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CANADA COMMUNICABLE DISEASE REPORT

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

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The picture on the cover of this issue illustrates the public health network - a network of individuals across Canada from many sectors and levels of government, who effectively work together to strengthen public health in Canada. (https://www.shutterstock.com/image-photo/structure-medical-researches-quality-blurred-background-1350333653)

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PUBLIC HEALTH NETWORK

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EDITORIAL

Networking—A quintessential public health activity

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It is fascinating that, despite the fact that networking is vital to the way that public health activities are planned, coordinated and carried out, relatively little has been written about it. This may be, in part, because it is described in so many ways: stakeholder engagement coordination, multidisciplinary work and an intersectorial approach. And it may be because networks are so integrated into the very DNA of public health that we rarely step back to appreciate them—much like a fish that simply assumes the existence of water.

A public health network is a group of people—people who represent organizations, interests or levels of government who work together to strengthen public health. Networks facilitate social interaction, the sharing of knowledge and the engagement in other activities related to a common goal within a specific domain of knowledge and practice (1). When you think about it, it is hard to conceive public health without networks.

This theme of the February 2020 issue of the *Canada Communicable Disease Report* (CCDR) is on these public health networks. Read about a "network of networks"—Canada's National Collaborating Centres (NCCs) (2). The NCCs include six centres of expertise, composed of multidisciplinary teams who work as knowledge brokers to identify gaps, and work on knowledge synthesis, exchange and uptake to promote evidence-informed decision-making in public health. They do this with the quintessential public health strategy of networking at all levels of Canada's public health system, with other disciplines and internationally to facilitate the uptake of knowledge into both policy and practice. The National Advisory Committee on Immunization (NACI) is another excellent example of the power of networking. NACI is a multidisciplinary committee, whose members possess some of the best knowledge of vaccines in the country. These members summarize the evidence and make recommendations for public health and clinical care. Established in 1964, NACI has been a trusted source of immunization guidance for Canada for almost 60 years (3,4). See some of their latest work in this issue of CCDR, with a summary of a recent NACI statement on the use of Trumenba™ for the prevention of meningococcal B disease (5). You will also find a few ID News items at the end of this issue that include a long overdue study that assessed the effectiveness of networking and partnerships designed to address public health priorities.

Networking, as a public health strategy, deserves more recognition and study. Although it is integral to the work of public health, there are surprisingly few studies that evaluate its effectiveness. We should surely learn more about what may work and what may not, and best practices that could all inform future networking strategies.

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Canada's National Collaborating Centres: Facilitating evidence-informed decision-making in public health

Alejandra Dubois[1]*, Mélanie Lévesque[1]

Abstract

Although evidence-informed decision-making is fundamental to public health, it is challenging in practice as there is a continual burgeoning of both evidence and emerging issues, which public health professionals need to address at local, regional and national levels. One way that Canada has addressed this perennial challenge is through its six National Collaborating Centres (NCCs). The NCCs for Public Health were created to promote and support the use of scientific research and other knowledge to strengthen public health practice, programs and policies in Canada. The NCCs identify knowledge gaps, foster networks across sectors and jurisdictions and provide the public health system with an array of evidence-informed resources and knowledge translation services. Each centre is hosted in academic or government organizations across Canada and focuses on a specific public health priority: Determinants of Health; Environmental Health; Healthy Public Policy; Indigenous Health; Infectious Diseases; and Knowledge Translation Methods and Tools. Since their launch in 2005, the NCCs have undergone two federal evaluations, the results of which clearly demonstrate their significant contribution to evidence-informed decision-making in public health in Canada, while identifying some opportunities for future growth. The NCCs successfully help to bridge the gaps between evidence, policy and practice and facilitate the implementation of evidence in multiple, often complex, settings.

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Keywords: Public health, networks, knowledge synthesis, knowledge translation, health equity, determinants of health, evidence-informed practice, evidence-informed decision-making

Introduction

A hallmark of public health in Canada and around the world is evidence-informed decision-making (EIDM) (1). In light of the fact that new knowledge is being continuously generated, there is an ongoing need in public health to synthesize this new evidence in the context of what is already known, incorporate it into the development and implementation of policy and practice and evaluate its application to ensure the desired outcomes are achieved. Although EIDM is fundamental to public health, it is challenging in practice. The World Health Organization has recognized that real-world implementation of evidence-based interventions is "one of the greatest challenges … [for] the global health community" (1). The challenges for public health in Canada include the following:

1. Decision makers may not have access to new evidence as it becomes available
2. Not all public health professionals have the knowledge, skills, or resources to undertake knowledge syntheses and knowledge transfer activities which are adapted to the needs of decision makers situated in various contexts
3. Public health organizations may lack the infrastructure to support such activities (2)

One way that Canada has addressed these perennial challenges is to develop the six National Collaborating Centres (NCCs), known collectively as the NCCs for Public Health program (NCCPH; www.nccph.ca). The NCCs were established in 2005 as part of the federal government's commitment to renew and strengthen public health in Canada (3). They were designed to promote and support the use of scientific research and other knowledge to strengthen public health practice, programs and policies in Canada. The NCCs have been described as a unique

network of "knowledge brokers" (4) who collectively "identify knowledge gaps, foster networks and provide the public health system with an array of evidence-based resources … and knowledge translation services" (5).

It is a tall order. The NCCs carry out their mission by fostering collaboration and networking among diverse stakeholders and drawing on regional, national and international expertise. They work with a wide range of organizations and across jurisdictions to create opportunities to learn from each other and to work together. For example, the NCCs partner with organizations such as the Pan-Canadian Public Health Network Council, the formal network that links all 13 provincial/territorial governments with the Public Health Agency of Canada and reports to the Conference of Federal/Provincial/Territorial Deputy Ministers of Health (6).

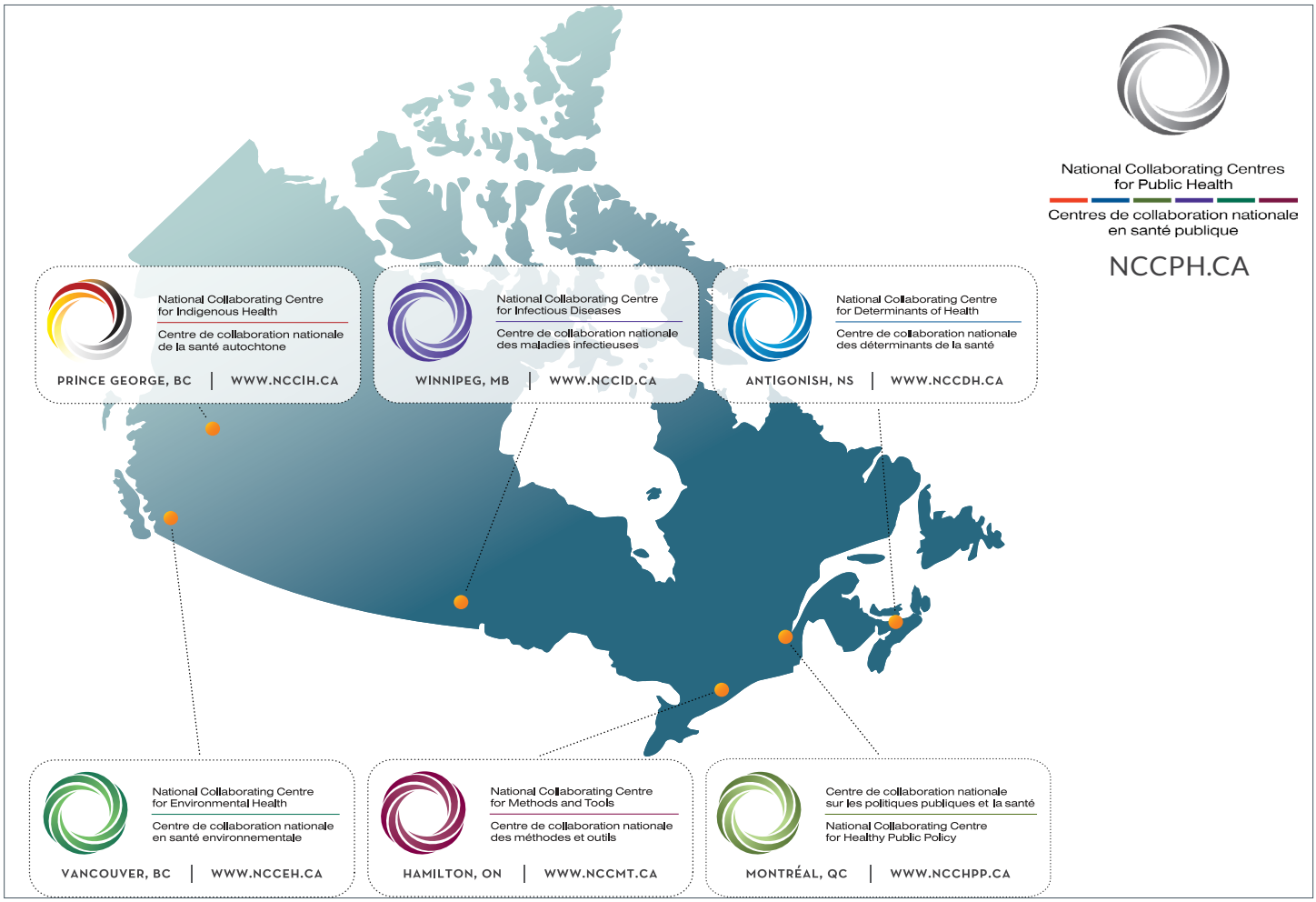
The purpose of this article is to describe what the NCCs do, identify their current priorities and topic areas for 2020 and beyond, and describe how they are able to facilitate the bridging of evidence and other knowledge systems into policy and practice.

The National Collaborating Centres for Public Health

Funded by the Public Health Agency of Canada and located across the country (**Figure 1**), each of the six NCCs focuses on a specific public health area: Determinants of Health, Environmental Health, Healthy Public Policy, Indigenous Health, Infectious Diseases, and Knowledge Translation Methods and Tools. Each NCC is hosted by an academic institution or government-based organization.

The NCCs synthesize and disseminate high-quality evidence and knowledges, foster collaboration among diverse stakeholders, and support public health professionals, policymakers and decision makers in using evidence-informed knowledge to improve health outcomes for Canadians. The NCCs turn research and other information into knowledge products tailored to specific audiences, contextualized to their settings and in both official languages. These include products such as guidance documents, reports, evidence reviews, fact sheets, and case studies.

Figure 1: National Collaborating Centres for Public Health



Each NCC has an expert advisory board for strategic orientation and advice. Priorities are established through a variety of strategies, including convening national gatherings, supporting and participating in networks and committees, administering surveys, conducting environmental scans and literature reviews, interviewing key informants, evaluating activities and resources, partnering with Indigenous leaders and organizations and working with governments at all levels. As described in a recent NCCPH document presented to the Pan-Canadian Public Health Network Council (*unpublished document, National Collaboration Centres for Public Health, 2019*), current priorities, strategies and key focus areas of each NCC are described in the following section.

NCC for Determinants of Health

The NCC for Determinants of Health (NCCDH) is hosted by St. Francis Xavier University in Antigonish, Nova Scotia. The NCCDH focuses on three priority areas: addressing the structural drivers of inequity; supporting a "culture of equity" in public health; and promoting action on the factors that influence health equity, the social determinants of health. Strategies for doing this include making health equity an explicit goal in organizations, programs and policies, promoting public health roles to advance health equity, supporting the application of promising equity-oriented knowledge and practices, facilitating networks and knowledge exchange and influencing knowledge translation practices to support action on health equity.

NCC for Environmental Health

The NCC for Environmental Health (NCCEH) is located at the British Columbia Centre for Disease Control, in Vancouver, British Columbia. The NCCEH has three priorities. The first is to raise awareness and increase understanding of 1) existing and emerging environmental threats and benefits and 2) how to mitigate these threats and optimize the benefits. The second is to translate and highlight research that informs the effective practice of environmental health. The third involves bringing together the aggregate experience of environmental health practitioners across Canada to inform practice that is effective and attuned to the evolving orientation of public health. Key areas include 1) both natural and built environments, 2) the changing climate, emergency preparedness and response and 3) resources to support public health inspection, protection and policy-making.

NCC for Healthy Public Policy

The NCC for Healthy Public Policy (NCCHPP) is hosted by the Institut national de santé publique du Québec in Montreal, Quebec. The NCCHPP has three priorities. First, to support the development of competencies and organizational capacity in policy analysis. Second, to support the implementation of intersectoral approaches to promote healthy public policies. Finally, to develop policy approaches for emerging issues in public health. Priority topics include public policy analysis, health in all policy, health impact assessment, climate change, population mental health and well-being, public health ethics, health inequalities as well as knowledge sharing.

NCC for Indigenous Health

The NCC for Indigenous Health (NCCIH) is based at the University of Northern British Columbia, in Prince George, British Columbia. The NCCIH has two priorities. The first priority is to increase understanding and application of Indigenous-informed evidence on First Nations, Inuit and Métis health across their lifespan to support public health policy, practice and program decision-making. The second is to foster partnerships, collaborations and networks to mobilize Indigenous-informed evidence across sectors and jurisdictions to support Indigenous health equity. The NCCIH health pillars include emerging priorities in public health, social determinants of health, child, youth and family health and Indigenous knowledge and public health.

NCC for Infectious Diseases

The NCC for Infectious Diseases (NCCID) is based at the University of Manitoba, in Winnipeg, Manitoba. The NCCID set three priorities for the upcoming years. The first is the support of public health responses to infectious diseases among migrants and mobile populations. The second is to address inequities in public health responses to communicable diseases in rural and remote communities. The third is to support opportunities for using big data for infectious disease surveillance, prevention, control and monitoring. Topics include HIV and sexually transmitted and bloodborne infections (STBBIs), tuberculosis, stigma, locally and culturally appropriate interventions, the Notifiable Diseases Database, antimicrobial resistance and stewardship, and climate change and vector-borne illnesses. The NCCID supports topic-specific networks (such as the STBBI Network and the past AMS Canada), and facilitates two or more national gatherings for knowledge exchange each year.

NCC for Methods and Tools

The NCC for Methods and Tools (NCCMT) is located at McMaster University, in Hamilton, Ontario. The NCCMT has three priorities. The first is to support evidence-informed decision-making in public health in Canada. The second is to make easily accessible, and, where gaps exist, to develop, methods and tools that facilitate increased capacity for evidence-informed decision-making. The third is to facilitate and support organizational change among public health organizations. The NCCMT develops resources to build organizational capacity, knowledge and skills related to EIDM across the broad spectrum of public health services in Canada, thus supporting better decision and policy-making across the major domains of public health. The NCCMT engages with regional, national and international networks and partners, across public health practice, education, research and knowledge translation, to identify gaps in knowledge and its application and collaborate to develop new tools and resources.

Discussion

For the nearly 15 years since their creation, the NCCs have demonstrated a proven track record for supporting and responding to the needs of public health with evidence, knowledge systems and building networks. Their biggest challenges are choosing what to work on, with whom, where and how. Indeed, public health includes a diverse interdisciplinary workforce, a wide range of programs and services and a large network of intersecting partners and stakeholders including community members and all levels of government.

To ascertain the effectiveness of the NCCPH program, two federal evaluations were conducted: the first one spanned from 2008 to early 2014 (7); and the second from 2014 to September 2018 (8). The latest evaluation report concluded that the NCCs are credible go-to sources on numerous public health issues, producing a wide range of high-quality knowledge translation products. The report identified many examples of NCC contributions to decision and policy-making in the public health field. It also indicated that the "NCCs' ability to collaborate on different initiatives and to network with different partners across the public health system is seen as one of the most valued capabilities of the Centres" (8).

The 2018 evaluation found that there were many examples of the contributions that NCCs have made to address emerging public health issues. It did, however, identify the need for flexibility to address emerging issues and the potential value of more collaboration with Public Health Agency of Canada in order to leverage the respective organizations' knowledge, resources and networks.

The current priorities, strategies and key areas of the NCCs are consistent with many of the macro trends in public health today: climate change, Health in All Policies, structural determinants of health inequities, big data, and demographic transitions (such as migrant and mobile populations) (9). The NCCs work is also consistent with the recent Public Health 3.0 approach advocated by the United States Department of Health and Human Services, which emphasizes "cross-sector collaboration and environmental, policy, and systems-level actions that directly affect the social determinants of health" (10).

The Public Health Agency of Canada recognizes the contribution of the NCCs and reaffirms its commitment to strengthening public health capacity through science, knowledge and EIDM. The NCCs are a foundational pillar of the Canadian public health infrastructure and a very valuable asset to protect and to benefit from.

Conclusion

There is an ongoing need for knowledge translation services to make evidence accessible and useful to public health professionals and organizations as well as all levels of government to advance national public health priorities. In addition, "in Canada's multijurisdictional health system, there continues to be a need to foster networks across the system. NCCs tend to occupy a unique niche focused on translating evidence and knowledge in a very practical manner to support public health professionals and organizations across the country" (8). The NCCs continue to fill a critical role in public health in Canada by helping to identify knowledge gaps and to bridge the divide between evidence, policy and practice. The NCCs have successfully demonstrated the ability to support the implementation of evidence in multiple, often complex settings, and will continue to take a leading role in Canada's public health system.

Authors' statement

AD — Original conception, review of drafts and final version
ML — Contribution to design, substantive input, review of drafts

Conflict of interest

None.

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Summary of the NACI Statement on the Use of Bivalent Factor H Binding Protein Meningococcal Serogroup B (MenB-fHBP) Vaccine for the Prevention of Meningococcal B Disease

Robyn Harrison[1,2], Robert Stirling[3], Oliver Baclic[3], Wendy Vaudry[2,4], on behalf of the National Advisory Committee on Immunization (NACI)*

Abstract

Background: Trumenba™, a bivalent, factor-H binding protein meningococcal serogroup B (MenB-fHBP) vaccine was authorized for use in Canada in October 2017 for the prevention of invasive meningococcal disease (IMD) caused by *Neisseria meningitidis* serogroup B in individuals 10–25 years of age. The National Advisory Committee on Immunization (NACI) provides recommendations regarding the use of meningococcal vaccines to the Public Health Agency of Canada.

Objective: To summarize NACI recommendations regarding the use of MenB-fHBP vaccine in Canada.

Methods: The NACI Meningococcal Disease Working Group developed a predefined search strategy to identify all eligible studies, assessed the quality of these studies, and summarized and analyzed the findings. According to the NACI evidence-based process, the working group then proposed recommendations and identified the grade of evidence that supported them. In light of the evidence, the recommendations were then considered and approved by NACI.

Results: The two serogroup B meningococcal vaccines currently authorized for use in Canada are not interchangeable as they contain different antigens and there are no published studies on the immunogenicity resulting from a vaccination series combining the two products. Following the review of evidence, NACI recommends that MenB-fHBP vaccine may be considered as an option for use in individuals 10 years of age and older in situations when a serogroup B meningococcal vaccine should be offered: 1) during serogroup B meningococcal disease outbreaks or with the emergence of hyperendemic *N. meningitidis* strains that are predicted to be susceptible to the vaccine; 2) for individuals who are close contacts with a case of invasive meningococcal disease caused by serogroup B *N. meningitidis*; 3) for individuals with underlying medical conditions that would put them at higher risk of meningococcal disease than the general population; or 4) for individuals at higher risk of exposure to serogroup B meningococcal isolates than the general population. NACI also recommends that MenB-fHBP vaccine may be considered as an option for individuals 10–25 years of age who are not at higher risk of meningococcal disease than the general population, but who wish to reduce their risk of invasive serogroup B meningococcal disease.

Conclusion: NACI recommends immunization against serogroup B IMD for all individuals who are at a higher risk of disease due to an underlying medical condition or an increased risk of exposure. In addition to providing guidance to public health decision-makers (i.e. provinces/territories making decisions for publicly-funded immunization programs), these NACI recommendations provide information to individuals, vaccine providers and organizations about vaccines that may not currently be included in publicly funded immunization programs. NACI continues to recommend against the use of the serogroup B vaccines in routine universal immunization programs in Canada at this time.

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Keywords: National Advisory Committee on Immunization, NACI, IMD, meningococcal vaccine, guidance

Introduction

Invasive meningococcal disease (IMD) usually presents as an acute febrile illness with rapid onset and features of meningitis or septicemia (meningococcemia), or both, and a characteristic non-blanching rash. Overall case fatality is approximately 10%, and up to a third of survivors may have long term sequelae, which can include hearing loss, neurologic disabilities, and digit or limb amputations. From 2012 to 2016, a total of 353 of 583 (60.5%) reported cases of IMD in Canada were due to serogroup B, with the highest rate being observed in infants younger than one year of age.

The National Advisory Committee on Immunization (NACI) provides recommendations regarding the use of meningococcal vaccines to the Public Health Agency of Canada (PHAC). Trumenba™, a bivalent, factor-H binding protein meningococcal serogroup B (MenB-fHBP) vaccine was authorized for use in Canada in October 2017 for the prevention of IMD caused by *Neisseria meningitidis* serogroup B in individuals 10–25 years of age. The objective of this article is to summarize the NACI recommendations on the use of MenB-fHBP vaccine for the prevention of serogroup B IMD in Canada (1).

Methods

To prepare the NACI *Statement on the Use of Bivalent Factor H Binding Protein Meningococcal Serogroup B (MenB-fHBP) Vaccine for the Prevention of Meningococcal B Disease*, the Meningococcal Disease Working Group (MDWG) identified 10 randomized controlled trials (RCTs) and six observational studies that examined the immunogenicity and 14 studies (11 RCTs and three observational studies) that examined the safety of MenB-fHBP vaccine. Following review and analysis, the MDWG proposed recommendations according to the NACI evidence-based process (2). The MDWG also requested information from one unpublished economic evaluation of MenB-fHBP and reviewed 14 published economic evaluations of protein based meningococcal vaccines against serogroup B IMD. PHAC conducted an analysis of the current epidemiology of serogroup B IMD in Canada. NACI critically appraised the available evidence and approved the specific recommendations brought forward.

Results

Epidemiology

Serogroup B is currently the most common cause of IMD in Canada. Between 2012 and 2016, 60.5% (n=353) of IMD cases were due to serogroup B, with the highest incidence in children younger than one year of age (n=10 cases annually; 2.7 cases per 100,000) followed by children 1–9 years (14 cases annually; 0.9 cases per 100,000) and adolescents 15–19 years (11 cases annually; 0.5 cases per 100,000). In the same time period, 63.8% (n=95) of cases of IMD in individuals 10–25 years were due to serogroup B, representing an incidence of 0.3–0.9 cases per 100,000 population in this age group.

Immunogenicity and effectiveness

In both adolescents (primarily 11–18 years) and young adults (primarily 18–25 years), MenB-fHBP vaccine was found to be immunogenic against both primary and secondary MenB test strains containing a range of fHBP variants that were representative of circulating strains causing invasive meningococcal disease at the time in Europe and the United States. There was limited evidence from two MenB-fHBP vaccine studies on persistence of the immune response up to 48 months post-vaccination in adolescents and 9–11 months in a small study in adults (24–66 years) and no data on the need for booster doses after the primary immunization series. The MDWG did not find any population-level data on the effectiveness of MenB-fHBP vaccine or its effect on meningococcal carriage or herd immunity.

Safety

Immunization with MenB-fHBP vaccine was found to be safe with no associated serious adverse events reported in immunocompetent individuals 10–25 years of age. Most systemic and local adverse events were mild to moderate in intensity and transient in duration (lasting 1–3 days).

Economics

None of the 14 articles (10 peer-reviewed studies and four study reports published by agencies) identified in the literature review included economic assessments of MenB-fHBP vaccine. The economic literature review found that 4CMenB (Bexsero®), which is authorized for use in Canada in individuals two months through 17 years of age, is not cost-effective at commonly used thresholds because of the low incidence of serogroup B IMD and the relatively high vaccine cost. Based on the economic evidence for 4CMenB vaccine and the age distribution of the burden of serogroup B IMD (highest in children younger than 10 years of age), the MDWG concluded that it was unlikely that the MenB-fHBP vaccine would be cost-effective.

Summary of NACI recommendations for the use of MenB-fHBP vaccine for the prevention of invasive meningococcal disease

NACI continues to recommend immunization against serogroup B IMD to all individuals who are at a higher risk of disease due to an underlying medical condition or at an increased risk of exposure. However, the two serogroup B meningococcal vaccines currently authorized for use in Canada are not interchangeable, as they contain different antigens and there are no published studies on the immunogenicity resulting from a vaccination series combining the two products. Therefore, the same vaccine product should be used for all doses in a vaccination series. If, in a person with an incomplete vaccination series, it is unknown what vaccine product they initially received, the initial dose(s) should be discounted and the vaccination series repeated using the same vaccine product for all doses in the new, repeated series.

Recommendations for public health publicly funded immunization programs

Recommendation 1: NACI recommends that the MenB-fHBP vaccine should not be offered in routine universal immunization programs in Canada at this time. (Strong NACI Recommendation).

- NACI concludes there is insufficient evidence to recommend routine universal immunization (Grade I Evidence)

Recommendation 2a: NACI recommends that a serogroup B meningococcal vaccine (MenB-fHBP vaccine or 4CMenB) should be offered in jurisdictions experiencing serogroup B meningococcal disease outbreaks or with the emergence of hyperendemic *N. meningitidis* strains that are predicted to be susceptible to the vaccine. (Strong NACI Recommendation).

- NACI concludes there is fair evidence to recommend vaccine use during outbreaks (Grade B Evidence)

Recommendation 2b: NACI recommends that the MenB-fHBP vaccine may be considered as an option for use in individuals 10 years of age and older in such circumstances. (Discretionary NACI Recommendation).

- NACI concludes there is insufficient evidence of the MenB-fHBP vaccine use in such circumstances (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 3a: NACI recommends that a serogroup B meningococcal vaccine (MenB-fHBP or 4CMenB) should be offered, in addition to chemoprophylaxis, for protection of individuals who are close contacts with a case of invasive meningococcal disease caused by serogroup B *N. meningitidis*. (Strong NACI Recommendation).

- NACI concludes there is insufficient evidence of vaccine effectiveness in close contacts of cases of IMD (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 3b: NACI recommends that the MenB-fHBP vaccine may be considered as an option for use in individuals 10 years of age and older who are close contacts with a case of IMD caused by serogroup B *N. meningitidis*. (Discretionary NACI Recommendation).

- NACI concludes there is insufficient evidence of the MenB-fHBP vaccine use in close contacts (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 4a: NACI recommends that a serogroup B meningococcal vaccine (MenB-fHBP or 4CMenB) should be offered for the active immunization of individuals with underlying medical conditions that would put them at higher risk of meningococcal disease than the general population to reduce the risk of invasive serogroup B meningococcal disease. (Strong NACI Recommendation).

- NACI concludes there is insufficient evidence of vaccine use in high-risk populations (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 4b: NACI recommends that the MenB-fHBP vaccine may be considered as an option for use in high-risk individuals 10 years of age and older, in a three-dose schedule (zero, 1–2, six months), to reduce the risk of invasive serogroup B meningococcal disease. (Discretionary NACI Recommendation).

- NACI concludes there is insufficient evidence of the MenB-fHBP vaccine use in high-risk populations (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendations for individual level decision-making

For individuals wishing to prevent serogroup B IMD or clinicians wishing to advise individual patients about preventing IMD with vaccines that may not be currently included in publicly funded immunization programs. For organizations or decision makers responsible for programs offering vaccine services to various groups including individuals at risk of acquiring IMD.

Recommendation 5a: NACI recommends that a serogroup B meningococcal vaccine (MenB-fHBP or 4CMenB) should be offered for the active immunization of individuals at higher risk of exposure to serogroup B meningococcal isolates than the general population to reduce the risk of invasive serogroup B meningococcal disease. (Strong NACI Recommendation).

- NACI concludes there is insufficient evidence of vaccine use in high-risk populations (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 5b: NACI recommends that the MenB-fHBP vaccine may be considered as an option for use in such high-risk individuals 10 years of age and older, in a two-dose schedule (zero and six months), to reduce the risk of invasive serogroup B meningococcal disease. (Discretionary NACI Recommendation).

- NACI concludes there is insufficient evidence of the MenB-fHBP vaccine use in high-risk populations (Grade I Evidence); therefore, this recommendation is based on expert opinion

Recommendation 6: NACI recommends that the MenB-fHBP vaccine may be considered as an option for individuals 10–25 years of age who are not at higher risk of meningococcal disease than the general population, in a two-dose schedule (zero and six months), to reduce the risk of invasive serogroup B meningococcal disease. (Discretionary NACI Recommendation).

- NACI concludes there is fair evidence of vaccine immunogenicity to recommend the MenB-fHBP vaccine when given according to the schedule used during clinical trials (Grade B Evidence)

Conclusion

NACI develops evidence-based recommendations for the use of vaccines marketed in Canada in order to support programmatic and clinical decision-making. The NACI *Statement on the Use of Bivalent Factor H Binding Protein Meningococcal Serogroup B (MenB-fHBP) Vaccine for the Prevention of Meningococcal B Disease* provides information and guidance, in addition to that provided in the product monograph, for the use of the newly licenced MenB-fHBP vaccine. Due to the low incidence of serogroup B IMD in the age group for which the MenB-fHBP vaccine is authorized for use, combined with an absence of data for vaccine effectiveness, duration of protection, effect on meningococcal carriage, herd immunity and cost-effectiveness, NACI has concluded that the vaccine should not be offered in routine universal immunization programs in Canada at this time.

Authors' statement

RS — Writing of original draft, reviewing and editing
OB — Writing of original draft, reviewing and editing
RH — Writing of original draft, reviewing and editing
WV — Writing of original draft, reviewing and editing

Conflict of interest

None.

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Infection prevention and control lapse involving medical equipment reprocessing at a family medicine clinic in Ottawa, Ontario, 2018

Geneviève Cadieux[1]*, Dara Spatz Friedman[1], Leslie Tilley[1], Tony Mazzulli[2], Cameron McDermaid[1]

Abstract

Background: In April 2018, Ottawa Public Health identified a large-scale infection prevention and control (IPAC) lapse spanning 15 years related to inadequate reprocessing of reusable critical medical equipment used in a family medicine clinic.

Objectives: To describe the public health response to, and estimate the risk of hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) transmission from, this IPAC lapse.

Methods: Patients who underwent a procedure of concern (during which reusable equipment may have been used) at this clinic were identified using Ontario Health Insurance Plan data and individually notified. Testing for HBV, HCV and HIV at the Public Health Ontario Laboratory was recommended, and the odds of infection were estimated.

Results: Of 4,495 patients possibly exposed to improperly reprocessed equipment, 1,496 (33.3%) underwent testing within six months of notification. The prevalence of HBV, HCV and HIV infection in this group was lower than in the general Canadian population. Among patients first diagnosed with HBV after a procedure of concern, the odds of HBV transmission were not increased when the procedure occurred within seven or 28 days of another patient with a positive HBV test result ($OR_{7\ days,\ age\text{-}adjusted}$=0.59, 95% CI: 0.14–2.51; $OR_{28\ days,\ age\text{-}adjusted}$=1.35, 95% CI: 0.62–2.93). The odds of HCV and HIV transmission could not be estimated because no patient was diagnosed with HCV or HIV after having a procedure of concern within 28 days of another patient with a positive HCV or HIV test result.

Conclusion: We found no evidence of HBV, HCV or HIV transmission associated with this IPAC lapse. However, transmission cannot be ruled out conclusively because only a third of possibly exposed patients underwent testing.

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Keywords: infection prevention and control, infection control lapse/breach, community-based healthcare settings, private practice/standards, family practice, ambulatory surgical procedures, cross infection/prevention and control, equipment contamination

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Introduction

In the ten year period from 2008–2017, the United States (US) Centers for Disease Control and Prevention (CDC) noted 61 healthcare-associated outbreaks of hepatitis B virus (HBV) and hepatitis C virus (HCV) associated with deviations from infection prevention and control (IPAC) best practices (1). More than 115,000 potentially exposed patients were notified as part of these healthcare-associated investigations, and 179 HBV cases and more than 295 HCV cases were identified (1). The majority (n=58/61 or 95%) of these healthcare-associated outbreaks of HBV and HCV occurred in non-hospital, community-based settings (1). Unfortunately, similar national surveillance data are not available for Canada, and the burden of HBV and HCV infections associated with IPAC lapses across Canada is not known. However, a recent survey of Ontario public health units noted a nearly six-fold increase in IPAC complaints and a near tripling of IPAC lapses from 2015 to 2018 (2).

The objectives of this article are 1) to describe a large-scale IPAC lapse involving inadequate reprocessing of reusable critical medical equipment at a family medicine clinic in Ottawa, Ontario; 2) to estimate the odds of HBV, HCV and human immunodeficiency virus (HIV) transmission as a result of this lapse; and 3) to illustrate the challenges encountered in the public health response to this lapse.

Background

In Ontario, the mandate and organization of public health units is defined by the *Health Protection and Promotion Act* (3). Ontario currently has a total of 35 public health units: 21 are independent of local municipal government, seven are regional health departments and seven are tied into a single-tier or other municipal administration (4). The *Ontario Public Health Standards* define mandatory public health programs and services (5); further guidance is provided in related Protocols and Guidelines. In 2015, the Ontario Ministry of Health and Long-Term Care amended the *Infection Prevention and Control Practices Complaints Protocol* (6), which mandates public health units to investigate complaints about IPAC practices in a variety of settings including personal service settings (e.g. nail salons, barber shops, tattoo parlours) and facilities in which regulated health professionals (e.g. nurses, physicians, dentists) operate.

Under the *Infection Prevention and Control Complaint Protocol, 2019* (6), public health units are mandated to receive complaints about IPAC practices, investigate these complaints, and take measures to reduce the risk of infection. Following a complaint, a public health inspector and/or nurse typically conduct an inspection of the premises using audit tools and other resources from Public Health Ontario (PHO) (7) and the Provincial Infectious Disease Advisory Committee (8,9) to assess deviations from IPAC best practices. In the *Infection Prevention and Control Complaint Protocol*, an IPAC lapse is defined as a "failure to follow IPAC practices resulting in a risk of transmission of infectious diseases to clients, attendees or staff through exposure to blood, body fluids, secretions, excretions, mucous membranes, non-intact skin, or contaminated equipment and soiled items" (6). A majority of IPAC complaints investigated by public health units involve deviations from or failure to adhere to IPAC best practices that, based on a risk assessment conducted by the unit, do not represent sufficient risk of infection transmission to be considered a lapse. PHO is available to support public health units with complex risk assessments.

If the medical officer of health or designate determines that an IPAC lapse has occurred, it must be disclosed publicly on the public health unit's website, as per the *Infection Prevention and Control Disclosure Protocol* (10). If an operator (i.e. a person operating a personal service or health care setting) does not either cooperate with the investigation or implement required corrective measures, and the medical officer of health or a public health inspector is of the opinion that a health hazard exists, a Section 13 order under the *Health Protection and Promotion Act* may be used to stop a practice or the provision of a service, or close a premise.

Methods

Detection of the infection prevention and control lapse

In April 2018, Ottawa Public Health (OPH) received a complaint from a member of the public concerning the cleanliness of a family medicine clinic, including its medical equipment. OPH staff inspected the clinic on the same day that the complaint was received. Several deviations from IPAC best practices were identified involving 1) all steps of reusable critical medical equipment reprocessing; 2) medication storage and administration; 3) laboratory specimen storage and handling; 4) hand hygiene; 5) environmental cleaning; 6) routine practices and additional precautions; and 7) occupational health and safety. These deviations from IPAC best practice were thought to have been present from the inception of the clinic in December 2003, until the time of the complaint in April 2018. Of note, physicians are members of a self-regulated profession; there are no routine inspections of IPAC practices in Ontario medical clinics.

The clinic voluntarily complied with OPH's requirement to cease performing all invasive medical procedures requiring the use of reusable critical medical equipment until further notice. Compliance with all corrective measures required by OPH was ensured through multiple follow-up inspections.

Risk assessment

In line with the public health mandate under the *Health Protection and Promotion Act*, the risk assessment focused on the potential for transmission of HBV, HCV and HIV, as these infections have the potential to go undiagnosed for several years, leading to poorer health outcomes and to secondary transmission. A query of the integrated Public Health Information System (iPHIS) for reported HBV, HCV and HIV cases residing in the area served by the clinic did not identify an excess of cases compared to the rest of Ottawa or to Canada.

Public Health Ontario qualitatively assessed the risk of infection transmission related to the inadequate reprocessing of reusable critical medical equipment to be "low" for HBV and HCV and "very low" for HIV. Public Health Ontario advised patient notification and testing for HBV, HCV and HIV.

In addition, OPH performed a quantitative risk assessment using published methodology (11,12). OPH's risk assessment used Canadian population prevalence estimates for HBV (13), HCV (14) and HIV (15), published estimates of the risk of transmission of HBV, HCV and HIV after a percutaneous exposure (16), and assumed a worst-case scenario where the reprocessing was

entirely ineffective; results from this assessment (not shown) were comparable with PHO's qualitative assessment. Had the estimated risk been closer to the 1:1,000,000 threshold for patient notification suggested in the literature (11,12), the OPH *Ethics Framework, 2014* may also have been applied to guide decision-making about patient notification and testing, as it was during OPH's response to an endoscopy clinic IPAC lapse in 2011 (17).

Possibly exposed patients: Definition

A possibly exposed patient was defined as someone who had an Ontario Health Insurance Plan (OHIP) billing record for an invasive medical procedure that may have involved reusable critical medical equipment at the family medicine clinic between its inception in December 2003 and the cessation of invasive procedures in April 2018. Patients were considered "possibly exposed" (rather than exposed) because some invasive procedures may not have involved the use of reusable critical equipment (e.g. a laceration repair could have been done with glue rather than sutures).

Possibly exposed patients: Identification

Over 90,000 unique patients were treated at the family medicine clinic between December 2003 and April 2018. To identify patients who were possibly exposed to reusable critical medical equipment, OPH reviewed the types of procedures performed at the clinic and whether single-use disposable or reusable equipment was typically used. Based on the information obtained from the clinic, OPH concluded that procedures of concern were as follows: removal of skin tags, moles and cysts using a blade or scissors; skin biopsy; incision, drainage and packing of an abscess or cyst; removal of an ingrown nail; laceration repair; removal of sutures or staples; and removal of a foreign body.

In consultation with the clinic, OPH generated a list of billing codes corresponding to the procedures of concern. The OHIP division of the Ontario Ministry of Health and Long-Term Care then extracted and transmitted to OPH all billing claims submitted by the clinic physicians involving one of the procedures of concern where the provider postal code was the same as that of the clinic (the clinic where the lapse occurred was the only clinic in its six-digit postal code area).

Possibly exposed patients: Notification

Patients possibly exposed as a result of this IPAC lapse were notified by mail in July 2018. The notification letter was approved by OPH and sent by the clinic. On the day of the mailout, OPH held a press conference and gave media interviews to disseminate the information to any exposed patients who were not identified in the OHIP billing data (e.g. uninsured patients, uninsured services, billing omissions). A website with detailed information about this lapse was also published on the day of the mailout. That same day, a fax was sent to healthcare system partners, including primary care providers, informing them of the large-scale IPAC lapse, patient notification and recommended testing, and providing resources to support patient counselling, testing and follow-up. Because the decision to undergo the recommended testing is a personal one, formal reminders were not issued to individual patients. OPH participated in multiple follow-up media interviews about testing uptake and aggregate results several weeks to months after the initial patient notification mailout.

Facilitation of laboratory testing

A Public Health Ontario Laboratory (PHOL) requisition for HBV, HCV and HIV testing pre-filled by one of the clinic physicians was included with every notification letter. This enabled patients to go to any specimen collection centre to have their blood drawn for testing and avoided a medical consultation to obtain a laboratory requisition.

Patients who did not want their results to be sent to the clinic were instructed to consult with their preferred health care provider to obtain a laboratory requisition for testing. A partially-filled PHOL laboratory requisition form (with the tests to be ordered and the special investigation number) was made available on the OPH website for those patients to take to their preferred health care provider.

Laboratory analyses

The PHOL carried out all post notification testing for HBV, HCV and HIV, and all testing was tracked using a special investigation number. Initial serologic testing for HBV, HCV and HIV was performed using the Abbott Architect instrument (Abbott Laboratories, Wiesbaden, Germany) following the manufacturer's instructions. Serum samples that were positive for HCV antibodies were then tested using a second serologic assay (ORTHO® HCV Version 3.0 ELISA Test System, Ortho Clinical Diagnostics Inc., Raritan, New Jersey, US) while serum samples testing positive for HIV antibodies underwent further testing using the Geenius™ HIV 1/2 Confirmatory Assay (Bio-Rad Laboratories, Redmond, Washington, US). Patients with serological tests suggestive of infection underwent DNA/RNA testing and genotyping as part of routine clinical management (cobas® HBV and cobas® HCV using the Roche 6800 instrument, Roche Molecular Systems Inc., Laval, Quebec, Canada; Abbott RealTime HIV-1 using the Abbott m2000 system, Abbott Molecular Inc., Des Plaines, Illinois US).

In the event that a cluster of two or more cases of HBV, HCV or HIV of the same genotype were detected, additional molecular testing would be sought from the National Microbiology Laboratory. All available post notification testing results were transmitted by the PHOL to OPH one month, three months and six months post-patient notification. In addition, the PHOL also provided all available positive and negative HBV, HCV and HIV serologic and molecular testing results, going as far back as 1996, for any patient who ever had a positive test for HBV, HCV or HIV and was possibly exposed as a result of this IPAC lapse. These data were used to estimate when the infection likely occurred and the possible infectious period.

HBV, HCV and HIV case investigations

HBV, HCV and HIV are provincially-reportable diseases under the *Health Protection and Promotion Act*. As such, all new cases reported to OPH are routinely investigated in accordance with the relevant policies and procedures. Specifically, a public health nurse contacts the diagnosing physician to request that a follow-up form be completed and transmitted to OPH; this form asks about risk factors for infection, follow-up care and contact tracing performed by the health care provider, and provides a checklist for counselling about measures to prevent transmission. If needed, a public health nurse also contacts the case or their next of kin to obtain risk factors, link to follow-up care, complete contact tracing, and provide counselling. Information gathered from the diagnosing physician using the follow-up form and, as needed, from the case, is then entered in the iPHIS.

All patients possibly exposed to this IPAC lapse with evidence of HBV, HCV or HIV infection, diagnosed through post notification testing or previously diagnosed and reported to OPH, were investigated as above. The Nurse manager and the epidemiologist for OPH's Sexually Transmitted and Bloodborne Infections team then manually reviewed the case investigation files for all HBV, HCV and HIV cases possibly exposed as a result of this IPAC lapse to look for any evidence of clustering or transmission related to the lapse and to identify any competing risk factors for infection.

Statistical analyses

The prevalence of HBV, HCV and HIV infection was estimated among patients who underwent post notification testing. The association between being diagnosed with HBV, HCV or HIV infection after a procedure of concern, and that procedure having occurred within seven days of another procedure involving a patient with a positive test result for the relevant virus predating their own procedure was estimated using odds ratios. Exposure and outcome assessment were based on available laboratory test results and date(s) of procedure(s) of concern. The outcome was HBV, HCV or HIV infection status after the procedure of concern. For the purposes of this analysis, patients were considered exposed if they underwent one or more procedure of concern within seven days following a patient with a positive HBV, HCV or HIV test result predating their own procedure. Patients were considered unexposed if they underwent one or more procedure of concern a) beyond seven days after a patient with a positive HBV, HCV or HIV test result predating their own procedure or b) after a patient who did not have any positive HBV, HCV or HIV test result. The seven day time window used was based on evidence of virus survival (18–22) and the frequency of use and reprocessing of critical instruments (i.e. transmission was only considered for the first person on whom the improperly reprocessed instrument was used; subsequent cycles of reprocessing would be expected to reduce the risk of transmission to effectively zero).

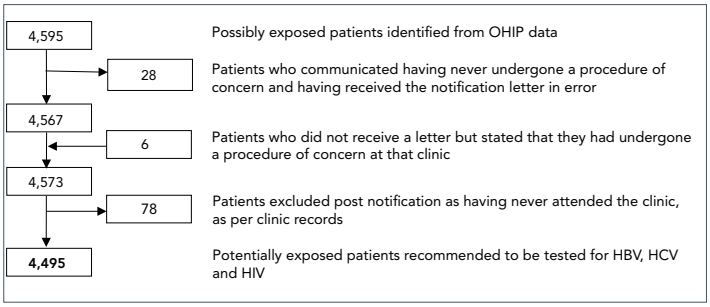
Because HBV and HCV infections can resolve spontaneously, we could not definitely ascertain some patients' HBV and HCV infection status at the time of their procedure. For example, a patient with no previous negative test for hepatitis B who first tested HBcAb-positive and HBsAg-negative (indicating immunity from resolved natural infection) after the lapse notification was considered both as a potential source of infection for another patient who had a procedure of concern within a seven day window, and as potentially having been infected through this procedure of concern. Similarly, because information about HIV viral load was not available (i.e. HIV viral load testing results are not reportable to public health in Ontario), patients with a positive HIV test prior to their procedure of concern were considered infectious at the time of their procedure.

Odds ratio was the measure of association selected because the low uptake of testing did not allow a reliable estimate of infection prevalence and 95% confidence intervals were estimated using the exact method. All analyses were conducted using Stata version 14.2 (StataCorp, US). Sensitivity analyses were conducted using a shorter and longer time window (one and 28 days) and patient-procedure-level data rather than patient-level data.

Results

A total of 4,595 patients were identified from OHIP billing data as having undergone a procedure of concern (**Figure 1**); together, these patients underwent a total of 6,832 procedures of concern. Of those 4,595 patients, 28 contacted OPH after receiving a notification letter to share that they never had a procedure of concern at the clinic, and 78 had never actually attended the clinic based on clinic records. An additional of six patients who had not been identified through OHIP billing data contacted OPH to share that they had undergone a procedure of concern at the clinic. Of the revised total of 4,495 possibly exposed patients, 1,496 (33.3%) underwent the recommended testing for HBV, HCV or HIV at least once within six months after the mailing of the IPAC lapse notification letters.

Figure 1: Identification of patients possibly exposed to this infection prevention and control lapse



Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; OHIP, Ontario Health Insurance Plan
Note: Some patients may have received a letter and self-assessed that they had never undergone a procedure of concern and failed to notify Ottawa Public Health or the clinic; these patients are included in this figure as possibly exposed. Some patients may have not received a letter, self-identified as having received a procedure of concern, and sought testing without using the special laboratory requisition containing the investigation tracking number; these patients are not included in this figure

On average, patients who completed the recommended testing tended to be older than those who did not. Completion of recommended testing did not differ based on the timing of the procedure of concern (recent or several years ago) or the number of procedures of concern (**Table 1**).

Table 1: Characteristics of patients possibly exposed to the infection prevention and control lapse, by completed HBV, HCV and HIV testing status six months following notification (N=4,495)

Patient characteristic	Potentially exposed patients who were tested (N=1,496)		Potentially exposed patients who were not tested (N=2,999)	
	N	%	N	%
Age group				
0–17 years	142	10	274	9
18–44 years	410	27	1,414	47
45–64 years	566	38	884	30
65 years and older	377	25	426	14
Data missing	1	<1	1	<1
Timing of most recent "at risk" procedure				
Less than 12 months ago	144	10	198	7
12–23 months ago	138	9	256	9
24–35 months ago	125	8	209	7
36 months ago or more	1,089	73	2,336	78

Number of "at-risk" procedures	Mean	Median	Range	Mean	Median	Range
	1.5	1	1–25	1.6	1	1–23

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus

Among patients who underwent post notification HBV, HCV and/or HIV testing, there were two new diagnoses of HCV infection (**Table 2**): one patient was RNA-positive (indicating a chronic infection) and the other was RNA-negative (indicating a resolved infection). The patient with chronic HCV infection was referred by their family physician to an infectious disease specialist for clinical management, and routine public health case investigation found that this patient had other risk factors for HCV infection (i.e. potential vertical transmission or horizontal transmission from household contacts). Post notification testing for HBV and HIV did not yield any new diagnoses of acute or chronic HBV infection or HIV infection.

Overall, among 4,495 patients possibly exposed to improperly reprocessed critical reusable equipment, based on all laboratory testing data available to OPH six months after the patient notification mailout, the prevalence was 0.07%, 95% CI: (0–2.8%) for any HBV infection (chronic or resolved), 0.35%, 95% CI: (0.10–0.80%) for any HCV infection (chronic or resolved) and 0.08%, 95% CI: (0–0.49%) for HIV infection. These results are lower than the estimated prevalence for the Canadian population for HBV (13), HCV (14) and HIV (15,23), and lower than recent estimates for HCV in Ontario (24).

Among patients first diagnosed with HBV infection any time after a procedure of concern, the odds of HBV infection were not increased if the procedure occurred within seven days after another procedure involving someone with a positive HBV test result predating the procedure ($OR_{within\ 7\ days}$=0.62, 95% CI: 0.15–2.63). Because patients who underwent post notification testing were older than those who did not, an age-adjusted odds ratio was estimated; the age-adjusted estimated was similar ($OR_{within\ 7\ days,\ age\text{-}adjusted}$=0.59, 95% CI: 0.14–2.51). Statistically non-significant results were also obtained when the exposure

Table 2: Number of patients who did and did not undergo a procedure of concern within seven days of a potentially infectious patient, by HBV, HCV and HIV status six months post notification[a]

Exposure status	HBV status[b] (N=1,466)			HCV status[b] (N=1,441)			HIV status[b] (N=1,251)	
	Chronic infection	Resolved infection (natural immunity)[c]	Not infected	RNA-positive (chronic infection)	Antibody-positive, RNA-negative/ unknown	Not infected	Infected	Not infected
Underwent a procedure of concern within 7 days[d] of another patient with a positive test result[d] for the relevant virus predating their own procedure (exposed)	0	2	153	0	0	78	0	8
Did not undergo a procedure of concern within 7 days[d] of another patient with a positive test result for the relevant virus predating their own procedure (unexposed)	1	26	1,284	5	12	1,346	1	1,242

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus

[a] Not all patients underwent testing for all three infectious agents; therefore, cell totals are different for each infection

[b] The outcome is infection status six-months post notification; cell counts also include patients diagnosed with HBV, HCV or HIV sometime after their procedure of concern and prior to the infection prevention and control (IPAC) lapse notification

[c] Case counts for chronic HBV infection and resolved HBV infection were combined in the analysis, given the extended duration of the IPAC lapse and the unknown onset of the infection

[d] This time window was based on the likely period of survival of the virus and the frequency of use and reprocessing of critical instruments (transmission was only considered for the first person on whom the improperly reprocessed instrument was used; subsequent cycles of reprocessing would be expected to reduce the risk of transmission to effectively zero)

time window was increased to 28 days ($OR_{\text{within 28 days, age-adjusted}}$=1.35, 95% CI: 0.62–2.93); analyses could not be performed using the one-day time window due to a numerator of zero. Similar results were obtained when the analysis was performed at the level of the patient-procedure ($OR_{\text{within 7 days, age-adjusted}}$=0.45, 95% CI: 0.11–1.85) rather than the patient. The odds of HCV and HIV transmission could not be estimated, because no patient was first diagnosed with HCV or HIV after a procedure of concern that occurred within 28 days after another procedure involving a patient with a positive HCV or HIV test result predating their own procedure.

Discussion

In response to an IPAC complaint, OPH identified an IPAC lapse spanning 15 years and involving inadequate reprocessing of reusable critical equipment in a family medicine clinic. Public Health Ontario qualitatively estimated the risk of infection to be "low" for HBV and HCV and "very low" for HIV. Possibly exposed patients were identified using OHIP billing data; they were then notified, through an individual letter mailout, of their potential exposure as a result of this IPAC lapse, and recommended to be tested for HBV, HCV and HIV. Six months post notification, only 33% of the patients had completed testing; a higher proportion of older patients underwent the recommended testing compared with younger patients. Post notification testing yielded two new diagnoses of HCV infection (i.e. one chronic and one resolved infection); the new case of chronic HCV infection was likely infected through vertical or household transmission. Post notification testing did not yield any new diagnoses of HBV or HIV infection. The prevalence of HBV, HCV and HIV infection among the possibly exposed patients was lower than in the Canadian population. The odds of HBV infection among patients who underwent a procedure within seven or 28 days following another procedure involving a patient with a positive HBV test result predating their own procedure were not increased. The odds could not be estimated for HCV and HIV due to insufficient numbers. Ottawa Public Health`s investigation found no evidence of transmission of HBV, HCV or HIV associated with this IPAC lapse. However, transmission cannot be ruled out conclusively because only a third of possibly exposed patients underwent testing.

Similarly, no evidence of transmission of HBV, HCV or HIV was found during OPH's investigation of an IPAC lapse at an endoscopy clinic in 2011 involving 6,992 patients (17), 75% of whom underwent post-lapse testing. Also, a review of healthcare-associated HBV and HCV outbreaks reported to the US CDC did not identify any HBV or HCV contamination related to the inadequate reprocessing of reusable critical medical equipment similar to those involved in this IPAC lapse (i.e. equipment used to perform minor surgical procedures) (1). Rather, the most common deviations from IPAC best practices that have resulted in HBV and HCV transmission were related to point-of-care glucose testing and misuse of multidose vials/injection equipment (1).

Strength and limitations

A major strength of this IPAC investigation was the ability to identify possibly exposed patients from OHIP data. This process could be further enhanced if OHIP data included a clinic-specific identifier as a mandatory field. Other strengths included the centralization of post notification laboratory testing at the PHOL enabling tracking of results, and the access to previous laboratory testing results for possibly exposed patients with a previous positive result for HBV, HCV or HIV. An important limitation of this IPAC investigation was the relatively low uptake of post notification testing, and potential selection bias due to patients self-selecting to undergo testing. Patients who opted to undergo post notification testing were older than those who did not; we attempted to account for this by estimating an age-adjusted OR, which was similar to the crude OR. Except for age (i.e. date of birth), sociodemographic characteristics of patients potentially exposed to this IPAC lapse were not collected or not available, and other factors associated with testing uptake could not be assessed. Furthermore, several factors limited our ability to ascertain exposure status and could have led to exposure misclassification and dilution of the effect: the inability to track which patient had been exposed to a given instrument because an instrument-tracking system (e.g. bar code) was not in place at this clinic; the lack of access to negative HBV, HCV and HIV results for testing completed before the notification (except for patients with a history of a positive test result for the same infection, as negative results are not reportable to public health) and the lack of precise information concerning when patients were first infected with HBV, HCV or HIV; and, whether or not they were infectious when they underwent the procedure of concern.

Conclusion

Findings from large scale IPAC lapse investigations such as these are important to share, so that they may inform the public health response to similar IPAC lapses in the future. Future IPAC lapse investigations would benefit from better outcome and exposure ascertainment, e.g. through access to all HBV, HCV, and HIV testing results (including negative results) from existing laboratory databases. Furthermore, because assessment of the risk of HBV, HCV and HIV infection in relation to an IPAC lapse is an imprecise process, whether a qualitative (25,26) or a quantitative (11,12) risk assessment method is used, provincial surveillance of IPAC lapses and related public health investigations and incorporation of findings from completed investigations would help bolster the evidence basis underlying risk assessments and would help inform decision making about patient notification and testing.

In Ontario, prevention of IPAC lapses is largely beyond the formal mandate of local public health units; that responsibility rests primarily with clinic managers and service providers, health care professional training programs, licensing bodies and

regulatory colleges, as well as the Ontario Ministry of Health and Long-Term Care. That said, following this IPAC lapse, OPH partnered with the College of Physicians and Surgeons of Ontario and PHO to offer a continuing professional development session on IPAC best practices to Ottawa family physicians. OPH also developed and delivered a training session for family medicine residents at the University of Ottawa. Finally, OPH performed an assessment of IPAC learning needs among Ottawa medical and dental clinics (27), with the goal of informing future interventions to improve IPAC practices in these settings.

Authors' statement

Cadieux was the primary author of the manuscript. Friedman contributed to the exposure and outcome assessment and provided feedback on the manuscript. Tilley performed the exposure and outcome assessment and provided feedback on the manuscript. Mazzulli oversaw the laboratory analyses and contributed to the manuscript. McDermaid performed all statistical analyses and contributed to the manuscript.

Conflict of interest

None.

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Optimizing communication material to address vaccine hesitancy

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Abstract

Vaccine hesitancy (the reluctance to accept recommended vaccines) is a complex issue that poses risk communication challenges for public health authorities and clinicians. Studies have shown that providing too much evidence on vaccine safety and efficacy to those who are vaccine-hesitant has done little to stem the growth of hesitancy-related beliefs and fears. The objective of this paper is to describe good practices in developing communication materials to address vaccine hesitancy.

An inventory of vaccination communication materials in Canada was assessed according to the Council of Canadian Academies Expert Panel on Health Product Risk Communication Evaluation (2015). Many of the current communication products could be improved to better align with evidence-based risk communication best practices. Five best practices were identified. First, identify target audience and establish trust. Second, provide both the risks and benefits of vaccination, as most people are looking for balanced information. Third, give the facts before addressing the myths. Fourth, use visual aids. Fifth, test communication material prior to launch.

Applying these best practices to current or future communication products will help vaccine providers (including physicians, nurse practitioners, pharmacists, public health professionals) to develop communication materials that are sensitive to the complex ways that people process and value information and thus more likely to optimize vaccine uptake in their communities.

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Keywords: vaccine hesitancy, communication, vaccine uptake, information products, risk communication, vaccine acceptance, vaccine misinformation

Introduction

Studies have shown that providing evidence of vaccine safety and efficacy to those who are vaccine-hesitant has done little to stem the growth of hesitancy-related beliefs and fears. Previous research has shown that messaging that too strongly educates and advocates vaccination can be counterproductive for those who are already hesitant (1). Providing too much information can even generate hesitancy (2). To address this paradoxical effect of some communication material, research has been done on what communication techniques and strategies are most effective. Research evidence of what works (or not) in health risk communication has been compiled by Fischhoff and colleagues (3) and endorsed as good practices by the Council of Canadian Academies Expert Panel on Health Product Risk Communication Evaluation (4). To explore how Canadian communication material reflects these best practices, we assessed an inventory of Canadian vaccination communication materials (websites, factsheets, posters, videos, etc.) using Fischhoff's good practices (3).

Although the communication of information is one of the primary tools at the disposal of vaccine providers, information alone is unlikely to dramatically change vaccine acceptance. Given the amount of financial and human resources invested in developing and diffusing communication materials about vaccination, it is critical to optimize these tools to ensure that they work as intended. The objective of this paper is to describe good practices in developing communication materials to address vaccine hesitancy. This is the second of a series of articles, produced by the Canadian Vaccination Evidence Resource and Exchange Centre (CANVax), which includes both the identification of existing resources and the creation of new resources by this group of multidisciplinary professionals (5,6).

General observations

Our analysis showed that existing communication materials in Canada could be improved to better align with established best practices in risk communication. We found that most communication material focused on risks of vaccine-preventable diseases, the risks of adverse events and "debunking common myths". The approaches used to debunk myths generally focused on the myth itself rather than the correct information. We found the information about risk was mainly qualitative (e.g. "The risk of adverse events after immunization is small" and "The diseases we can prevent with vaccines can lead to pneumonia, deafness, brain damage, heart problems, blindness and paralysis in children who are not protected"). Few of the materials used probabilities to quantify risks. When probabilities appeared, they were unidirectional (e.g. presenting only risk of diseases or number of cases in an outbreak) rather than bidirectional (e.g. presenting risk of diseases and risk of adverse events after immunization). Only a minority of the materials used graphics or videos.

We then did a limited scan of international materials and found that some communication tools that have been developed do meet best practices and could be adapted for Canadian parents (e.g. http://talkingaboutimmunisation.org.au/).

Best practices

Addressing vaccine hesitancy requires tailored strategies that are tested, evidence-informed and take into account that vaccine hesitancy is complex and context specific, varying across time, place and vaccine type (7).

1. Identify target audience and establish trust

"Understanding the perspectives of the people for whom immunization services are intended, and their engagement with the issue", wrote Goldstein and colleagues, "is as important as the information that experts want to communicate" (8). The amount, content and type of information that is needed to move a vaccine-hesitant individual toward vaccine acceptance differs greatly from the basic information needed by a person who is already favourable to vaccination and intends to vaccinate. Research has shown that vaccine-hesitant individuals are "active information-seekers" that are looking for "balanced" information presenting both pros and cons of vaccination in order to make an informed decision about vaccines (9,10). Their information needs are usually not fulfilled with typical information from public health authorities, as this information generally does not usually provide references to scientific studies and is often perceived as focusing on the benefits of vaccines and not discussing the potential risks of vaccines (11). Addressing those who are strongly anti-vaccines merit specific strategies. This is not the subject of the current paper but will be addressed in a future CANVax Brief.

A key factor influencing vaccination decision-making is trust in the effectiveness and safety of vaccines, in the system that delivers them, including the reliability and competence of the health services and health professionals, and in the motivations of the policy-makers who decide which vaccines are needed when and where (11). Many studies have shown that vaccine hesitancy was not due to being uninformed or misinformed, but reflected a general distrust of doctors, government sources and/or pharmaceutical companies (12–14). In this context, the perceived credibility of the institutions delivering the vaccination information often matters more than the information itself (15), highlighting the importance of transparency and honesty (16). Presenting both the potential benefits and potential harms of vaccines is also key. Studies in other countries have shown this to be a promising approach for increasing vaccine acceptance (17–19).

Research has shown that individuals, when faced with information that contradicts their values, can feel threatened and react defensively. This creates resistance, resulting in a strengthening of their initial beliefs and reducing the likelihood of engaging in the desired behavior (i.e. vaccination acceptance) (20). However, messages can be framed in ways that addresses patients' values and promotes trust (21). For example, when human papilloma virus vaccination was framed as a cancer-prevention vaccination, less resistance was generated than when it was framed as a means to prevent a sexually transmitted infection (22).

2. Provide both the risks and benefits of vaccination

Providing information about the risk and benefits of vaccination is not as simple as it might seem (3). When developing communication material, healthcare workers must be sensitive to the complex ways by which people process and value information. Do not assume that "numbers will speak for themselves". How the message is developed is as important as the content (23): while the content of the tools should be based on available scientific evidence, the development should be based on risk communication (24).

Best practices arising from this literature review include providing data on risks and benefits of vaccination and providing critical qualitative information:

- Providing numeric likelihood of risks and benefits of vaccination

Tools should clearly define both the risks and potential consequences of not being vaccinated (risks of vaccine-preventable diseases) and the risks of adverse events after vaccination. This should be done using not just words but also numbers. Keep denominators constant (e.g. one in 10,000; 25 in 10,000) and use whole numbers rather than fraction or decimals (25,26).

- Providing critical qualitative information

Material should not only present quantitative numeric information on vaccination risks and benefits, but should also provide qualitative information to present the evidence supporting these estimates. Focus on the critical information and why it is critical that people understand this information in order to make their vaccination decision. For example, people might not realize that their individual vaccination decision has an impact on herd immunity, or parents may not understand that postponing vaccination is an option.

3. Give facts; then address myths

One of the main objectives of most communication material on vaccination is to "correct" misconceptions about vaccination. But communication material needs to be carefully designed, as attempts to debunk a myth could actually reinforce it (20). When developing communication material, put the emphasis on the facts, not the myths. The common technique of headlining the vaccination myth in big, bold letters is not the best strategy, as people will remember the myth, not the fact. Instead, communicate the core fact in the headline, and then follow-up with an alternative explanation. When a myth is debunked, a gap in the person's mind is created. To be effective, the communication material must then fill that gap (**Figure 1**).

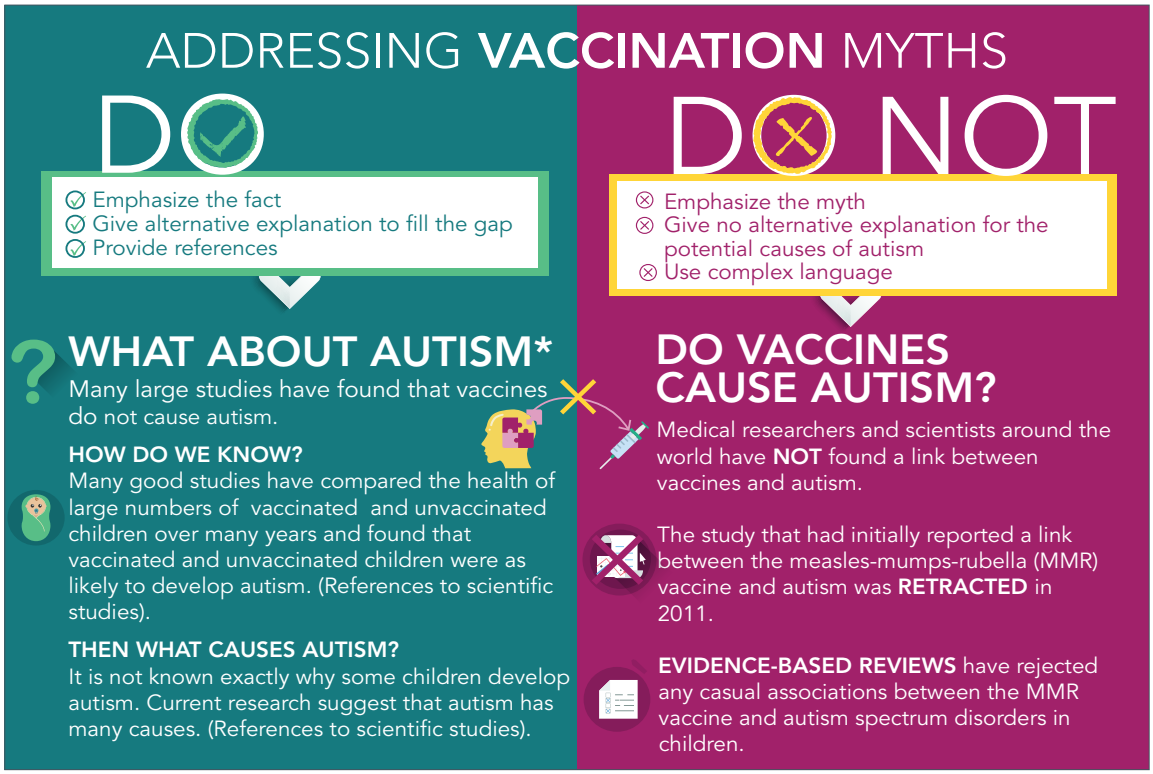
4. Use visual aids

Visual supports like infographics or video can enhance a person's understanding of complex risk information. Studies have shown that visual aids may help people to understand health risks, especially for those with low numeracy skills (27,28). Visual aids include videos, pictures, icons array (i.e. a picture using one shape that is repeated a specific number of times, usually 10, 100 or 1,000, with some of the shapes altered, usually in a different color, to represent a proportion) or infographics (i.e. a combination of images and text to quickly summarize a large amount of information). Graphs can make numeric information easier to understand and pictographs are the best strategy for communicating both gist (meaning) and verbatim (exact details) knowledge (**Figure 2**).

Figure 2: A short introduction on vaccine safety by Immunize Canada

Source: https://www.youtube.com/watch?v=Y4N4_1PNtfk

Figure 1: Addressing vaccination myths



Source: Adapted from http://adelaidephn.com.au/assets/What_autism.pdf

5. Test communication prior to launching

It is important to test a communication material prior to launching to make sure it is working as intended for the target audience. The results might be surprising: a study showed that information given in frequency formats (e.g. one out of 10 infants will have a fever after a vaccination) were perceived as more risky than the same information conveyed in probabilistic terms (e.g. 10% of infants will have a fever after a vaccination) (27). Studies have also shown that as many as one out of two adults do not have the necessary skills to interpret probabilities and other mathematical concepts (27,28).

- Use communication material that is clear and easy to understand

Use simple language, short sentences and subheadings. Avoid dramatic language and derogatory comments that alienate people. It is important that numbers used are easy to understand (28).

- Avoid the back-fire effect

For those who are strongly fixed in their views, being confronted with counter-arguments can cause their views to be strengthened (29). Testing communication material is important, as even carefully crafted efforts to influence individuals holding factually incorrect beliefs can, in fact, reinforce these beliefs (29).

Conclusion

Risk messaging cannot be "one-size-fits-all". Most people are seeking balanced information on vaccines when deciding whether to take them or not. People need to verify with their health care provider that there is misinformation on vaccines. People with strong antivaccination views may not change their minds, regardless of what the message is or how it is communicated, so short messaging may be all that is indicated. To address the spectrum of beliefs that contribute to vaccine hesitancy, communication materials need to be tailored and targeted to these different knowledge systems, and the unique information needs and preferences of particular communities (8,23). Updates on this issue will be published on the CANVax website (5).

Authors' statement

ED — Conceptualization, supervision, writing—original draft
DG — Writing—review and editing
MV — Data curation, formal analysis, writing—review and editing

Conflict of interest

Dr. Dubé reports grants from the Public Health Agency of Canada, the Quebec ministry of Health and Social services, le Fonds de recherche en Santé du Québec, the Canadian Institutes of Health Research, the Canadian Immunization Research Network, and the Social Sciences and Humanities Research Council of Canada. Dr. Vivion reports grants from Canadian Public Health Association and from Canadian Immunization Research Network during the conduct of the study.

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Effective partnerships to address public health priorities

Source: Awale J, Choudhary M, Solomon R, Chaturvedi A. Effective Partnership Mechanisms: A Legacy of the Polio Eradication Initiative in India and Their Potential for Addressing Other Public Health Priorities. *Am J Trop Med Hyg*. 2019 Oct;101(4_Suppl):21-32. https://doi.org/10.4269/ajtmh.18-0938

While many factors contributed to the successful elimination of polio from India, partnership and coordination mechanisms at multiple levels that have evolved over the years have been an important element. The lessons learned from these partnership and coordination mechanisms among various stakeholders involved in service delivery, surveillance, community mobilization, and governance deserve documentation as a legacy of the program. This article discusses the various processes and techniques adopted to build strong partnerships and coordination mechanisms among stakeholders by optimizing their strengths and using opportunities that lead toward the eradication of polio from India. Secondary data and literature review of relevant reports, papers and documents were adopted as the methodology for developing this research article. The article provides a model conceptual framework for partnerships and applies that framework to the CORE Group Polio Project (CGPP) partnerships in India and the partnerships among stakeholders for polio eradication in India. The learnings and expertise of the CGPP in developing, managing, and nurturing partnerships can be adapted and replicated for elimination or controlling other diseases (especially those that are vaccine-preventable as well as tuberculosis and vector-borne diseases) and for ending preventable child and maternal deaths.

The impact of medical legal partnerships to improve health outcome

Source: Muñoz-Laboy M, Martinez O, Davison R, Fernandez I. Examining the impact of medical legal partnerships in improving outcomes on the HIV care continuum: rationale, design and methods. *BMC Health Serv Res.* 2019 Nov 20;19(1):849. https://doi.org/10.1186/s12913-019-4632-x

Background: Over the past two decades, we have seen a nationwide increase in the use of medical-legal partnerships (MLPs) to address health disparities affecting vulnerable populations. These partnerships increase medical teams' capacity to address social and environmental threats to patients' health, such as unsafe housing conditions, through partnership with legal professionals. Despite expansions in the use of MLP care models in health care settings, the health outcomes efficacy of MLPs has yet to be examined, particularly for complex chronic conditions such as HIV.

Methods: This on-going mixed-methods study utilizes institutional case study and intervention mapping methodologies to develop an HIV-specific medical legal partnership logic model. Up-to-date, the organizational qualitative data has been collected. The next steps of this study consists of:
1) recruitment of 100 MLP providers through a national survey of clinics, community-based organizations, and hospitals;
2) in-depth interviewing of 50 dyads of MLP service providers and clients living with HIV to gauge the potential large-scale impact of legal partnerships on addressing the unmet needs of this population; and,
3) the development of an MLP intervention model to improve HIV care continuum outcomes using intervention mapping.

Discussion: The proposed study is highly significant because it targets a vulnerable population, PLWHA, and consists of formative and developmental work to investigate the impact of MLPs on health, legal, and psychosocial outcomes within this population. MLPs offer an integrated approach to healthcare delivery that seems promising for meeting the needs of PLWHA, but has yet to be rigorously assessed within this population.

2019 novel coronavirus: Outbreak update

Source: Government of Canada. 2019 novel coronavirus: Outbreak update; 2020 Feb 04. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html

How Canada is monitoring the 2019 novel coronavirus

The Public Health Agency of Canada (PHAC) is working with provinces, territories and international partners, including the World Health Organization, to actively monitor the situation.

Canada's Chief Public Health Officer of Canada is in close contact with provincial and territorial Chief Medical Officers of Health to ensure that any cases of 2019-nCoV occurring in Canada continue to be rapidly identified and managed in order to protect the health of Canadians.

For more information, visit Canada's response page.

Risk to Canadians

PHAC has assessed the public health risk associated with 2019-nCoV as low for Canada.

Overall, the risk to Canadian travellers abroad is low. The risk to Canadian travellers to China is assessed as high. The Government of Canada recommends avoiding:

- **all non-essential** travel to China
- **all travel** to Hubei Province, China, including Wuhan city

Public health risk is continually reassessed as new information becomes available.

History

On December 31, 2019, the World Health Organization was alerted to several cases of pneumonia in Wuhan, China. The virus did not match any other known virus. On January 7, 2020, China confirmed 2019-nCoV.

See the travel health notice (https://travel.gc.ca/travelling/health-safety/travel-health-notices/210) for more information if you are considering travelling to China.

Can Commun Dis Rep 2020:46(1) Erratum

Canada Communicable Disease Report Editorial Team

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In the report "*National Influenza Mid-Season Report, 2019–2020*" on page 25, it should read: "This is a summary of Canada's influenza season based on surveillance data available from August 25 to December 14, 2019 (epidemiological weeks 35 to 50) and strain characterization and antiviral testing data available from September 1 to December 19, 2019 (1)… instead of "This is a summary of Canada's influenza season… in the weekly FluWatch reports prepared by the Public Health Agency of Canada."

On page 26, it should read "The National Microbiology Laboratory (NML) has characterized 159 influenza viruses (78 A(H3N2), 45 A(H1N1)…" instead of 45 A(H2N3).

On page 26, it should read "A total of 36 influenza B viruses… in the production of the 2019–2020…" instead of 2018–2019.

On page 27 reference 8, it should read "Allen UD" instead of "Upton DA".

This correction has been made to the online version as of February 6, 2020.

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