Rural Immunization Programs

Considerations for the Canadian Context

What's **Inside...**

In March 2020 the WHO declared COVID-19 a global pandemic.

The ongoing rollout of COVID-19 vaccines in Canada has raised questions about how to effectively and equitably plan vaccination campaigns. Vaccine rollout in rural, remote, and Northern communities has unique challenges.

This review of evidence provides an overview of the rural risk profile for COVID-19 and vaccination in rural Canada, and explores factors contributing to success in rural vaccination campaigns and ways to reduce vaccine hesitancy.

The COVID-19 pandemic has renewed interest in vaccination strategies and policies related to immunization in Canada. Vaccination programs are proven health interventions, effectively reducing disease burden and saving 2-3 million lives worldwide each year (1–3). Vaccines also improve the overall health of communities, partially compensating for negative determinants of health such as poverty and poor living conditions (4). Vaccination is critical to controlling disease outbreaks ; modeling studies have shown that delaying a vaccine by as little as one week can result in a surge of cases (5,6). The approach that a health organization takes to a vaccination campaign can have a significant influence on vaccine decisions and adherence.

This document seeks to provide a summary of evidence of the unique challenges of vaccination in rural areas in Canada, a look at rural vaccination strategies, and an assessment of the advantages and disadvantages of these strategies for COVID-19 vaccine roll-out in the Canadian context. We are not providing

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a systematic or scoping review, but reflects the results of a literature search using the terms "rural vaccination", "rural vaccination strategies", and "vaccination strategies" on Google Scholar, PubMed, and OVID; the first ten pages of results were reviewed for each. In addition, a narrative search was performed for the terms "vaccination Canadian Indigenous communities," "vaccine hesitancy Canada" and "rural vaccination Canada," to reflect specifically Canadian issues. Unpublished results from a survey of the Rural, Remote and Northern Public Health Network, and from a National Collaborating Centre for Indigenous Health pamphlet, are also described.

VACCINATION IN CANADA

In Canada, there is no standard for vaccine delivery or data management. Although fairly similar, vaccine schedules and delivery methods vary by province and territory (7), making data comparison challenging. Some provinces keep registries; other provinces, and the federal government, use telephone surveys to estimate vaccine coverage. The Public Health Agency of Canada's adult National Immunization Coverage Survey is based on self-reported data. Those who have knowledge of vaccines are more likely to be vaccinated (8); they are also more likely to be able to provide data to a self-reported survey (9), so these results have limitations. In general, inter-provincial data are hard to compare, and information at the national level is less reliable (8) . National survey results show that 76% of two-year old children had received all recommended doses of diphtheria, tetanus and pertussis vaccine (10); that 65% of adults 65 years of age and older reported being vaccinated against influenza (9); 42% of adults 65 years of age and older reported receiving the pneumococcal vaccine (9); and only 10% of adults reported having received a booster dose of the pertussis vaccine after 18 years of age (9). Although estimates of vaccine coverage vary by age group and vaccine, there is general consensus that the national herd immunity vaccination targets set by the Public Health Agency of Canada are not being met across the country, even for those groups identified as being at high-risk for severe complications (7–9,11).

Vaccination rates may be lower for certain sub-populations, such as immigrants and First Nations, Inuit, and Métis peoples. Clinical guidelines for physicians treating immigrants in Canada state that "30%–50% of new immigrants are susceptible to tetanus; 32%–54% of new immigrants are susceptible to either measles, mumps or rubella; and immigrants from tropical countries are 5–10 times more susceptible to varicella" (12). In addition, a large proportion of foreign-born people from hepatitis B prevalent areas (ranging from 20-80%) are not immunized against the disease (12). Disease immunity rates for North American women vary based on country of origin, suggesting that the vaccine histories of immigrant women do not match those of Canadian-born citizens, despite Canadian healthcare (11). This is particularly relevant in the context of a pandemic: immigrant women and children had especially low turnout at H1N1 vaccination clinics in 2010, particularly in western provinces (11). The 2017 Childhood National

[1] The terms vaccination and immunization are used interchangeably in literature and in this paper; vaccination specifically refers to "the act of introducing a vaccine into the body to produce immunity to a specific disease", while immunization refers to the "process by which a person becomes protected against a disease through vaccination." (51)

[2] While immunization for the disease outbreak is critical, it is also important to ensure routine vaccinations are maintained to avoid concurrent outbreaks.

[3] Note that these results exclude those whose parents were unable to respond to a survey in English or French, children in First Nations on-reserve communities, and institutionalized children.

[4] The term used by the authors to refer to aggregate First Nations, Metis and Inuit populations.

[5] The term used by the authors.

[6] Available at https://nccid.ca/webcast/vaccine-hesitancy-and-first-nations-inuit-and-metis-populations-during-covid-19/

Immunization Coverage Survey excluded those whose parents were unable to respond to a survey in English or French, children in First Nations on-reserve communities, and institutionalized children. The survey notes that these subpopulations, which include many children of immigrants and First Nations children, "may have differences in vaccination coverage and access or utilization of healthcare services from that of other Canadian children" (13).

VACCINATION OF FIRST NATIONS, INUIT, AND MÉTIS PEOPLES

Disaggregated national data on vaccination rates of First Nations, Inuit, and Métis peoples are not available. However, Indigenous children and adults experience far higher rates of vaccine preventable disease than their non-Indigenous Canadian counterparts (4,14). In Alberta, where statistics are available, vaccine coverage of Aboriginal children was 30% lower than children in the general population (4). Targeted vaccine promotion efforts have had some positive results: between 2006-2011, there were no new on-reserve cases of measles, mumps, rubella, tetanus, diphtheria, and polio, although cases of mumps, haemophilus influenza type b (Hib), and invasive meningococcal disease were reported (15). Higher burden of vaccine-preventable disease in Indigenous communities likely also reflects environmental factors. These include factors that increase the risk of disease transmission such as crowding, poor ventilation, and lack of running water, as well as factors like poor air quality and malnutrition that can compromise immune response to vaccines (4,14). Lower rates of vaccination may also reflect historical trauma and resulting distrust of medical services, and lower availability of medical services in remote communities. Dr. Sarah Minwanimad Funnell's webinar on vaccine hesitancy in First Nations, Inuit and Métis communities provides more depth on these issues in the context of COVID-19.

First Nations, Inuit, and Métis communities have been disproportionately affected by past pandemics like H1N1, and their risk for severe outcomes, death, and social disruption is higher than in other populations. As such, the National Advisory Committee on Immunization has identified "adults living in Indigenous communities […] where infection can have disproportionate consequences such as those living in remote or isolated areas where access to health care may be limited" as priority groups for receiving the COVID-19 vaccine (16). Approximately 58.8% of Indigenous people in Canada live in rural areas (17) and thus rural vaccination strategies will need to be carefully tailored to ensure this goal is met. The number of on-reserve cases of COVID-19 in Canada has increased exponentially since September 2020 (18), and the rates are disproportionately high: as of Jan. 19th, the rate of reported cases of COVID-19 in First Nations living on reserve was 40% higher than the rate in the general Canadian population (19). As of January 21st, 2021, there were 14,488 confirmed positive COVID-19 in First Nations communities, 5,368 active cases, 618 hospitalizations, and 129 deaths (19).

RURAL RISK PROFILE AND CHALLENGES FOR IMMUNIZATION PROGRAMS

Canadian rural communities are very heterogeneous, but in general are older, sicker, and less affluent than urban populations, with lower rates of availability and use of medical care and worse outcomes when they obtain care (20,21). Socioeconomic conditions and educational attainment in rural areas are lower, and risk factors such as smoking, low physical activity, and poor diet are more prominent (20,21). Rurality itself may not be a determinant of health: the high level of heterogeneity in health outcomes for rural residents indicates that determinants of health within rural areas may be of greater importance (22). The composition of rural areas affects health risks: Francophone communities have shown better outcomes, for example, than areas with large transient populations (22). Better health in Francophone communities may reflect differences between Quebec and other provinces, and further research is needed to see if these findings in particular are reproducible at a regional level (22).

Rural, remote and Northern communities in Canada have a unique risk profile for COVID-19. While geographic barriers in remote areas can provide some protection from exposure if visitors are prevented from entering the community, the virus is spread more easily due to poverty, crowded housing, and lack of clean and running water for sanitation, which are conditions on many First Nations reserves (23). Movement to and from rural communities, particularly seasonal agricultural labour and travel to larger centres for services, can increase the risk of disease transmission. Many rural communities have poor communication technology, which limits the spread of information about disease prevention, and can lead to an increase in stigma and inappropriate response to the disease, as well as decreased ability of health professionals to connect with cases and their contacts. Rural communities may also be at greater risk of other consequences of COVID-19: initial results from an unpublished 2020 survey conducted by the Rural, Remote and Northern Public Health Network indicate that mental health challenges, substance use, and addiction relapse have increased since the pandemic began, and that stigma, fear, and a lack of locally relevant messaging are complicating disease response in rural areas. Further research is needed to more accurately assess the impact that the pandemic has had on rural communities, although the need for mental health supports and clearer messaging for rural communities was validated by a survey done by the Canadian Rural Revitalization Foundation (24).

There are various reasons for the incomplete success or failure of rural vaccination campaigns. Vaccination has high costs, even when the vaccines themselves are free: the time spent learning about vaccination, traveling to centres that provide medical care, and taking time off work can be deterrents (8). Rural people may not have medical centres nearby, and transportation time, difficulty, and costs can be significant barriers; in addition, medical clinics in rural areas often have short hours of operation, making booking appointments more challenging (25,26). Lastly, a lack of awareness about the disease, screening options, and the vaccine itself can be barriers to vaccination in rural areas. A study investigating HPV vaccination in rural Alabama adolescents identified lack of knowledge about the vaccine as a key barrier to vaccination (27). An effective vaccination strategy has to account for the level of health literacy in rural areas, as well as geographic and socio-economic barriers.

VACCINE HESITANCY IN CANADA

Vaccine hesitancy refers to "delay in acceptance or refusal of vaccination despite availability of vaccination services" (28). An increasing number of people delay or refuse vaccination for their children in Canada: recent estimates have put this number at between 15-20% of parents (29). Initial findings from cross-sectional surveys in high-income countries indicate that vaccine hesitancy may hinder rollout of a COVID-19 vaccine. Although the majority of people surveyed indicated they planned to be vaccinated, up to one quarter said that they would not, or are unsure (29). The reasons for vaccine hesitancy in Canada are complex. Some people are active objectors, but a 2015 study found that the majority of Canadian parents who do not immunize their children fail to do so because of complacency and procrastination, as well as "barriers to access" which would not be classified as vaccine hesitancy (8). Vaccine hesitancy is often clustered in regions or communities (7); this is likely due in part to peer group expectations. As such, social pressure can be an effective motivator in encouraging parents to vaccinate their children (8,30). In addition, advice from a trusted medical professional reduces vaccine hesitancy: low-income families without a household doctor are less likely to be vaccinated, but 89% of Canadian parents usually followed the advice of a child's doctor or nurse regarding immunization (8). Qualitative data suggests that this is true for recent immigrant women, who rely more on trusted healthcare providers for vaccine information in the absence of the social networks they used in their home countries (11). As such, a vaccine strategy that incorporates peer learning, the involvement of trusted medical professionals, and reduction of costs and barriers is more likely to be successful.

FACTORS CONTRIBUTING TO SUCCESS IN RURAL IMMUNIZATION CAMPAIGNS

There are similarities between the successful strategies for rural vaccination describe in peer-reviewed literature. Successful immunization campaigns typically: engage community representatives and involve target communities in the design of vaccine rollout; use proven health communication techniques; use healthcare workers other than doctors to provide vaccines; and use community facilities for vaccination. The following section will explore each component in more depth.

Community involvement

Community representatives are individuals who are part of the target community, who work with public health officials to provide advice about vaccine rollout and to support vaccine promotion. Often, but not always, these representatives have a leadership role in their community, as influencers or agents of change: "it […] matters who is providing vaccination-related information and how it is provided" (31). There are numerous benefits to involving community representatives in the design of vaccination strategies. Such representatives are aware of community beliefs, stigmas, and fears, as well as any cultural or spiritual concerns with vaccination; as such they are uniquely positioned to advise medical professionals

on knowledge gaps, educational needs, and roll-out strategies that would be culturally appropriate (26,32). Given the heterogeneity of rural communities in Canada and the clustering of vaccine hesitancy (7), a better understanding of community perceptions and concerns can allow for a more nuanced and effective approach to vaccine promotion and delivery (31).

By acting as an advocate for vaccination, a community representative can also help set social norms in a way than a public health official cannot. This is especially important in First Nations, Inuit, and Métis communities, where vaccine hesitancy may be more prevalent, due in part to negative experiences with mainstream healthcare systems and health care professionals. Given the historical and on-going trauma experienced by Canadian Indigenous peoples, the meaningful involvement of Indigenous community members in public health initiatives is essential for gaining trust and increasing participation. Several international studies have illustrated the impact of community representatives. In India, the involvement of auxiliary nurses and midwives in disseminating information about measles and rubella vaccination led to 90.5% vaccination coverage, in spite of a negative social media campaign (2). By contrast, a study of vaccination rates in Indigenous Australians showed that a free vaccination campaign was not successful (no increase in the rate of vaccination); the authors recommended using a community liaison to increase future vaccination education and uptake (33).

CASE STUDY OF PERTUSSIS VACCINATION IN AN AMISH COMMUNITY

In 2009-2010 there was a pertussis outbreak in a rural Amish community in Illinois. After the identification of the outbreak, public health officials worked with community members, particularly business owners, to determine effective communication methods for a vaccination campaign. The campaign was highly successful: time slots for pre-scheduled appointments were completely booked, 251 community members were vaccinated, and the campaign had a no-show rate of less then 5% for pre-booked appointments (32,34). By working with community representatives, public health officials were able to introduce the idea of cocooning, a method of providing vaccinations to those who interact with an infant to allow them a bubble of protection (32,34). The authors suggest that the use of community representatives, combined with targeted health messaging, educational outreach and prescheduling allowed for this campaign to be so successful (32).

Communicating Value

The use of social marketing principles in the design of vaccine strategies can contribute to vaccine acceptance, by increasing awareness, addressing reasons for hesitancy, and framing recommendations in compelling ways that emphasize the benefits of vaccination (see Nowak et al., 2015 for a more complete discussion). Persuasive communication, informed by a thorough understanding of the target audience, is a key component of social marketing. Persuasive does not mean coercive; a culturally safe approach includes respectful listening, building trust, and openly discussing concerns. Framing vaccination information in terms

of benefits to the patient, and outlining the risks of choosing not to vaccine, has been shown to be beneficial (31). Motivational interview techniques, such as avoiding arguments and outlining the gap between a patient's desired outcome (good health for themselves and their families) and present behaviour (vaccine hesitancy) are also useful (35). Vaccines providers should provide credible, accessible information about vaccine risks and benefits, based on current evidence, both verbally and in written form, ideally in a patient's first language (36). Communication techniques such as using presumptive language – for example, "you are due for your vaccine" instead of "would you like to be vaccinated" – have also been proven to be effective in increasing vaccine uptake (36). Non-verbal communication is important, particularly in intercultural patient-clinician interactions: maintaining eye contact, open body positioning, and a positive and encouraging tone of voice can increase patient comfort and trust.

Community facilities

Vaccination campaigns conducted in schools, churches and other communal areas tend to be successful, as studies in Haiti, Canada and the USA have demonstrated (25,32,37,38). Vaccination campaigns conducted in centrally located community spaces can remove barriers such as distance from health care settings and travel time; those conducted in schools remove the need for parents to take time off work for their children's vaccinations (25,39,40). The use of a school setting also creates opportunities for public health education: parents are typically provided with vaccine information and then asked for consent to vaccinate their child. Parents who receive educational information in this way are more likely to vaccinate their children than parents who have to find vaccination information on their own (39). It is worth noting that this kind of program is only possible with the assistance of churches, community centres or schools, further highlighting the importance of cultivating supportive community representatives.

Involvement of other healthcare professionals

Rural vaccination can be increased by taking advantage of the medical contacts that people have in their communities: by using pharmacists, sick visits, and other involvement with healthcare professionals as opportunities for vaccine education and administration (36). Encouraging healthcare workers other than doctors to administer vaccines can increase vaccination rates in rural areas by making vaccination more convenient. Canadian studies have shown that the addition of pharmacists as vaccine providers increases the rates of influenza vaccination: in addition, rural communities are more likely to use pharmacists for vaccinations than urban communities (Isenor et al., 2018). Pharmacists are situated in most communities in Canada (42,43), and frequently have repeated contact with those at high risk from vaccine preventable illnesses; this puts pharmacists in a strong position to identify those in need of vaccination and to provide vaccines. During a two-year community trial of pharmacy based vaccination clinics in rural British Columbia, pharmacists identified elderly pharmacy users who were at high risk for influenza, and mailed them vaccine invitation letters. A concurrent promotional campaign was conducted in local newspapers, radio and cable TV, and posters were put up in pharmacies and community locations. The trial resulted in increased vaccination rates for elderly residents: of those who were vaccinated, 20% attended due to the personalized letter that they received, and 33% attended after reading about the opportunity in a community newsletter (42). In the rural context, where medical care may be sought out less frequently, all medical visits should be used as opportunities to review vaccine status and recommend required immunizations for both the patient and any children they have (Mead, 2019).

[7] Village-level health workers who act as a contact point between the community and the health service.

THE ROLE OF MOBILE HEALTH IN VACCINE STRATEGIES

The use of mobile and wireless technology in healthcare, often abbreviated mhealth, has become a popular tool in data collection, disease management, self-monitoring medications or diet, and booking health appointments (44–46). Mhealth has also been used as a component of successful vaccination strategies. In rural and urban communities in Bangladesh, vaccine coverage increased when mothers received SMS reminder messages at the time their children were due for vaccines (47). During a cholera outbreak in Haiti, mhealth was used to manage vaccination campaign data, producing high quality data that was both cheaper and less time-consuming than a paper system, although upfront costs were higher (48). In the Haiti example, connecting a census to the vaccination campaign allowed for information to be pre-populated, speeding up the vaccination process and allowing public health workers to determine the rates of vaccination coverage in real time (37). The recent introduction of the COVID-19 case and contact tracing and monitoring apps in Canada has illustrated the benefit of mobile health technology. Although there are advantages to using mhealth in vaccine rollout, Canada has uneven telecommunications coverage in rural and remote areas: the Canadian Radio-television and Telecommunications Commission estimates that broadband services that meet its speed targets are only available to 37% of households in rural areas (49). Enhanced mobile wireless coverage and 99% broadband coverage have been identified as federal priorities (50); however, vaccine strategies that rely only on mhealth technology are not likely to be uniformly beneficial in rural Canada at this time, favouring rural areas that are closer to urban centres.

CONCLUSION

For rural communities in Canada, the barriers of time, distance, and opportunity cost, as well as an inaccurate perception of risk and vaccine hesitancy, can reduce vaccine uptake and adherence. This is a serious concern, both for COVID-19 immunization and to reduce the burden of other vaccine preventable illnesses. Although existing evidence suggests that some rural communities, and particularly First Nations, Inuit, and Métis communities, are disproportionately likely to be unvaccinated, data is sparse. Improved data collection is essential to better inform vaccine policy in rural and remote regions. Although there are data gaps, peer reviewed literature points to several promising techniques for developing rural vaccine strategies: engaging community representatives in vaccine education and vaccine roll-out; using proven health promotion communication techniques; using community facilities for vaccine campaigns; and involving healthcare providers such as pharmacists in vaccine promotion and delivery.

Improved data collection is essential to better inform vaccine policy in rural and remote regions.

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Project #567

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Points to **take away...**

Vaccine rollout in rural, remote, and northern communities poses unique challenges. However, vaccine rollout can be facilitated, and vaccine hesitancy reduced in these communities, by:

- Engaging community representatives in the planning of vaccine rollout and promotion strategies
- Using community facilities such as schools as vaccination delivery sites
- Using motivational interview techniques and social marketing principles to communicate the value of vaccination
- Involving other healthcare professionals, particularly pharmacists, in vaccine rollout

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