guideline publication were developed in 2010. Key areas of difference between the 2021 CTFPHC and the 2010 PHAC screening recommendations were the types of screening methods, ways to implement the screening, the age group to be screened, and the methodology used to develop the recommendations. The PHAC's 2010 recommendations were to screen for CT and NG in sexually active individuals younger than 25 years of age and in GBMSM and transgender populations, regardless of age; and targeted screening (screening and repeat screening as indicated) for individuals 25 years of age

and older with risk factors for infection (22). The PHAC's 2010 recommendations for screening for CT and NG were based on expert opinion, which was informed by a review of the epidemiological data and scientific literature at the time. In contrast, the 2021 CTFPHC recommendation is annual, opportunistic screening for CT and NG in sexually active individuals younger than 30 years of age with no known risk factors for infection, at primary care visits, using a self- or clinician-collected sample. The 2021 CTFPHC recommendation for screening for CT and NG was developed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach (24), which provides an assessment of the strength of their recommendation as conditional and an assessment of the certainty of the evidence as very low (20).

Using the GRADE-ADOLOPMENT method (25), the NAC-STBBI CT and NG Screening Working Group (WG) undertook a review of the evidence that informed the 2021 CTFPHC guideline and decided to adapt it to develop a NAC-STBBI guideline on screening for CT and NG. The NAC-STBBI guideline question was, "should any screening vs no screening/usual care/any other screening be used for non-pregnant people?" As part of this process, the NAC-STBBI WG updated the CTFPHC's systematic review (SR), "Screening for chlamydia and/or gonorrhea in primary health care on effectiveness and patient preferences" (26), to examine the most recent evidence on the effectiveness of any screening vs no screening/usual care/any other screening in non-pregnant people.

The objectives of this project were to revise the existing PHAC CT and NG screening guideline and assess new evidence for screening in non-pregnant, sexually active individuals and update, as required, the existing guideline while considering the following recommendations from the CTFPHC: i) increasing the screening age from younger than 25 years to younger than 30 years, regardless of the presence of risk factors for infection other than age; and ii) using an opportunistic approach to screening. This guideline is intended to be used by primary care providers (i.e., nurses, physicians), provincial/territorial sexual health program staff, local public health agencies, sexual health clinics, professional associations, and researchers.

Methods

The NAC-STBBI CT and NG screening recommendations were developed following the methods outlined in the 2014 edition of the World Health Organization (WHO) handbook for guideline development (27). The evidence was assessed using the GRADE approach to determine the certainty of evidence and the strength of the recommendations (24). The GRADE-ADOLOPMENT method (25), was applied to the 2021 CTFPHC guideline to develop the NAC-STBBI guideline and resulted in an update of the SR and other evidence that informed the guideline, including national case rates and an environmental scan of national and international CT and NG screening guidelines. The GRADE-ADOLOPMENT method is an approach to guideline development that combines adoption, adaptation and, as needed, *de novo* development of recommendations. It emphasizes the importance of using existing guidelines and tailoring them to local needs (25). The Appraisal of Guidelines for Research & Evaluation (AGREE) II Instrument was used to evaluate the methodological quality of the identified guidelines (28). Finally, PROGRESS-Plus equity factors were identified in the guidelines to assess the range of social determinants and factors that contribute to health equity (29). Research implications were also developed by the NAC-STBBI WG to describe the practical applications of the findings. The full CT-NG screening guideline received PHAC approval and was subsequently published on the Government of Canada website.

Working group

The NAC-STBBI consists of STBBI subject-matter experts, clinicians, researchers, and program managers. The NAC-STBBI established a WG for guideline development consisting of three members of the NAC-STBBI who were supported by the NAC-STBBI Secretariat and other research professionals within PHAC (PHAC team). The PHAC team independently conducted an SR update of available studies, including primary studies and SR on CT and NG screening, and scanned for published screening guidelines by examining the SR in 2021 by CTFPHC (20), and searching the websites of international organizations and provincial/territorial organizations.

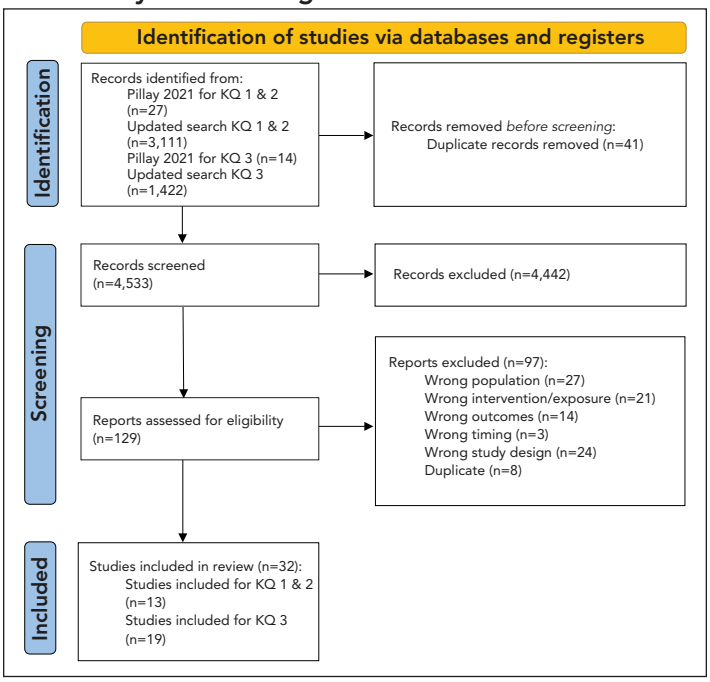
Review of the evidence

The key questions from the SR completed by the CTFPHC were modified and approved by the WG to guide the development of the screening recommendations. More specifically, the population eligibility criteria were expanded to include sexually active individuals younger than 30 years and opportunistic screening was added as an intervention of interest.

A hierarchical approach was used to search for evidence to update the CTFPHC SR (26). The updated search was conducted for October 1, 2019 to May 19, 2023, using the same search strategies as the CTFPHC SR. The studies included in the original SR were screened against the new eligibility criteria (26), and reported on CT and NG screening types, patient values and preferences, equity, feasibility, acceptability, cost and cost-effectiveness analyses. Studies published in English and French were included. The PHAC team also searched for SR, followed by primary studies, when no SRs were available. The grey literature search included searching sources identified in the CTFPHC SR, as well as additional sources identified by the NAC-STBBI WG and Secretariat. Sources searched included trial registries, conference abstracts, reports and CT/NG screening guidelines from international, provincial and territorial public health organization websites. Reference lists of all included studies and relevant SRs that were identified in the updated search were searched by hand for any missed studies. Two members of

the PHAC team screened studies, extracted and analyzed the data, and assessed the quality/certainty of the evidence using the GRADE approach (refer to **Figure 1** for the flow diagram of study selection) (24). Finally, an environmental scan (30) was executed by performing a Google search, which found 17 public health organizations with guidelines on CT and NG screening published between 2015 and 2023; of those, nine were international (16,31–40) and eight were Canadian (20,41–48).

Figure 1: Flow diagram of study selection on Gonorrhea and Chlamydia screening since 2019



Abbreviation: KQ, key question

The certainty of the evidence was assessed at four levels (24,49):

- **High:** We are very confident that the true effect lies close to that of the estimate of the effect.
- **Moderate:** We are moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- **Low:** Our confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
- **Very low:** We have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

Management of conflicts of interest

Members of the WGs and NAC-STBBI are required to identify affiliations and conflicts of interest on an annual basis. The NAC-STBBI Secretariat reviews WGs and committee member affiliations to ensure there are no conflicts of interest. The WG and committee members are also asked to identify any new affiliations at the start of every meeting and teleconference. No conflicts were identified by the WG or NAC-STBBI members that would prevent them from participating in the discussion and voting on the committee recommendation.

Results

Evidence synthesis

Details of evidence from different sources/types (evidence profile) and evidence to decision judgements are available in **Table 1** and **Table 2**. In addition to the 41 records identified from Pillay *et al.* (26), 4,533 records were located from databases. Following the title and abstract screening, 4,442 records were excluded, and 129 records were sought for retrieval. All records were assessed for eligibility and 97 records were excluded (Figure 1). A total of 32 records were included in the review, including original articles on screening types, patient values, preferences, and feasibility and impact on health equity of CT and NG screening. The excluded studies contained the incorrect population, intervention/exposure, outcome, study timing and study design. Five SRs were identified and included (4,50–53). The studies from these SRs were assessed for any missing eligible articles that could be included in the evidence review (4,50–53). No additional studies were retrieved. Eleven studies were identified for full-text screening from the grey literature search.

Table 2: Summary of evidence-to-decision framework judgements

Domain	Judgement
Problem	Yes
Desirable effects	Moderate
Undesirable effects	Small
Certainty of evidence	Very low
Values	Possibly important uncertainty or variability
Balance of effects	Favors the intervention
Resources required	Don't know
Certainty of evidence of required resources	Very low
Cost effectiveness	Probably favors the intervention
Equity	Probably increased
Acceptability	Probably yes
Feasibility	Probably yes

Summary of the evidence

The certainty of evidence for the screening of CT and NG in asymptomatic, non-pregnant individuals was very low. The review retrieved 32 articles that included five randomized controlled trials (4,15,50–52), five cohort studies (53–57), seven qualitative studies (12,58–63), five cross-sectional studies (8,64–67),

Table 1: Evidence profile

Key guideline question: Should [any screening 1] vs [no screening/usual care/any screening 2] be used for non-pregnant people?	
Outcomes by organisms (CT, NG and CT+NG) and screening type	**Findings/Assessment of certainty of evidence**
Chlamydia: Universal screening compared to no screening or usual care	
Chlamydia infection transmission (1 RCT) van den Broek *et al.*, 2012	A register based yearly program found chlamydia positivity in the intervention blocks at the first invitation was the same as in the control block/usual care (4.3%) and 0.2% lower at the third invitation than in the control block/usual care, which was not statistically significant (odds ratio: 0.96, 95% CI: 0.83–1.10).
Certainty of evidence	⊕⊕◯◯[a,b,c] LOW Risk of bias, Indirectness
Chlamydia and pelvic inflammatory disease (PID) (3 RCTs) Oakeshott, 2010; van den Broek *et al.*, 2012; Hocking *et al.*, 2018	Universal screening compared to usual care in primary care did not significantly reduce prevalence of chlamydia in adolescents and young adults. Screening for chlamydia reduces rates of PID; however, the effectiveness of a chlamydia test in preventing PID over 12 months may be overestimated.
Certainty of evidence	⊕◯◯◯[a,b,c] Very LOW Risk of bias, Indirectness
Benefits: Gonorrhea screening	
Nil	Nil
Chlamydia and gonorrhea: Clinic-based screening compared to no screening or usual care	
Chlamydia and gonorrhea infection transmission/infection rates (3 studies) Fielder *et al.*, 2013; Reed *et al.*, 2021; Tomcho *et al.*, 2021	In a study comparing clinic-based screening to no screening, 64% of the participants agreed to self-collected vaginal swabs while in clinic with 1% testing positive for an STI. Universal screening compared to usual care in primary care reduced prevalence of chlamydia and gonorrhea in some health clinics including emergency departments but not all.
Certainty of evidence	⊕◯◯◯[a,b,c] Very LOW Risk of bias, Indirectness
Chlamydia and gonorrhea: Universal screening compared to no screening	
Pelvic inflammatory disease	Universal screening compared to no screening for chlamydia and gonorrhea before an IUD insertion did not reduce risk for the infection.
Certainty of evidence	⊕◯◯◯[a,b,c] Very LOW Risk of bias, Indirectness
Harms: Chlamydia screening: Any screening versus no screening	
Negative psychosocial impact (2 studies) Walker *et al.*, 2013; Campbell *et al.*, 2006	One cohort study and a randomized pre-post study examined any screening versus no screening and found that home-based screening and self-collected swabs for chlamydia and gonorrhea have some negative psychosocial impact but is acceptable.
Certainty of evidence	⊕◯◯◯[a,b,c] Very LOW Risk of bias, Indirectness
Harms: Gonorrhea screening	
Nil	Nil
Harms: Chlamydia and Gonorrhea screening	
Nil	Nil
Benefits: Chlamydia screening: Home-based screening compared to clinic-based screening	
Chlamydia infection transmission (3 studies) Senok *et al.*, 2005; Söderqvist *et al.*, 2020; Gasmelsid *et al.*, 2021	Home-based screening for chlamydia is at least as effective as clinic-based screening in detecting rates of chlamydia. Results for which intervention was greatest was mixed.
Certainty of evidence	⊕⊕◯◯[a,b] LOW Risk of bias
Benefits: Gonorrhea screening	
Nil	Nil
Benefits: Home-based screening compared to clinic-based screening [health problem and/or population	
Chlamydia and gonorrhea infection transmission/infection rates (1 study) Reagan *et al.*, 2012	No difference in positivity rates were found between the home-based group compared to the clinic group.
Certainty of evidence	⊕◯◯◯[a,b,d] Very LOW Risk of bias, Imprecision
Harms: Chlamydia screening	
Nil	Nil
Harms: Gonorrhea screening	
Nil	Nil
Harms: Chlamydia and Gonorrhea screening	
Nil	Nil

Abbreviations: CT, *Chlamydia trachomatis*; CI, confidence interval; IUD, intrauterine device; NG, *Neisseria gonorrhoeae*; PID, pelvic inflammatory disease; RCT, randomized controlled trial; STI, sexually transmitted infection

[a] Symbols to describe certainty of evidence in evidence profiles: high certainty ⊕⊕⊕⊕, moderate certainty ⊕⊕⊕◯, low certainty ⊕⊕◯ and very low certainty ⊕◯◯◯

[b] Risk of bias; issue with blinding and the authors did not mention any information related to the use of an appropriate analysis method that adjusted for all the critically important confounding domains

[c] Interventions do not always directly match the research question

[d] Total number does not meet the optimum sample size

four cost-effectiveness studies (9,10,68,69), a prospective delayed start pragmatic study (6), a controlled pre-post quasi experimental study (70), a randomised pre-post study (71), a retrospective service evaluation (11), a mixed-method study (72), and a health utility study (73).

The environmental scan retrieved 11 guidelines (16,31–40) from nine international organizations and nine guidelines (20,41–48) from eight Canadian public health organizations on CT and/or NG screening. These guidelines varied mostly on the approach to screening used (opportunistic, universal, or risk-based screening). Most guidelines recommend screening individuals younger than 25 years of age (16,32–48), while only two organizations recommend screening individuals younger than 30 years of age (20,31).

The WG decided to use indirect evidence from the NAC-STBBI syphilis screening recommendations (17) because of a lack of direct evidence on the frequency of CT and NG screening.

Benefits of screening

The benefits of screening for CT were assessed in three randomized control trials and a controlled cohort study comparing universal screening to usual care. The authors found little evidence that universal screening impacted CT positivity rates (4), prevalence rates (50), and incidence of PID (4,38,50,53). Notably, the results on positivity rates were not consistent. A prospective delayed start pragmatic study and a pre-post quasi experimental study assessing clinic-based universal screening found that rates for CT significantly decreased in primary care (paediatrics clinic and family clinic), and in one of two emergency departments included in the study (6,70).

Three studies comparing home-based screening to clinic-based screening on CT infection transmission found that home-based screening, where an asymptomatic individual orders a self-sample test kit from a website, collects their sample and sends it to a laboratory for processing, is beneficial to increase access to services. A randomized controlled trial found that clinic-based opportunistic screening detected slightly higher rates on CT than home-based screening (52). However, a retrospective cohort study and a pre-post study reported that non-invasive self-sampling (urine sample or vaginal swab) resulted in a higher CT detection rate, suggesting that at-home screening is at least as effective as clinic-based screening, while also being an accessible alternative to in-clinic screening (11,55). In contrast, two studies found that NG rates increased following the implementation of clinic-based universal screening in the family clinic, while decreasing in the pediatric clinic and one of two emergency departments (6,70).

Harms of screening

Three studies found little evidence of negative psychosocial impact from screening efforts. A cohort study comparing universal screening to no screening found that, irrespective of the test result, females were afraid about the possibility of receiving a positive test (56). However, females who received a positive test had less concern about their test, their future health and their partners reaction compared to females who reported on how they thought they would feel if they received a positive test (56). A randomized pre-post study comparing CT home-based screening to no screening found that the invitation to participate in screening resulted in higher anxiety scores in females compared to males (71). Screening did not impact overall well-being, as anxiety decreased following the submission of the test among males, and decreased in females following a negative test result (71). Similar findings were reported in a randomized controlled trial investigating screening for CT and NG, where males were more likely to complete screening at home, compared to in-clinic, with no difference in positivity rates (51).

Patients' preferences and values

Patients' preferences and values on CT screening were assessed in seven qualitative studies. These studies assessed no screening or compared universal screening to no screening. Most participants reported that they would get tested for CT and would encourage others to get tested (59). The negative emotions that arose from screening were related to embarrassment with sexual health issues, the association that STIs have with sexual promiscuity (12,58,60), perceptions of public stigma (56,58,62), concern for their future reproductive health (60), anxiety regarding notifying their partners (60), and anonymity (12). Despite these potential barriers to testing, participants reported recognizing the need to balance harms of screening with the benefits (56,57).

Qualitative studies assessing perceived barriers to CT and NG screening found that fear and aversion (65), social stigmas (62,65), negative consequences (62,65), confidentiality (62), and the reputation of the clinic represented significant barriers to being tested, which could increase the risk of spreading infection to others (62,65).

Cross-sectional data suggests that both positive and negative beliefs influence the decision to seek regular CT testing. Positive beliefs (such as the reassurance of not being infected), increases the intention to seek CT testing; meanwhile, negative beliefs (such as feeling that getting tested is embarrassing) reduces intentions to seek testing (64). Females were significantly more likely to hold positive beliefs than males (8).

A randomized controlled trial feasibility study and a retrospective cohort study comparing home-based to clinic-based CT screening found that a higher percentage of individuals who tested at home returned samples compared to those who were subject to clinic-based opportunistic screening (52,55). An exception to this finding was among females under 20 years

old, who returned more samples in the clinic-based group than the home-based group (52). A service evaluation study did not find that online self-sampling for CT increased the number of individuals screened (11). Similarly, a controlled trial with randomized stepped wedge implementation did not support a registered based CT screening program as participation rate declined over screening rounds (4).

A randomized controlled trial and a retrospective cohort study found that home-based CT screening did not vary in opt-out rate compared to usual-care and opportunistic screening (52). Findings on self-sampling were mixed, where a higher proportion of males used self-sampling compared to usual-care or opportunistic screening (55); however, females were more likely to take part in self-sampling than males when comparing universal self-sampling to usual care (4). Furthermore, participation rates were higher among the older age groups (4). Qualitative findings related to acceptability of CT and NG screening found a very high rate of acceptance with the idea of offering universal screening to adolescents using a tablet-based NG/CT screening tool in a private room. Adolescents felt it would address concerns about discussing NG or CT screening with clinicians, while parents or guardians felt that using tablets may increase participation to screening but were concerned about the lack of personal interaction with a healthcare provider (63).

Making recommendations

The NAC-STBBI WG developed the recommendations in seven meetings held between June and September 2024. The WG members reviewed the evidence-to-decision table presented by the PHAC team, and the available national and provincial (Alberta, Québec) epidemiological data (74,75). During the formulation of the recommendations, the NAC-STBBI WG considered both the desirable and undesirable outcomes of screening interventions, the values and preferences, feasibility, equity, resources, cost and cost-effectiveness of the interventions. They also discussed the implementation of the recommendations and research gaps. The discussion was facilitated by a methodologist with the goal of reaching consensus across the NAC-STBBI WG.

The draft recommendations, the evidence, and the WG's rationale for the recommendations were first presented to the NAC-STBBI on June 27, 2024 for their input. With the committee's suggestions, final recommendations were compiled by the WG and sent to the NAC-STBBI on September 5, 2024 for their review. Consensus and approval of the recommendations was obtained on September 26, 2024. The PHAC approval was provided by the Vice-President of the Infectious Diseases and Vaccination Programs Branch on October 24, 2024. The recommendations were subsequently added to PHAC's Chlamydia and lymphogranuloma venereum guide (76), and Gonorrhea guide (77), within the STBBI Guides for Health Professionals (78).

According to the GRADE approach (24), the certainty of evidence was rated as very low and the strength of the recommendations was rated as conditional. The conditional recommendations are worded as "the NAC-STBBI guideline suggests....". The implications of conditional recommendations are:

- **For patients:** "The majority of individuals in this situation would want the suggested course of action, but many would not. Decision aids may be useful in helping patients to make decisions consistent with their individual risks, values, and preferences."
- **For clinicians:** "Different choices will be appropriate for individual patients; clinicians must help each patient arrive at a management decision consistent with his or her values and preferences. Decision aids may be useful in helping individuals to make decisions consistent with their individual risks, values, and preferences."
- **For policy makers:** "Policy making will require substantial debate and involvement of various stakeholders. Performance measures should assess if decision-making is appropriate."
- **For researchers:** "The recommendation is likely to be strengthened (for future updates or adaptation) by additional research. An evaluation of the conditions and criteria (and the related judgments, research evidence, and additional considerations) that determined the conditional (rather than strong) recommendation will help identify possible research gaps."

Recommendations

Screening is a process aimed at detecting a condition in an asymptomatic person. Recommendations developed by the NAC-STBBI are made at the population-level (**Box 1**). It is important to note that they may not apply to specific individuals, particularly as it relates to individuals in groups or communities who may have higher rates of CT and NG when compared to the general public. It is always essential to consider the context of the risk behaviours and epidemiological factors outlined in the recommendation.

Discussion

To implement this screening recommendation, clinicians are suggested to offer universal annual screening in all sexually active persons under the age of 30 years. For individuals 30 years of age or older, a risk assessment should be conducted in all sexually active individuals, since those who are at high risk for CT and NG infection may not always self-identify or be easily identified.

Chlamydia trachomatis and NG infections are often associated with social stigma, shame and embarrassment, which could prevent an individual from seeking screening and

Box 1: Recommendations

Recommendation 1: *Chlamydia trachomatis/Neisseria gonorrhoeae* screening for non-pregnant adults and adolescents

The NAC-STBBI suggests universal annual screening* for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in all sexually active persons under the age of 30 years. **(*Conditional recommendation; very low certainty of evidence*).**

Recommendation 2: *Chlamydia trachomatis/Neisseria gonorrhoeae* screening for adults and adolescents with multiple partners or a new partner

The NAC-STBBI suggests screening* every three to six months for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in all persons with multiple sexual partners or a new partner since last tested. **(*Conditional recommendation; very low certainty of evidence*).**

Recommendation 3: *Chlamydia trachomatis/Neisseria gonorrhoeae* screening for high prevalence groups and communities

The NAC-STBBI suggests that "opt-out" screening* for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections be considered as frequently as every three months** in populations or communities*** experiencing high prevalence of CT and NG (and other STBBI), such as:

- Gay, bisexual and other men who have sex with men (GBMSM)
- People living with HIV
- People who are or have been incarcerated
- People who use substances or access addiction services
- Some Indigenous communities

(*Conditional recommendation; very low certainty of evidence*).

Considerations

* Options to increase screening uptake should be explored. They include:

- Opportunistic screening (offering screening when an individual accesses health services and has not undergone recent STBBI testing)
- Increasing accessibility and normalizing testing through strategies such as outreach testing and opt-out screening
- Facilitating sample collection through strategies such as non-invasive collection of specimens, including self-sampling

** Consider aligning screening with other health services ("opportunistic screening") such as HIV or addiction care.
*** Consider local epidemiology, travel history and individual patient risk factors when determining which groups/communities to target.

Factors associated with *Chlamydia trachomatis/Neisseria gonorrhoeae* infections (79–81):

Behaviours/activities

- Sexual activity involving contact with oral, genital or anal mucosa (81–84)
- Multiple sexual partners (82–85)
- Sexual contact with a person infected by CT/NG ("known case") or other STBBI (84,85)
- Substance use, including chemsex (84,85)

Epidemiological/biological

- Previous CT/NG infection or other STBBI (83,84)
- HIV infection (82–85)
- High prevalence in geographical area (82–85)
- High prevalence in population groups (82–85)
- Housing instability/street involvement (82,83,86,87)

Abbreviations: CT, *Chlamydia trachomatis*; NAC-STBBI, National Advisory Committee on Sexually Transmitted and Blood-Borne Infections; NG, *Neisseria gonorrhoeae*

treatment (20,88). Making STI screening routine has been suggested as a way to help destigmatize STI testing by not singling out individuals because of their reported or assumed risk behaviours (31). Making screening integral to care helps to reduce stigma and normalize conversations around sexual health. Individuals who have had a negative experience with the healthcare system may be reluctant to seek care. Alternate strategies and approaches may be needed to enhance trust and improve comfort with accessing health services. These strategies may vary across provinces/territories, local communities, and/or population groups. A "one style fits all" strategy is unlikely to be successful.

Options to increase screening uptake should be explored. For example, opportunistic screening capitalizes on existing healthcare interactions and relations by offering screening when individuals access health services and have not undergone recent STBBI testing (18). The CTFPHC recommends opportunistic screening of sexually active individuals younger than 30 years of age for CT and NG at primary care visits (20). Grennan *et al.* endorses CTFPHC's new screening guideline and adds that the benefits will not only increase the number of cases diagnosed, but it will decrease transmission, and possibly reduce the likelihood of being a risk factor for HIV acquisition (7,89). Outreach testing (testing in a community-based setting) and opt-out programs (offering testing automatically unless the individual declines) are two strategies that have been shown to increase accessibility and normalize testing. Opt-out screening have demonstrated greater success in identifying cases compared to opt-in programs (offering testing to those who accept) (66,90). Other strategies to increase screening are the utilization of self-collection kits, non-invasive collection specimens and home-based screening. Increased availability of point of care testing, self-test and rapid tests offer new ways to test the public and may improve acceptability and uptake (20,91,92).

Although the optimal screening interval is unknown, the NAC-STBBI suggests annual screening for non-pregnant adults and adolescents less than 30 years of age, three to six months for all persons with multiple sexual partners or a new partner, and every three months in populations or communities experiencing high prevalence of CT or NG infections may be cost-effective (68,69,93).

The PHAC and NAC-STBBI continue to monitor the changes in the epidemiology of high prevalence populations/behaviours. The publication of new evidence and the modification of screening guidelines among health authorities is monitored in order to respond to the latest developments. These screening recommendations will be revised if new evidence becomes available in the coming years, or if the epidemiological situation changes to justify subsequent updates to the recommendations. However, there are still knowledge gaps on the natural history of CT and NG infections. *Neisseria gonorrhoeae* is considered a serious public health threat since it has been increasingly developing resistance to antimicrobial drugs recommended as treatment (94). Further research in the potential harms of overdiagnosis of infection that may clear spontaneously and the overuse of antimicrobials which may contribute to antimicrobial resistance is crucial to evaluate if intensive screening and treatment programs are justified.

Above all, STBBI research is mainly focused on specific groups of individuals, such as people living with HIV and GBMSM. Studies focused on the general population are lacking and present a significant gap in evidence. Attempting to generalize evidence from these groups to apply to the general population is not always practical given their significant differences in population groups. Traditionally, GBMSM populations have experienced higher rates of STBBI infections resulting in suggested higher frequency of STBBI screening among this population. Addressing the research gaps listed above would be beneficial to inform whether to update or reaffirm the CT and NG screening recommendations in the future. The focus of future research studies should also be targeted to the serious outcomes of untreated CT and NG infections. In addition, further research comparing different screening intervals would be informative.

Limitations

There was variation in the certainty of evidence and applicability of studies. Much of the evidence used to inform the development of these recommendations was based on studies conducted on various age ranges. Studies examining CT and NG screening in the group that is less than 25 years old versus the group that is less than 30 years old were lacking. There was also limited evidence on the comparison of different screening programs, such as opportunistic screening, universal screening, self-sampling and targeted screening and whether the interventions are cost-effective. Despite implementing a range of interventions to control CT and NG infections, there is a lack of high certainty evidence that population prevalence can be reduced by screening programs or opportunistic testing. There is also a lack of high-quality empirical evidence for the benefits of testing for the prevention of PID, ectopic pregnancy, infertility and epididymo-orchitis. Since the NAC-STBBI WG did not have a patient representative, patient perspectives were acquired through the evidence. Inclusion was restricted to English and French language studies only.

Conclusion

Chlamydia trachomatis and NG infections have increased steadily over the past few years. Ongoing review and monitoring of the most recent Canadian surveillance data is integral to ensure individuals/populations with high infection prevalence are identified quickly. It is important for healthcare providers to be aware of the growing public health burden of CT and NG infections so that cases can be identified and treated and the onward transmission of the infection interrupted. Overall, the NAC-STBBI suggests three screening recommendations: i) universal annual screening for CT and NG infections for all sexually active persons under the age of 30 years; ii) screening

every three to six months for the same infections in individuals with multiple sexual partners or a new partner since last tested; and iii) "Opt-out" screening for CT and NG infections to be considered as frequently as every three months in populations or communities experiencing high prevalence of CT and NG (and other STBBI). The certainty of the evidence for the screening of CT and NG is very low and the strength of the recommendations are conditional.

Authors' statement

HB — Conceptualization, investigation, writing–original draft, review, editing
DB — Investigation, writing–original draft, review, editing
HS — Conceptualization, investigation, writing–review, editing
MH — Writing–review, editing
JG — Writing–review & editing
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A-CL — Writing–review & editing
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Competing interests

None.

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