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ORIGINAL RESEARCH

# Assessing the effectiveness and feasibility of implementing mitigation measures for an influenza pandemic in remote and isolated First Nations communities: a qualitative community-based participatory research approach

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## ABSTRACT

**Introduction:** The next influenza pandemic is predicted to disproportionately impact marginalized populations, such as those living in geographically remote Aboriginal communities, and there remains a paucity of scientific literature regarding effective and feasible community mitigation strategies. In Canada, current pandemic plans may not have been developed with adequate First Nations consultation and recommended measures may not be effective in remote and isolated First Nations communities.

**Methods:** This study employed a community-based participatory research approach. Retrospective opinions were elicited via interview questionnaires with adult key healthcare informants ($n$=9) regarding the effectiveness and feasibility of implementing 41 interventions to mitigate an influenza pandemic in remote and isolated First Nations communities of sub-Arctic Ontario, Canada. Qualitative data were manually transcribed and deductively coded following a template organizing approach.

**Results:** The results indicated that most mitigation measures could potentially be effective if modified to address the unique characteristics of these communities. Participants also offered innovative alternatives to mitigation measures that were community-specific and culturally sensitive. Mitigation measures were generally considered to be effective if the measure could aid in decreasing virus transmission, protecting their immunocompromised population, and increasing community awareness about influenza

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pandemics. Participants reported that lack of resources (eg supplies, monies, trained personnel), poor community awareness, overcrowding in homes, and inadequate healthcare infrastructure presented barriers to the implementation of mitigation measures.
**Conclusions:** This study highlights the importance of engaging local key informants in pandemic planning in order to gain valuable community-specific insight regarding the design and implementation of more effective and feasible mitigation strategies. As it is ethically important to address the needs of marginalized populations, it is recommended that these findings be incorporated in future pandemic plans to improve the response capacity and health outcomes of remote and isolated First Nations communities during the next public health emergency.

**Key words:** mitigation measures, Aboriginal, community-based participatory research, influenza pandemic, qualitative analyses, remote and isolated communities.

# Introduction

It is inevitable that a novel influenza virus will cause another global influenza pandemic in the future[1]. Influenza pandemics can cause high rates of morbidity and mortality in humans, along with wide-scale social and economic disruption[2]. Marginalized populations, such as Canadian Aboriginal (First Nations, Inuit, and Métis) populations living in geographically remote areas, continue to be disproportionately impacted by influenza pandemics[3-7]. Aboriginal Canadians reportedly overrepresented the number of patients admitted to an intensive care unit during the 2009 H1N1 influenza pandemic (A(H1N1)pdm09) outbreak and the severity of disease experienced was higher among Canadian First Nations[5,8]. Most Canadian Aboriginal communities are faced with unique, multifaceted challenges that impact their pandemic response capacity; for instance, being geographically remote limits their access to required healthcare services and medical supplies[9-11]. Access and provision of healthcare services for Canadian First Nations is further complicated since various government organizations (eg federal, provincial, and First Nations) are responsible for the health of First Nations in Canada and these organizations have yet to clearly define their roles and responsibilities during an influenza pandemic[12]. Furthermore, overcrowded housing conditions and impoverished lifestyles appear to promote virus transmission during an infectious disease outbreak in these already marginalized communities[10].

Given the aforementioned, it is vital for Canadian First Nations to have pandemic plans in place that include context-specific, community-informed measures in order to improve their pandemic response capacity and mitigate the injustice that may occur during the next public health emergency[11,13,14]. However, in Canada, existing national and provincial pandemic plans appear to recommend universal mitigation measures that may not be effective in remote and isolated First Nations communities due to the underlying social, economic, environmental, and cultural differences that impede feasible implementation[4,9,12,15]. Commonly recommended mitigation measures can be categorized as either pharmaceutical interventions (eg vaccines, antivirals) or non-pharmaceutical interventions (eg isolation, quarantine)[1]. Although pharmaceutical interventions are considered to be the best mitigation measures, limitations of supply and cost restrict their usage, especially in remote and isolated First Nations communities[1,9,16]. Non-pharmaceutical interventions may help reduce the number of attack and death rates, along with lessening the pressure on the healthcare infrastructure, associated with influenza pandemics and are therefore recommended to supplement the use of pharmaceutical interventions[16-18]. Unfortunately, there are significant gaps in the scientific literature regarding the effectiveness and feasibility of implementing non-pharmaceutical interventions, especially for remote and isolated First Nations communities[1,12,19]. It is vital to understand which mitigation measures are most effective in order to use the limited amount of resources available for

 

maximal impact and reduce the associated unintended social and economic consequences[12,16].

Previous pandemic planning efforts worldwide have been typically guided by government agencies, public health agencies, expert scientists, and mathematical modeling studies[20-23]. While these various sources provide important information during the pandemic planning process, the limited use of public consultation has been noted[20-22]. In Canada, the Assembly of First Nations noted that First Nations were not appropriately included in the creation of the national and provincial influenza pandemic plans[24]. Public participation is increasingly being encouraged in the health policy-making process[25,26] since locally impacted populations best understand the barriers faced when implementing public health recommendations and can propose innovative modifications or solutions[13]. Engaging Aboriginal populations in the pandemic planning process can provide valuable insight into how local community perspectives and cultural values impact the effectiveness and feasibility of executing recommended mitigation measures[10,22,27,28].

Thus, the purpose of the presented study was to elicit retrospective opinions regarding the effectiveness and feasibility of implementing mitigation measures during A(H1N1)pdm09 from adult key healthcare informants residing in remote and isolated First Nations communities, using a community-based participatory research (CBPR) approach. These insights will aid in creating much needed recommendations for mitigation measures in remote and isolated First Nations communities that are context-specific and include First Nations perspectives. It is important for remote and isolated First Nations communities to have specific recommendations in place to increase compliance and reduce virus transmission[29]. In turn, as these recommendations address the unique challenges faced by Canadian First Nations, they should be incorporated into future pandemic plans to improve the response capacity and health outcomes of Canadian First Nations during the next public health emergency.

# Methods

### *Study area and population*

The present study employed a CBPR approach as participatory research methods have been shown to be successful when partnering with Aboriginal communities[30-32]. CBPR approaches can encourage Aboriginal participation, and including their input may result in more appropriate outcomes from research and policy efforts[33,34]. As CBPR approaches value the equitable engagement of partners, collaboration occurred between the researchers and community members throughout the research process[30-32,35]. As such, a community-based advisory group was formed of three representatives (one from each study community) to aid in designing the study, informing and piloting the questions, and disseminating the results[36,37].

The three study communities (names omitted for anonymity purposes) are characterized as remote (ie nearest service center with year-round road access is located over 350 km away) and isolated (ie only accessible by plane year-round) First Nations communities and are located in northern Ontario, Canada[12,38]. Adult key informants were purposively selected based on their experience as healthcare professionals (eg health directors, clinical coordinators, registered nurses) working in a healthcare facility (eg hospital, nursing clinic, health center) in a remote and isolated First Nations community. Selected participants were also directly involved in their respective communities' response to A(H1N1)pdm09; thus, they had the required experience and authority to comment. Based on the high rate of healthcare personnel turnover in the study communities and availability of participants, a total of nine participants (three from each community) met the inclusion criteria and were invited to participate in the presented study.

### *Data collection and analyses*

Based on a literature review of current national, provincial, regional, and community level pandemic plans and relevant

literature, 41 mitigation measures (two pharmaceutical and 39 non-pharmaceutical) were included in the interview questionnaire. The key informants were asked open-ended questions regarding whether each measure was used during their response to A(H1N1)pdm09 and the effectiveness of each measure in the setting of a remote and isolated First Nations community. Effectiveness was defined as 'effects under real-world constraints' that could include 'feasibility, cost, logistics, operational and infrastructure constraints, and acceptability in terms of concerns surrounding legality and ethics, equity, public confidence, and potential unintended consequences'[19]. Neutral probes were used to promote elaboration, and participants were encouraged to suggest and discuss alternative and/or additional mitigation measures based on their previous experiences[39].

The interview questionnaires were conducted by the lead author (NAC) from July 2010 to October 2011, at a place and time most convenient for each participant after verbal informed consent was obtained (being culturally appropriate for the region)[37,40]. Interviews ranged from 2 hours to 4 hours in duration, were conducted in English (as requested by the participant), and audio recorded (with the participant's permission).

The qualitative data were manually transcribed into electronic format and deductively analyzed following a template organizing approach utilizing the interview questionnaire as a coding template[39,41]. For subsequent analysis and interpretation, the data were further categorized according to whether or not the measure was used and considered to be effective by the participants. The aforementioned data analysis was an iterative process completed multiple times by the lead author (NAC) and confirmed by the co-author (LJST) to increase accuracy[42].

### *Ethics approval*

Approval to conduct this research was granted by the Office of Research Ethics at the University of Waterloo, and the involved communities (eg Band Councils, the locally elected First Nations government); ethics approval number ORE#16117.

# Results

Participants reported that 30 of the 41 questioned mitigation measures were used in some form or the other during their response to A(H1N1)pdm09. All of the measures used were considered to be effective and an additional mitigation measure was suggested. Participants agreed that three measures not used during their A(H1N1)pdm09 response would be considered to be effective in mitigating an influenza pandemic in a remote and isolated First Nations community (Table 1). The most relevant findings are presented below and highlighted by participants' representative quotes[43].

### *Screening the general public and travelers for influenza-like illness at public places*

Participants reported that screening the general public for influenza-like illness (ILI) using health questionnaires and declarations at public places (eg airport, school, church, local stores, health facilities) was successful during A(H1N1)pdm09. Although the lack of required supplies and trained personnel were reported issues, participants stated that screening was a particularly effective measure because it provided an opportunity to diagnose and treat people with ILI early on. However, one participant raised an important ethical concern with implementing screening measures:

> *It's like a moral decision, do you send your workers over there, [they] have a chance of getting infected … morally, ethically can we put our people at the front line for people to die for other people?* (Participant 2)

Thus, the participants suggested some alternatives to reduce the risk associated with implementing screening measures. One alternative was to provide personal protective equipment for screeners and a 'sick bay' for them to take short-term residence in so as not to risk transmitting the virus to their family. Another suggested alternative was to only provide relevant health information instead of having personnel to screen at public places if the virus was highly pathogenic.

 

**Table 1: Effective and ineffective measures to mitigate an influenza pandemic in remote and isolated First Nations communities suggested by study participants (*n*=9)**

| Effective mitigation measures | Ineffective mitigation measures |
|---|---|
| Entry screening of travelers | Exit screening of travelers |
| Screening for influenza-like illness at public places | Closing down all borders |
| Travel restrictions or advisories on all arriving passengers | Quarantining a geographic area (cordon sanitaire) |
| Travel restrictions or advisories on all departing passengers | Disinfecting clothing, shoes, or other objects of persons exiting affected areas |
| School closures | Sanitary measures at frontiers or on conveyances |
| Childcare center closures | Self-health monitoring and reporting if ill, but no restrictions on movement |
| Workplace closures | Urging entire population in an affected area to check for fever at least once daily |
| Isolation (of ill individuals) | Animal/human interchange (measure was not applicable) |
| Quarantine (of non-symptomatic contacts of ill individuals) | |
| Restricting attendance or cancelling public gatherings | |
| Modifying cultural practices (at church and funerals) | |
| Traditional medicine | |
| Rapid influenza diagnostic tests | |
| Vaccines | |
| Antivirals | |
| Public education | |
| Hand hygiene | |
| Respiratory etiquette | |
| Social distancing measures | |
| Avoiding visiting | |
| Avoiding crowding | |
| Voluntary sheltering | |
| Home support program | |
| Monitoring trends of influenza-like illness | |
| Contact tracing | |
| Human surveillance and case reporting | |
| Wearing surgical masks and N95 respirators | |
| Wearing other personal protective equipment | |
| Air disinfection | |
| Surface disinfection (beyond usual practice) | |
| Ventilation (ie open windows) | |
| Visitor restrictions (in health facilities) | |
| Minimizing aerosol-generating procedures (in health facilities) | |
| Isolation precautions (in health facilities) | |

Participants said that screening incoming travelers at the airport was an effective measure because it was feasible to implement and would increase awareness in community members regarding the severity of the influenza pandemic situation. However, participants reported that it was difficult to have enough human resources available to screen passengers on each arriving plane. A suggested alternative was to request the airline companies to screen and provide health information to their passengers prior to boarding flights. Participants did not screen departing travelers during A(H1N1)pdm09 as the measure was perceived to be unfeasible and not a priority due to the additional human and other resources required to screen all departing passengers in addition to all arriving passengers. However, as some participants still stated that this was an ethical measure and aided in containing an outbreak, a suggested alternative was to direct efforts towards community educational health campaigns in an effort to inform community members about when it was safe to travel.

### *Travel restrictions or advisories on arriving and departing passengers*

The participants reportedly employed both travel restrictions and advisories on all arriving and departing passengers, no matter if they were visitors or community members, during their A(H1N1)pdm09 response. The travel recommendations generally began as voluntary advisories and escalated to mandatory restrictions as the outbreak progressed and more cases were confirmed in the nearby region. Anecdotal commentary indicated that these measures had low rates of compliance, as some community members doubted the worthiness of these measures, and were difficult to enforce, especially if other travel methods were available (eg winter road, boat). However, most participants reported that these travel measures helped contain the outbreak and were effective owing to the feasibility and cost-benefits associated with their implementation. In addition, participants described that these measures helped increase awareness amongst community members about the pandemic. Furthermore, other participants stated the importance of executing these measures to aid in decreasing virus transmission, especially in a remote and isolated community with a high prevalence of immunocompromised individuals:

> *The community did … the [travel] restrictions and the advisories because we are [an] isolated [community], so I think it was necessary … considering the grave consequences that H1N1 had on terms of health and … considering all the chronic diseases prevalent in this community, I think it was very prudent and wise.* (Participant 3)

### *Closing down all borders and quarantine of a geographic area*

Closing down all borders and quarantine of a geographic area (cordon sanitaire) were not implemented during the study communities' response to A(H1N1)pdm09, although the possibility of implementing these measures was discussed during the community pandemic committee meetings. The majority of participants said that these measures were not effective; however, some participants believed that these measures could potentially protect their immunocompromised population under certain conditions. For instance, participants said that these measures could be effective if the virus was highly pathogenic, if an outbreak was not yet present in the nearby region, and if all of the coastal communities quarantined simultaneously. Participants reported that these measures would be difficult to implement, but still feasible since the communities are primarily accessed by airplanes and the Band Councils would have the political power to declare these measures.

> *[Be]cause we can probably quarantine the whole community … to keep the community safe, we're [in] … a better position to do that because we only get flights in.* (Participant 2)

> *That's what they were discussing during our meetings, that they [First Nations governing body] could override all the other political levels out there and just say nope, nobody is coming in or out.* (Participant 3)

On the other hand, some participants raised concerns about being able to maintain and enforce these measures, especially with regards to acquiring needed supplies and resources.

> *It would have to be [a] pretty severe virus … it's hard to make an isolated community more isolated. It's the manner of how you get supplies, and how do you actually maintain life, especially [because it is] so remote up here. So, it would need to be done with caution and planning, careful planning.* (Participant 9)

To reduce disturbances associated with implementing these measures, participants suggested that community members could practice a subsistence lifestyle to sustain themselves during this period. Also, another beneficial modification suggested was to partially close the community's borders, so that a mode of receiving needed supplies and human resources could still function.

### *Closing down community schools, childcare centers, and workplaces*

The majority of participants said that closing down schools and childcare centers in the community were effective mitigation measures that were employed during their A(H1N1)pdm09 response. Generally, participants stated that these measures limited virus transmission in the community; they reported that it was difficult to implement other infection control measures (eg hand hygiene, respiratory etiquette) in the younger age groups. Participants noted that school closures done in tandem with restricting children's access into local community stores limited the ability of children to congregate elsewhere. Furthermore, participants stated that school and childcare center closures were feasible because there was often a guardian at home to care for the children, especially if workplaces were closed simultaneously. Although not used during their A(H1N1)pdm09 response, most participants thought closing workplaces would be an effective measure. Some participants raised concerns about the expense of employees' wages due to lost hours; thus, closing only non-essential community workplaces was suggested to minimize the associated economic losses. However, this modification was contested as some participants did not consider any workplaces in a northern remote and isolated community to be non-essential.

> *I can't think of any non-essential work places here … all the ones I'm thinking of are essential, like we only have two stores, so no … it wouldn't be practical.* (Participant 3)

### *Isolation and quarantine*

Both mandatory and voluntary isolation of ill individuals and quarantine of non-symptomatic contacts of ill individuals were used to mitigate the effects of A(H1N1)pdm09 in the study communities. These measures were perceived to be effective in minimizing virus transmission, especially if implemented at the beginning of a community outbreak. However, some participants mentioned that these measures were not feasible to implement since it was challenging to ensure that community members followed the recommendations. Also, finding locations to isolate and quarantine individuals was problematic due to the overcrowding present in most homes and the lack of space to accommodate ill people in community healthcare facilities.

> *Not effective, not in our community because it's like, there's overcrowding in their homes already [and] in the nursing station [local healthcare facility] there's no place to isolate them, it's just not physically possible to isolate them in our center.* (Participant 8)

Thus, participants noted that some buildings in the community (eg school, church) could be potential places to isolate or quarantine people as needed. Furthermore, participants suggested that only the home contacts of an index case should be requested to quarantine, as it would be challenging to maintain daily community functions if all of the casual contacts were also required to quarantine since extensive social networking occurs in their communities.

### *Restricting public gatherings, modifying cultural practices, and traditional medicine*

Participants stated that all non-essential community events (eg dances, pow wows), whether indoors or outdoors, were either canceled or postponed during A(H1N1)pdm09. Participants generally reported that canceling or postponing events was more effective than simply restricting attendance since no human or other resources were required to screen people attending the event. Furthermore, as people generally travel often between the coastal communities, participants reported that cancelling or postponing events limited virus transmission as people would not have the opportunity to congregate. Participants stated that most community members seemed disappointed by the enforcement of these measures but generally complied.

Church services and funerals were still held during A(H1N1)pdm09 as these events were considered to be essential and culturally important. Thus, participants stated that cultural practices (eg kissing, handshaking) were modified and various infection control measures (eg limiting

attendance, health teachings, using hand sanitizers and masks) were employed to decrease virus transmission. The vast majority of participants believed these measures to be effective, feasible to implement, and accepted by community members especially if advocated by the Band Council and the Elders in the community.

> *They teach people right at the entrance door of the church and they provided gloves and masks if they … [had] mild signs and symptoms, they had the cleaning soap … they were told not to do it, not even the communion, and also you know limit church gathering as much as you can.* (Participant 1)

Moreover, traditional medicine was suggested as an additional effective measure to mitigate an influenza pandemic in a remote and isolated First Nations community as some community members reportedly sought treatment from traditionalists during A(H1N1)pdm09. Thus, participants reported that traditional medicine should be included as a helpful mitigation measure for the next influenza pandemic.

### *Rapid influenza diagnostic tests in healthcare facilities*

Although commercially available influenza diagnostic tests were not available for use during their A(H1N1)pdm09 response, the majority of participants said that these diagnostic tests would be effective to determine if influenza was the causative agent of a community outbreak. Participants stated that these point-of-care diagnostic tests would be helpful to reinforce a diagnosis and ensure proper treatments are prescribed. Although some participants raised concerns about the accuracy and cost-effectiveness of these diagnostic tests, others said it would be especially valuable in a remote and isolated setting because of the long time period typically required to receive laboratory results.

> *Point-of-care is critical up here because it can be days before we get specimens out and then days before we get results back. So any kind of point-of-care, anything is most effective here, more so than it would be in a hospital where there's a lab that can do it.* (Participant 9)

### *Vaccines and antivirals*

All of the participants reported that pandemic vaccines and antivirals were used during their A(H1N1)pdm09 response and were effective since community infection rates appeared to reduce after commencing these measures. It was also noted that antivirals were not given prophylactically to healthcare providers or contacts of an index case during A(H1N1)pdm09. Although some participants reported that prophylactic antiviral treatment would be ideal, others said it would not be the best use of resources and may contribute to the creation of antiviral-resistant virus strains.

Although the communities received enough vaccines and antivirals, some difficulties related to distribution to and within the communities were reported. For instance, it was noted that one community was only distributed half of their allotted vaccines in a timely manner. Also, shortages of qualified personnel to immunize and lack of adequate education hindered the distribution of vaccines in the communities. Confusion regarding what symptoms were required to receive antivirals led to inadequate patient treatment in some cases, and some participants reported that antivirals with short expiration dates were delivered to their community. Thus, participants suggested that providing more education regarding these measures would increase community vaccine uptake rates and help ensure that individuals seek and receive antiviral treatment when appropriate.

## Discussion

In general, participants reported that most of the questioned measures could potentially be effective in mitigating an influenza pandemic in a remote and isolated First Nations community. Participants reported that mitigation measures were considered to be effective particularly if the measures aided in decreasing virus transmission, protecting their high-

 

risk population, and increasing community awareness about influenza pandemics. However, participants reported that some of the measures that they considered to be effective were not necessarily feasible to implement given the unique conditions experienced in their communities. A number of barriers limited the feasibility of implementing community mitigation strategies, such as lack of supplies, monies, trained personnel, and community awareness, along with overcrowding in homes and insufficient healthcare facilities. Furthermore, participants noted that compliance with some recommendations was low and therefore the measures were hard to enforce. As previously alluded to, many characteristics of remote and isolated First Nations communities (eg geographic isolation, inadequate access to health care, culture)[38] affect their pandemic response capacity[11]. Thus, in order to address their unique conditions and reduce the unintended consequences associated with implementing mitigation measures, the study participants suggested numerous alternatives and modifications to most of the proposed measures.

The retrospective insights collected from this study reveal some important issues that are necessary to address when planning for a future influenza pandemic in a remote and isolated First Nations community. Considering the challenges of timely distributing pharmaceutical interventions to remote locations, these findings suggest that the implementation of non-pharmaceutical interventions is especially vital to mitigate the effects of an influenza pandemic in these communities. Accordingly, the participants desired that many options for mitigation measures be recommended and that the measures be modified to address their specific community needs. It is also important that mitigation measures incorporate traditional medicine and practices as this aligns with the First Nations holistic approach to health and the importance First Nations place on these practices to aid in health emergencies[44].

Moreover, these findings suggest that community acceptance of mitigation measures is conducive to people actually adhering to the measure. In many cases, participants mentioned the need for educational health campaigns to increase community awareness and in turn adherence to public health recommendations. These findings highlight the importance of providing community- and culturally appropriate education to these communities to raise awareness so members understand the situation and how to appropriately respond[29,36,45]. Also, these results revealed that participants often stated that the decision to implement mitigation measures would be dependent on the virulence of the virus. This notion of considering different community mitigation strategies depending on the severity and magnitude of the influenza pandemic situation aligns with the direction given from reputable authorities[46,47].

Furthermore, previous research has noted that living in a remote and isolated community may initially provide a barrier to the introduction of an infectious disease[10]. However, due to the living conditions (eg impoverished overcrowded housing), small population sizes, a high proportion of immunocompromised individuals, and tight social networking apparent in most remote and isolated communities, disease transmission is typically intensified and difficult to contain once community exposure has occurred[4,10,29,48,49]. Thus, participants emphasized the value of rapidly commencing measures that helped to delay or contain a community disease outbreak. For instance, rapid diagnostic interventions ideally implemented at the initial stages of a community outbreak are particularly important in enclosed settings[49,50].

Likewise, border control measures (eg travel restrictions and advisories, screening measures) were generally considered to be effective by the participants and may be more feasible in isolated communities because identifying exposure sites and monitoring the movement of individuals may be more easily achieved[12]. Also, participants highlighted the importance of limiting or preventing the ability of community members to congregate (eg closing down schools, canceling public gatherings) in order to reduce virus transmission. Although church services and funerals were still held for cultural reasons, these findings support the results of previous studies in that participants were open to modifying cultural practices

 

to decrease virus transmission, especially if advocated by community Elders[29].

Given the aforementioned, these findings have some implications for pandemic planners. Previous studies have highlighted the importance of addressing local characteristics in pandemic plans so that recommended measures will be feasible, culturally appropriate, and accepted by the community[27,28,48,51]. These findings reinforce the importance of engaging and partnering with community members in the pandemic planning process as they possess a vast amount of knowledge regarding community mitigation measures and the potential unintended consequences of implementing such interventions[27,48]. Thus, CBPR approaches are recommended to update current pandemic plans with more recommendations specific for remote and isolated First Nations communities as these plans are important guides for communities. These participatory approaches foster engagement as partners are equitably engaged, knowledge generation is combined with action-oriented outcomes, and various methods can be employed[35,52-55]. Also, it is imperative that action is directed at addressing the barriers these communities faced when implementing recommended mitigation measures. For instance, supply and resource distribution plans and the strategies that guide these plans should be revamped to better address the needs of remote and isolated First Nations communities during a public health emergency[45].

The presented research has various strengths: it provided policy-makers and health professionals with insight from local key informants regarding the effectiveness and feasibility of implementing mitigation measures in remote and isolated First Nations communities in hopes of designing more appropriate mitigation strategies for the future. However, some limitations were noted. In this study, it was assumed that the key informants would share reliable and trustworthy information regarding their experiences and the topic at hand[28]. Also, the results may not be widely generalizable due to the unique characteristics of the study communities and the non-random sample of participants; however, the presented suggestions and insights may be of use to other similar enclosed settings.

Future studies evaluating the use of community mitigation measures in geographically remote Aboriginal communities during various influenza pandemic scenarios are required as great variation exists within and between each Aboriginal group in Canada[3,56,57]. Furthermore, research suggests that community-level epidemiological and modeling studies are required to quantitatively confirm the effectiveness and potential cost-benefits of recommended mitigation measures[58,59]. Given this, future research should be directed towards conducting community mitigation models to quantitatively evaluate which of the suggested community-specific mitigation measures would be most optimal in geographically remote Aboriginal communities.

# Conclusion

As another global influenza pandemic is inevitable, it is important that pandemic plans contain effective community mitigation measures. Geographically remote Aboriginal communities are predicted to be disproportionately impacted by a future influenza pandemic; thus, it is vital that recommended mitigation strategies are feasible, accepted, and culturally appropriate. However, current Canadian pandemic plans appear to have been developed without adequate First Nations consultation and universally recommended mitigation measures may not be effective in remote and isolated First Nations communities.

The results of this study indicated that most mitigation measures would only be effective and feasibly implemented in a remote and isolated First Nations community if modifications were made to account for the unique characteristics of these communities. Local key informants should be engaged using participatory approaches in the pandemic planning process as they possess a wealth of knowledge concerning the effectiveness of mitigation strategies and the direction of mitigation efforts in health policies. These findings should be used by pandemic planners

to update current pandemic plans and include more recommendations specific for remote and isolated First Nations communities as it is ethically important to address the concerns of marginalized populations to improve their pandemic response capacity and health outcomes during the next public health emergency.

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