



Canadian Healthcare workers' experiences during pandemic H1N1 influenza: Lessons from Canada's response

A Review of the Qualitative Literature

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Background

In 2009, a novel influenza A (H1N1) virus subtype emerged to become the first global pandemic to be declared in over four decades (Charania and Tsuji 2011). The World Health Organization (WHO) first reported the novel influenza strain on March 18th, 2009 and declared the global outbreak of influenza A (H1N1) a pandemic on June 11th, 2009 (Standards 2010). By the end of that year, the pandemic had caused over 16,000 deaths worldwide (Wynn and Moore 2012). In Canada, the 2009 H1N1 influenza pandemic (pH1N1) caused 8,678 hospitalizations, 1,473 (17.0%) intensive care unit admissions, and 428 (4.9%) deaths (Scott 2010). Responding to this pandemic cost Canada an estimated \$2 billion (Health and King 2010, Standards 2010, Wynn and Moore 2012). Prior to official pandemic status, on May 1st 2009, Canada had reported 51 confirmed cases of pH1N1 (Standards 2010). Canada's first peak occurred in June 2009, primarily in Manitoba, and the second from mid-October to mid-November (Embree 2010). A

study of Canadian patients critically ill with pH1N1 found that the groups of people most affected were young adults, females, and Aboriginals, all without significant comorbidities (i.e., relatively healthy) (Kumar, Zarychanski et al. 2009). A systematic review of clinical and epidemiological factors of pH1N1 also reported a high infection rate in children and young adults, with fewer elderly people infected (Khandaker, Dierig et al. 2011).

Canada's public health response to pH1N1, recommended by the Public Health Agency of Canada (PHAC), was prevention through vaccination, which led to the highest mass immunization campaign in the nation's history, with 40-45% of the population vaccinated for pH1N1 (Scott 2010). Health Canada approved the adjuvanted pH1N1 vaccine on October 22nd, 2009 and by October 29th, 2009, the first long lines for vaccines had formed (Standards 2010). The federal government was responsible for purchasing and distributing the vaccine to the provinces, and the provinces were responsible for determining how to best administer

the vaccine (Drolet, Ayala et al. 2013). Although Canada's response to pH1N1 has been praised as improved compared to the response to the 2003 outbreak of Severe Acute Respiratory Syndrome (SARS) (Silversides 2009), the effectiveness of Canada's response to pH1N1 has also been critically reviewed to identify key challenges and opportunities for improvement during the next disease outbreak (Spika and Butler-Jones 2009, Kendal and MacDonald 2010, Low and McGeer 2010, Standards 2010, Moghadas, Pizzi et al. 2011). In particular, the disproportionate impact among Canada's Aboriginal (First Nations, Inuit, and Métis) populations is well documented (Rubinstein, Predy et al. 2011, Richardson, Driedger et al. 2012), with studies investigating upstream factors potentially contributing to the uneven pH1N1 impact (Lowcock, Rosella et al. 2012, Navaranjan, Rosella et al. 2014).

Additionally, the critical role filled by healthcare workers (HCW) in responding to a public health emergency has been recognized, with several studies investigating



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HCWs' willingness to work during a pandemic (DeSimone 2009, Balicer, Barnett et al. 2010, Bennett, Carney et al. 2010, Devnani 2012) and the ethics of expecting HCWs to put themselves at personal risk (Simonds and Sokol 2009, Devnani, Gupta et al. 2011). Furthermore, the impact of this ethical dilemma on HCWs such as nurses has been investigated through studies considering moral distress among nurses and their perceptions of working during an emergency (O'Boyle, Robertson et al. 2006, Oh and Gastmans 2013). Understanding the opinions and behaviors of HCWs working in pandemic situations will improve effectiveness of pandemic response interventions. This paper reviews all relevant qualitative research that looks at Canadian healthcare workers' lived experiences during the 2009 H1N1 pandemic. This is the first review of the qualitative research on this subject undertaken by the National Collaborating Centre for Infectious Diseases (NCCID) to date.

Methods

Studies that used qualitative research methods to investigate the experiences of healthcare workers in Canada during the 2009 – 2010 influenza "A" (H1N1) pandemic were included in this review. Relevant studies were identified using the following medical subject headlines (MeSH) and key words: "H1N1," "pandemic," "influenza A," "healthcare worker," "health care worker," "public health," "public health nurs*," "experience," "Canad*," and "qualitative". The search timeframe was limited from January 2009 to present. Databases searched were those available through New York University (NYU) School of Medicine and BOBST library, including Ovid, Medline, PubMed, Embase, EBSCO

(CINAHL), Scopus, Web of Science, Web of Knowledge, JStor, and ProQuest Dissertations and Theses. In addition, relevant articles were searched for by topic through NYU's BOBST library under the following subjects: sociology, anthropology, nursing/medicine, social work, and public health. Finally, additional literature was searched for using Google Scholar and by scanning bibliographies of included studies and relevant reviews (Simonds and Sokol 2009, Balicer, Barnett et al. 2010, Pahlman, Tohmo et al. 2010, Tigert Walters 2010, Devnani, Gupta et al. 2011, Boldor, Bar-Dayyan et al. 2012, Devnani 2012, Rossow 2012).

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Once identified, studies were reviewed to ensure that the inclusion criteria were met, including that data collection was specific to the 2009 influenza A (H1N1) pandemic in Canada. The paucity of available literature meant that studies that included qualitative analysis of open-ended survey questions were also included, in addition to studies using more standard qualitative methods, such as interviews and focus groups.

Results

Three studies met the inclusion criteria: 1) a qualitative study focused on isolated Northern First Nations communities; 2) a thesis using qualitative methods to explore the lived experiences of public health nurses (PHN) in Manitoba; and 3) a mixed-methods online survey investigating the experiences of specialty physicians in Quebec. The specific focus of each study's region or population is consistent with the directed nature of qualitative research.

Charania and Tsuji (2011)

Charania and Tsuji (2011) used a community-based participatory approach to address the disproportionate impact of pH1N1 in First Nations communities. A community-based advisory group was formed with five participants, representing the health sector and Band Councils, to ensure the study was addressing the communities' needs using culturally appropriate methodology. This group assisted in developing the study's objectives, design, and data collection instruments, and participated in validating the results and disseminating the findings.

Study Methodology and Analysis

The objective of this study was to identify barriers experienced by healthcare providers during pH1N1, and culturally appropriate opportunities to improve in advance of the next pandemic, in three remote and isolated Subarctic First Nation communities. Semi-structured interviews were conducted with 13 key informants in February 2010, when community-illness rates had returned to baseline. Each community has a federally funded community public health centre and a primary care facility equipped with 24-hour nursing

staff. The communities are located in Northern Ontario and their estimated populations are 850, 1700, and 1800 people, respectively. Study participants were purposively selected to represent the three key sectors responsible for health care services: 1) federal health centres, 2) provincial hospitals, and 3) Band Councils. Interview questions were based on relevant academic literature discussing pandemic readiness. Data analysis used a combination of deductive and inductive thematic analysis to create both “theory-driven” codes (using the existing pandemic response framework outlined in the regional First Nations and Inuit Health Branch (FNIHB) pandemic influenza plan) and “data-driven” codes (which emerged as new codes from the data) respectively. The final codes were presented on paper to each community’s pandemic committee (consisting of 8 – 10 study participants per community) and verbally validated.

Study findings

From the in-depth interviews with healthcare workers and health sector key informants (from here on collectively referred to as “HCW”), Charania and Tsuji (2011) identified three main barriers and three areas for improvement in the communities’ pandemic responses. These findings were based on eight codes that emerged during data analysis, the first six of which were further discussed in the paper, including: vaccine, antivirals, health services, supplies, public health measures, and communication. The codes surveillance and emergency response were not discussed in the paper. Barriers to effective pandemic response include: 1) insufficient human resources, 2) overcrowding in houses, and 3) a lack of community awareness. Areas to be addressed for improvement in future pandemic responses include: 1) strengthen human resources, 2) ensure access

and availability in the community to general supplies, and 3) increase funding for community education.

Human resources

HCW participants representing all three communities reported that a shortage of human resources created a shortage of staff in health facilities and the staff feeling over-worked. HCW participants reported that sufficient vaccine doses were received and that their communities accepted the vaccine. One community’s estimated vaccine uptake was 80%, considerably higher than Canada’s national immunization rate of 40 – 45%. However, HCWs from one community stated that the community experienced an H1N1 outbreak before vaccine was available. HCW participants from two communities reported efficient vaccination clinics. This efficiency was credited to having received extra support workers from Health Canada and implementing a modified immunization certificate course to train additional health care personnel. Workers in these communities used personal protective equipment (PPE) and separated patients with clinical symptoms of H1N1. HCW participants representing the community they described as having an inefficient vaccination clinic cited a lack of human resources as the primary problem. A shortage of staff meant that nurses became exhausted and did not have time to implement safety precautions, such as PPE, and consequently became sick. In addition, nursing shortages were further stressed by a lack of training in how to run a mass immunization clinic (MIC) and a lack of auxiliary staff for positions such as security and crowd control. Health Canada’s FNIHB is responsible for providing public and primary health care (when provincial services are unavailable) when First Nations are living on reserve. The

authors recommended that they should focus on recruiting full-time, permanent nurses who are oriented to the hardships of the job and are culturally sensitive. In addition, if required during a pandemic, an interdisciplinary team of healthcare providers should be sent to the communities to provide services such as mental health, respiratory therapy, and disease education.

HCW participants also mentioned the importance of an alternative care site (ACS) to provide necessary health care services as a satellite clinic during a pandemic. There was unanimous agreement that for ACS to be feasible, funding and human resources need to be secured before the next pandemic situation. It was noted that government officials have a responsibility to secure the necessary funding and human resources to implement ACS if healthcare facilities are overwhelmed during a disease outbreak, as recommended by the Canadian Pandemic Influenza Plan for the Health Sector. Despite this recommendation, the authors mention that the Ontario Health Plan for an Influenza Pandemic says that funding sources for equipment and infrastructure for ACS are not yet identified.

Infrastructure and supplies

Unanimously, HCWs from all communities reported that some public health measures were difficult to enact due to their communities’ infrastructure, such as overcrowding in homes preventing segregation of sick family members. HCWs collectively agreed that government officials have an obligation to continue to focus efforts on improving housing infrastructure and living conditions in First Nations communities, noted to be their legal and moral responsibility as outlined by the 1876 Indian Act.

HCWs representing all communities reported that although they generally had enough supplies, the supplies were not always delivered in a timely manner. HCWs representing one community reported that their health centre needed to charter a plane at their own expense to bring in necessary supplies. HCW participants from all three communities reported receiving enough antiviral medication, but again noted that distribution needs to be timely and further, the medication expiry dates should not be short-dated. Additionally, HCW participants mentioned a lack of available medical equipment, for example, mechanical ventilators for severely ill patients. Largely, HCW participants agreed that the general community lacked basic infection control supplies, such as surgical masks and hand sanitizers. Purchasing these items was said to be a financial burden for low-income families. Participants called for increased funding from the federal and provincial governments to ensure adequate supplies, especially for low-income families. They suggested that government officials establish an emergency fund that could be accessed to purchase supplies in times of disease outbreak. Moreover, participants noted that transportation to remote communities was often unpredictable, and especially vulnerable to hostile weather, and stockpiling supplies when possible, such as food, ahead of the next pandemic was recommended. Well-timed distribution is necessary for resources (vaccines, antiviral medication, pandemic supplies), as many participants felt that even though supplies were adequate, they arrived too late. It was also suggested that all government levels collaborate to assess resource distribution plans, particularly with respect to difficult to access communities to ensure equality and efficiency.

Communication and community awareness

HCW participants unanimously lauded each community's formation of a "community pandemic committee" to promote effective teamwork and communication. While HCW representatives of one community reported this committee was successful, participants representing the other two communities stated that key committee members could have improved the pandemic response by taking a more active role and providing added support to the committees' efforts. Many participants noted that they were also in constant communication with their neighbouring coastal communities to exchange information and provide mutually beneficial support. One participant said that their weekly teleconferences were effective for sharing information. Most participants also believed that some media sources provided misleading information that contributed to unnecessary anxiety or information that was irrelevant to their situation in remote isolate communities.

All participants mentioned a lack of community awareness and knowledge of the pandemic. Despite distributing information through various sources, some community members remained unaware of influenza pathogenesis, pandemic vaccine effectiveness, and the significance of community infection control measures. A few participants noted that even some healthcare facility staff did not follow isolation recommendations, as they were seen in the community after they had been sent home sick and community events had been cancelled. Despite this, HCW participants reported that community residents generally observed recommended infection control measures, even those they considered unnecessary or that

required adjusting cultural practices. Community educational sessions to emphasize the meaning of vaccination and general infection control, together with region- and community-specific influenza mitigation information would be helpful in improving community attitudes to a pandemic response. Further, the study participants felt that pandemic preparedness should be made a political priority at all levels of government with representation from First Nations communities and communication of the plans to communities in advance of the next pandemic.

Study limitations

The authors do not include a section on study limitations, however it appears to be a well-designed and appropriately analyzed study with appropriate representation of and participation from the communities. As is ideal, two researchers conducted the analysis, which is noted to have been done several times to increase rigour. In addition, their methodology for developing the codes is well described and community representatives validated the codes in a systematic manner. Rigour could have also been strengthened through triangulation of data sources, such as including community focus groups or document analysis, to further support findings from the interviews.

Study conclusions

The main barriers to an effective pandemic response in these First Nations communities that were identified included overcrowding in houses, insufficient human resources (such as nurses), and inadequate community awareness of disease processes. The main areas identified for improvement of future pandemic responses include increasing human resources and funding. Additional funding is required to improve

community education and awareness of health and disease issues and to ensure there are sufficient general supplies in the community facilities and homes.

Long (2013)

As a requirement for the Master of Nursing degree at the University of Manitoba, Long (2013) conducted a qualitative study to determine both the lived experiences of public health nurses (PHNs) in Manitoba during pH1N1 and their current role in pandemic planning activities. She found that PHNs are connected to their communities and are trusted sources of information for the community members. This, together with the PHNs' appreciation for the importance of their roles in the community, makes them valuable assets for the health regions, who should involve PHNs in planning the pandemic response interventions to improve efficiency. PHNs need support from their managers, community, and in their personal relationships to ensure maximum effectiveness in fulfilling their roles. In addition, ethical dilemmas that create moral distress among PHNs should be anticipated and planned for in the pandemic preparedness activities.

Study findings

Long addressed the following research questions: 1) What is the perceived experience of public health nurses in Manitoba in responding to the 2009 H1N1 influenza pandemic; and 2) generally, what is the extent of the PHNs' current involvement in pandemic preparedness? From these, five themes emerged: 1) communication and dissemination of information; 2) personal and professional challenges; 3) personal face of the pandemic; 4) regional support; and 5) lessons learned.

Communication and dissemination of information

Within the theme of communication and dissemination of information are two sub-themes: 1) sources and influences of information and 2) credibility and consistency of information. The first sub-theme describes the significant variation in the source of the information the PHNs received and the impact of this information. PHNs described how the information was changing by the hour and how limited access to computers at the clinics meant that they were often receiving their information from the media, for example in their cars on the way to work. They also described the flow of information and decision making as often unidirectional and top-down, without regard for their existing experience and knowledge of running immunization clinics.

The PHNs also recognized their role as a trusted source of information for their communities and expressed concern at not having a more prominent role in public education, such as calming the public after alarming media reports. The PHNs from all three regions described long lineups of individuals and families at immunization clinics as likely having been influenced by media reports, for example about a young otherwise healthy hockey player who died suddenly from the influenza pandemic strain and the vaccine shortages reported in the United States.

The second sub-theme dealt with credibility and consistency of information, and largely stemmed from the PHNs' reported lack of ability to provide clear and consistent information to their communities. The PHNs reported that vaccine eligibility criteria reported by public health officials was constantly changing and was as confusing for them as for the general public.

Consequently, this often resulted in upset and frustrated community members and the PHNs feeling that their personal credibility was in jeopardy, as they had no control over the quality of the information they were providing. The PHNs agreed that a single public health information source to provide timely and clear guidance to health professionals and to members of the general public would have been more effective.

A lack of credibility and consistency of the information surrounding both availability and safety of the pandemic vaccine was also a challenge. The initial limited supply of vaccine created difficulty in being able to recommend it to eligible recipients. The PHNs reported that it was difficult to balance their knowledge of the pandemic with the communities' perceptions. Alarming media reports about the risks of infection created high demand for vaccines and at other times public perception saw the pandemic as "overblown," with the PHNs then struggling with how to encourage vaccination without creating hysteria. Other PHNs reported experiencing internal conflict when they questioned vaccine safety themselves, but were required to recommend it within their communities.

Personal and professional challenges

Within the theme of personal and professional challenges experienced by PHNs, two sub-themes emerged: 1) obligations to others and 2) challenging work conditions. As discussed above, all study participants reported difficulty in meeting their obligation to provide clear consistent communication regarding vaccine availability and safety, and the risk of pH1N1 infection. The PHNs were frustrated by the lack of vaccine when demand was high, and then, by the time vaccines were available, public

perception had changed to view the disease as overblown.

The study participants also discussed their feelings of inadequate personal protection from pH1N1 infection and the overwhelming workload. Especially at the beginning of the pandemic when the vaccine eligibility was strict, PHNs were unable to vaccinate their family members, colleagues, or themselves and thus felt it was necessary to develop contingency plans. For example, one nurse said that if she thought she might be infected, she would go to a hotel instead of going home, to protect her unvaccinated family. Even when H1N1 vaccination was available, it was made inconvenient: for example, PHNs reported having to get seasonal flu shots and H1N1 shots on different days, although they also reported that this policy was changed later in the pandemic. In addition, the study participants said that they took the initiative to encourage fellow PHNs who were pregnant to avoid working at immunization clinics.

Cramped spaces at the immunization clinics made it difficult to maintain their practice standards, such as maintaining patient confidentiality. The study participants reported stress in being responsible for patient safety when enforcing the mandatory, standard 15-minute post-vaccination period: some patients lied about having waited the required time and, although they were aware this was a lie, the nurses felt powerless to make them stay. Long hours at the clinics also significantly affected the nurses' daily lives, making it difficult to get enough sleep or carry out normal household duties, such as getting groceries.

Study participants felt a sense of obligation to ensure that fellow non-PHNs, recruited to help with immunizations, were properly

oriented and comfortable giving vaccines by intramuscular injection. The PHNs discussed the rewarding side of traveling to train other nurses (for example, from hospitals and long term care facilities) and ambulance drivers, and that this was enabled using an "H1N1 binder" which was provided as a base for training. However, conflict arose when inexperienced managers, managers who were not nurses, and/or other administrative staff wanted to process vaccine recipients as fast as possible, even if the newly recruited nurses were not yet comfortable or needed their regular breaks. The PHNs noted that they felt responsibility to act as advocates for the new nurses so that the work could be done safely. PHNs also reported stress surrounding a lack of cultural sensitivity in training and orientation: for example, one PHN reported being told to provide education on hand-washing on First Nations' reserves where she knows that there is no water. Contradiction between meeting obligations to superiors and management and the obligations PHNs felt towards their colleagues and patients contributed to stress experienced by the PHNs.

Study participants also discussed challenging work conditions as a result of relating to the public, the quick pace of the clinics, personal safety, and power issues within clinics. The mood and behavior of the public tended to create stress at the clinics, especially at the beginning of the pandemic, when vaccine eligibility was restricted. As discussed above, PHNs struggled to enforce vaccine eligibility criteria that were constantly fluctuating, creating tension among the clinic attendees. One PHN said that she was told it would be her fault if the denied community member died and that sometimes people waiting in line became uncharacteristically hostile. Although these incidents were infrequent, hostility from

the public directed at the PHNs was challenging and some PHNs felt harassed for information for the first time in their career, such that they avoided contact with people. The PHNs discussed the stress related to counting vaccine doses and calculating the number of people present and if the vaccine supply would be adequate. Nurses reported a feeling of having an audience as people in lines watched the process and their actions closely. This, together with the cramped space and the already high tension, was especially difficult given the need to process people in a timely fashion. Dealing with children was particularly difficult as, in contrast to typical immunization clinics for kids at schools, parents were present and often pushed for the vaccination to be quick or were sometimes short with their kids, contributing to the overall tense atmosphere. Without enough time to reassure kids, the nurses sometimes felt it was necessary to restrain them to administer the vaccine, which was done as the public watched and further contributed to the situational tension.

The long line-ups and quick pace meant that nurses often felt unable to keep up with the workload, often forgoing their breaks. Additional pressure resulted when other public health programs did not stop, so the regular workload continued. Even if other nurses were left behind at the office to carry out these programs, these nurses were burdened with extra work to cover for the nurses at the clinics, which was stressful for all the nurses. PHNs reported feelings of isolation when they were pulled from their regular teams and reassigned to other areas. Although they understood the need to go where they were needed, they worked 16 hour days for 5 days a week and felt disconnected from the activities of their regular teams, resulting in a loss of support that would typically

have been provided by these stable, longer-term working relationships.

PHNs also experienced risks to their personal safety. Northern PHNs reported that they were pressured to travel in adverse weather conditions they normally would not travel in to hold immunization clinics. Many PHNs also discussed a risk of infection with the pandemic virus due to working in cramped, unfamiliar spaces and not having been vaccinated. Several participants noted that because most nurses were not vaccinated and the clinics were so crowded, if there had been a case of H1N1, all the immunization staff would have gotten sick and been unable to continue working.

Power issues in managing the clinics were also challenging for PHNs. Some nurses felt pressured to vaccinate medical doctors who wanted the vaccine, even though they were not eligible for vaccination at that time. Inter-professional tensions resulted when managers who were not nurses wanted to take over certain components of the vaccine clinics. The PHNs sometimes felt challenged by their perceived obligation to question the managers' decisions, for example to advocate for their public health training and ability to organize and run a successful immunization clinic, or to advocate for inexperienced fellow nurses who were not comfortable giving injections. A key difference between H1N1 immunization clinics and the seasonal flu vaccination clinics was that PHNs had to depend on a central team with Manitoba Health to order the necessary supplies in a timely manner. This was taxing when mistakes were made, such as ordering incorrect quantities, the wrong items (e.g., type of needle), or unnecessary items (e.g., sterile drapes that went unused). The nurses reflected that they are generally used to being in control of situations, so it was often difficult

for them to acknowledge that the pandemic response plan included defined roles for each profession that must be respected. One nurse disclosed that she actually had had to “learn how to sit back a little bit” and trust others to arrange the logistics.

At clinics where the leadership team was described as positive and helpful, tension was considerably less prominent. One PHN described how her manager trusted her completely to run the day-to-day clinic operations and he provided support by making coffee. There were also examples of nurses being innovative in improving clinic efficiency when they were supported and allowed to implement their own ideas. One group of PHNs established a designated kids' table so that nurses who were not as skilled at administering vaccinations would not have to handle kids, and another PHN group arranged the process so that nurses inexperienced with giving injections could do other tasks, such as drawing up the vaccines. In response to frequently changing venues, PHNs who felt supported and able to act autonomously were better equipped to identify context-specific techniques to help them stay flexible and adapt to new situations daily or within the day, such as efficiently setting up a clinic and keeping clinic documents organized. Other challenges that the nurses discussed included lack of material resources, lack of nursing staff for the clinics, insufficient help for the physical set up the clinics, and little financial support. PHNs reported having to borrow supplies from other facilities and ask other departments for help. Despite these challenges, the nurses also discussed the importance of maintaining a sense of humor and ability to marvel at the situation.

Personal face of the pandemic

The study participants reported feeling as if they were the “personal face of the pandemic” because of their personal and professional connections to the community. PHNs perceived themselves to be key sources for information within their communities, especially in small towns, which was thought to be both a positive and challenging experience. Some rural nurses disclosed that they avoided community settings such as churches and grocery stores when the vaccine was unavailable. Others described difficulties in convincing friends and family to accept their professional advice. In contrast, other nurses described feeling honoured to provide important vaccine information for family and friends. PHNs identified their strong linkages to the community as an asset that provided community members with an avenue to have their individual needs met. For example, a group of urban PHNs identified a need to provide information for new Canadians in their native language. They created specialized clinics, such as one that provided 300 vaccines in a day and “not a word of English was spoken.” PHNs also described the importance of taking time to reassure people, noting that the community has faith in them and trusts the information they provide.

The pandemic also provided PHNs with a positive opportunity to strengthen and expand their professional networks, forming lasting relationships with other nurses and other disciplines, within their region and across different regions. Interacting with other healthcare workers, through training other nurses in administering vaccines and interacting with professionals from other disciplines (such as pharmacists), created an atmosphere of supportive teamwork. Study participants noted that this type of atmosphere has always been

an integral part of public health, particularly during crisis situations. One northern PHN noted the satisfaction of being part of a global team: for example, they received vaccine for pregnant women from Australia. This nurse emphasized that she could really see that they were part of a global team, working on the same problem as the World Health Organization.

PHNs were required to fill various roles depending on the circumstances, and thus had to be flexible during a single clinic and from clinic to clinic. They learned to recognize team members' individual strengths so that efficiency and safety was maximized. Roles included answering phone calls at public health offices, managing immunization clinics, administering vaccines, observing clients post-vaccination, obtaining informed consent, educating the public and other regional staff, drawing up vaccines, and planning clinic operations, such as setting up clinics and managing immunization supplies. Some PHNs also reported being tasked to act as clinic leads given their existing knowledge of immunization programs and experience with rolling out community based immunization clinics. Several PHNs described their frontline experience with other mass immunization clinics and previous seasonal flu vaccine clinics, although on a smaller scale, as valuable experiences that had adequately prepared them for coordinating the much larger scale H1N1 vaccine clinics. PHNs also applied their experience in handling and properly storing vaccine, as once a vaccine vial was punctured, the nurses ensured all 10 doses were used. In contrast, PHNs reported their frustration when they observed other team members incorrectly handle the vaccine, which led to wastage. This situation increased tension among the team, because the other PHNs

felt that nurses should be responsible for drawing up the vaccines, as they have more experience in this.

Finally, the PHNs also reported feeling a sense of pride and accomplishment that they could provide a valuable service to their community and act as advocates for their profession's important role in society.

Regional support

Long (2013) found that, in order for PHNs to effectively fulfill their roles, they require a variety of support systems, including an existing regional pandemic plan and team, directives from management, access to timely updates, access to expertise such as medical officers of health, and regular meetings to distribute updates.

Northern PHNs stated they had support from the region immunization coordinator and access to an "H1N1 binder," which outlined the roles and responsibilities specific to PHNs and was said to be a valuable tool when planning and implementing immunization clinics and training non-PHN team members in giving immunizations. While some nurses identified continuing to provide basic public health services concurrent with pandemic interventions as challenging, several nurses felt supported by their health region's management to prioritize pandemic public health services in their communities.

Many nurses reported that being recognized as trusted and valuable team members by the regional team, and especially management, was an essential source of support during a stressful time. PHNs noted that it is imperative that regional managers appreciate PHNs' roles and responsibilities in order to more successfully provide support

at immunization clinics. Further, PHNs also noted the success of immunization clinics was enhanced when they received support from interdisciplinary team-members, such as clerical and maintenance staff assisting in setting up clinics in unfamiliar venues as well as pharmacists providing their expertise with vaccines at immunization clinics. Some study participants indicated that while PHNs are used to working with interdisciplinary groups, other regional staff might not be and this should be accounted for when preparing emergency response plans. Finally, a number of nurses indicated that they received fundamental support from their families and friends while they worked stressful, extended hours at immunization clinics.

Lessons learned

Long (2013) observed that growth occurred at the professional and organization levels as PHNs incorporated certain lessons to be better prepared for the next pandemic and expressed a sense of pride in having "survived" the pandemic, increasing their confidence in their ability to respond even more efficiently during the next pandemic. Most study participants reported they are now more prepared to face another pandemic-like event because they have a clearer understanding of what is expected of them during a pandemic response, such as large immunization clinics. Their experience with pH1N1 has also contributed to the PHNs feeling more competent, and thus confident, in contributing to future pandemic response plans for their health regions and communities. Challenges in quality of communication and disseminating information to the public, as discussed above, prompted nearly all study participants to report that, for the next pandemic, each region requires a comprehensive

communication strategy to effectively respond to the public.

Strategies that proved effective during pH1N1, such as pairing junior nurses with experienced nurses and incorporating interdisciplinary teamwork into pandemic preparedness plans, should be scaled up, given the importance of effective collaboration experienced during pH1N1.

Study participants were questioned about their knowledge of the Community Health Nurses of Canada (CHNC) Professional Practice Standards (CHNC 2011) and Public Health Nursing Competencies (CHNC 2009) specific to reportable communicable disease prevention and control and responses varied. Approximately half of the study participants were familiar with the CHNC practice standards, noting that the standards are used in current job descriptions and orientation packages for newly hired PHNs and are sometimes referenced during staff meetings. Other participants felt they should know these standards, but were unable to list them or provide further details. All three regions submitted an electronic copy of their regional pandemic plan to the researcher upon request, however, none of the pandemic plans mentioned either the CHNC Professional Practice Standards or the Public Health Nursing Competencies.

Study limitations

Long acknowledged the following limitations to her study: 1) the study includes only 13 participants, and only three from Northern regions; 2) recall bias is possible, as data were being collected four years after the event; 3) the study participants were not asked directly if they would like to be included in pandemic planning; 4) the pandemic plans received for analysis had undergone

several revisions since 2009 and were likely not the same as those used during the pandemic; and 5) the CHNC practice standards and professional practice model (CHNC 2011) and the CHNC public health nursing discipline specific competencies (CHNC 2009), all of which have been in use for a few years and which study participants appear to have used to some degree, should be further evaluated in public health nursing research to determine their worth for systematic use in emergency preparedness and response by health regions.

Although Long discussed the number of study participants as a limitation, small sample size is inherent in qualitative research, the objective of which is achieving depth of data rather than breadth, as is typical for quantitative studies (Padgett 2012). Although Long discussed the final themes with her thesis advisor and verified them with study participants, co-coding from the beginning of data analysis would have added additional rigour (Padgett 2012). In addition to having only three Northern PHN participants (as opposed to four urban and six rural participants), these nurses participated via individual telephone interviews rather than in-person focus groups. Although Long justified this discrepancy with issues of cost and convenience, the difference between an in-person interaction versus over the telephone (and consequently an assumed decreased ability to read facial expressions and body language) may have impacted the data. Furthermore, the dynamic of an individual interview versus as a focus group with peers is different, with an advantage of focus groups for non-sensitive material being that interaction with peers can stimulate memory and bring up topics that an individual may not have thought of alone (Padgett 2012). This variation in data collection methods may have

impacted the data and should be noted.

Despite these limitations, study strengths include: 1) representation from a diverse group of PHNs that also met specific inclusion criteria and from distinct health regions in Manitoba; 2) maintenance of an audit trail during data analysis; 3) peer-debriefing; 4) member checking to verify results; and 5) triangulation of qualitative data with documents (pandemic response plans, the published standards and competencies relevant to the profession). These strategies are important in maintaining rigour in qualitative research, increasing the trustworthiness of the results (Charmaz 2006, Padgett 2012).

Study conclusions

Long's thesis found that, in response to the 2009 H1N1 pandemic, PHNs drew on their nursing knowledge, community knowledge and connections, professional code of ethics, the CHNC practice standards and public health nursing discipline competencies, and professional and personal partners. Study participants applied their nursing experience, innovation, and sense of humor to overcome challenges such as managing public demands for information and supporting fellow nurses who were newly trained and inexperienced in administering injections. Long's study documents the lived experiences reported by Manitoban PHNs to improve understanding of their roles for the next pandemic and advocate for their inclusion when preparing for the next pandemic. Although several challenges at the personal, professional and organizational levels were noted, all of the study participants indicated they felt proud of their accomplishments in planning mass immunization clinics for their communities in a time of crisis.

Nhan, Laprise et al. (2012)

Nhan, Laprise et al. conducted a mixed-methods web-based learning needs assessment to describe Quebecois physicians' perceptions of management of pH1N1 at the physician level and identify areas for improvement. The survey consisted of multiple-choice and open-ended questions to collect both quantitative and qualitative data. The results were intended to inform the agenda of an interdisciplinary continuing education session to address knowledge gaps surrounding the World Health Organization (WHO) guidelines for responding to health care emergencies and on the perceived implementation issues during pH1N1. When the preliminary results were shared at the meeting, the association members encouraged the authors to seek publication of the results.

Study methodology and analysis

Appropriate ethics approval was obtained. All physicians who were members of either the Quebec association of infectious diseases and medical microbiologists (AMMIQ) or the Quebec association of public health and preventive medicine (AMSSCQ) were invited to participate. The surveys were emailed in April 2010 and submissions were closed May 2nd, 2010.

The researchers developed the survey based on their individual expertise and on the literature and two members of AMMIQ and three members of AMSSCQ reviewed it. It was composed of four broad questions, which included both multiple choice and open-ended sub-questions: 1) participation in pH1N1 management; 2) their practice profile; 3) types of frustrations/difficulties during the pandemic; and 4) an open-ended question asking for suggestions for improvements for future

pandemic-like emergencies. For question three, there was a checklist of 22 items in seven categories and at the end of each category participants were asked to freely describe issues they encountered. The seven categories include aspects of pH1N1 management at 1) the clinic level, 2) the public health level, 3) overall crisis management, 4) communication process, 5) vaccination, 6) overall management of the two pandemic waves, and 7) issues not covered in previous categories.

Qualitative data were analyzed using inductive, open coding methodology to create themes. Three researchers first independently coded the data and created the themes, upon which team consensus was met. As a team, the researchers used concept mapping to further refine the themes.

Study findings

Only the respondents who had personally experienced the pH1N1 outbreak while serving in a professional capacity were eligible; 102 of 317 (32.2%) respondents met these criteria and were included in the analysis. Of the 102 eligible respondents, quantitative analysis revealed that 85.3% reported negative experiences with pH1N1 management. Physicians from both specialties identified issues with the communication process (e.g., dissemination of clinical practice guidelines [CPG] and route of communication). Specialty-specific issues identified by infectious diseases/medical microbiologists (IDMM) primarily involved laboratories and infection prevention and control, vaccine availability, and overall management of the two pandemic waves. Specialty-specific issues identified by public health/preventive medicine specialists (PHPMS) primarily involved the decision-making process in the

prioritization of high-risk groups for vaccination. More than half of the PHPMS respondents identified issues with the top-down management style, communication processes, and patient management at the public health level (expert committees, case reporting, and epidemiological investigation).

Of the 102 respondents, 62 (60.7%, 37 IDMM and 25 PHPMS) respondents provided written comments. Two central themes emerged: 1) coordination, for example of protocols, roles, and communication; and 2) resource-related difficulties, such as laboratory resources, patient management, and the vaccination process. More open codes related to coordination (n = 180) than to resources (n = 64).

Coordination

Issues related to the coordination of the pandemic response were the most common difficulties identified by the physicians. Inadequate collaboration across levels of pandemic management, especially between expert advisors and workers in the field, resulted in poor communication and subsequent confusion surrounding information received and decision-making processes. A lack of clarity surrounding the distinct roles and inadequate communication between physicians in the field and expert advisory committees was cited as a significant barrier to efficient pandemic management. Some physicians questioned the committee members' credentials and the validity of their decisions. Additionally, physicians were frustrated by the lack of transparency in the decision-making process and by a lack of personal autonomy. Many physicians attributed the ineffectiveness of the top-down management model and the slow decision-making processes to the large number of people at the top administrative level. They

suggested including more medical specialists at the decision-making level and allowing for greater autonomy at the regional and local level.

The primary communication problems identified included a slow dissemination of information and an overwhelming number of information sources and divergent, often unclear, messages. As an example, the content of Clinical Practice Guidelines (CPGs) was noted to be inconsistent and frequently changing, and sometimes contradictory, between distinct pandemic management levels and advisory committees, creating confusion among physicians over which ones to follow. In addition, the CPGs were disseminated too slowly and were inflexible to accommodate certain specific situations or regions. Inefficiency was also identified regarding the epidemiologic investigations protocols, specifically: changing requirements of the case report form; lack of timely feedback at the local level; and the inconsistent handling of surveillance and modeling data, and data analysis. It was suggested that centralizing communication management and using the Internet instead of teleconferences could strengthen the consistency of communicated information. Greater transparency and access to collected data at the local level was also seen as important. Finally, the increased workload created by pandemic activities, such as attending inefficient meetings, was noted to be unmatched by additional financial compensation.

Resource-related difficulties

Problems were identified surrounding the issue of availability of required resources, including laboratory resources for diagnosis, managing ill patients efficiently, and ensuring effective vaccination

campaigns. In laboratory settings, physicians noted limited access to supplies, such as diagnostic material and tests, as well as a lack of human resources (staff). Physicians also noted that emergency rooms were frequently overwhelmed and criticized that patients with influenza-like symptoms were not evaluated prior to being sent to the ER. They recommended that patients be evaluated elsewhere, the number of single hospital rooms be increased to accommodate patients with pH1N1, and the process for transferring patients be made more efficient. Several issues were identified with the vaccination process, including late delivery of vaccines after the onset of the second pandemic wave and late notification of their arrival. Physicians recommended an improved risk assessment process in determining high-risk groups for vaccination prioritization, particularly with respect to the elderly and school-aged children, both of which were targeted late in the vaccination campaign. Physicians proposed that the vaccine be available earlier for the general public, available to the chronically ill through special clinics, and that more information on the vaccine be available to healthcare workers.

Study limitations

The authors acknowledge the following limitations of this study: relying on a convenience sample; using a survey that lacked established construct validity; and possible recall bias among the participants. Although the qualitative data were not collected with traditional in-person qualitative research methods (such as in-depth interviews, focus groups), the thematic content analysis of the open-ended questions was robust and appropriate, especially as the data were originally collected only to inform a continuing

education seminar and not for publication.

Study conclusions

Responses to healthcare emergencies can be strengthened through improving transparency and reinforcing relationships between physicians and health authorities. Further involving professional associations in planning responses and as a communication channel should be considered. Further qualitative studies would help describe how to improve the implementation of emergency response plans, empower stakeholders, and identify discrepancies between pandemic plans and the actual events.

Discussion

Although the above studies are specific to distinct populations of healthcare workers and/or regions, common themes emerged across them, including: 1) improving timely availability and access to resources, including human resources, vaccines, and specific supplies required by each discipline to fulfill their roles (such as infection control supplies, supplies for MICs, and laboratory supplies); 2) issues of self-care among healthcare workers; 3) improved communication, notably increased consistency of messages, consolidated sources of information, and targeted communication to be context specific; 4) improved collaboration and teamwork across disciplines, particularly with respect to definitions of roles and responsibilities and transparency in decision-making.

Availability of resources

HCW participants in all the studies reviewed mentioned a lack of resources as inhibiting the

Table 1: Key findings of included studies

Year	Study	Key Findings
2011	Charania and Tsuji	Main barriers identified: overcrowding in houses, insufficient human resources, and inadequate community awareness. Main areas for improvement identified include increase human resources and funding for community education and general supplies.
2013	Long	PHNs are important assets for the health regions: they are essential sources of information for the community and are connected to the community; they appreciate and need to be supported to fulfill their roles; they should be involved in the planning of pandemic response interventions to improve efficiency and effectiveness; and ethical dilemmas that cause PHNs moral distress should be acknowledged and anticipated in pandemic preparedness activities.
2012	Nhan, Laprise et al.	85.3% of 102 eligible respondents reported negative experiences with pH1N1 management centred around two main themes: 1) coordination, for example of protocols, roles, and communication and 2) resource-related difficulties, such as laboratory resources, patient management, and the vaccination process.

Table 2: Research objectives and design of included studies

Study	Purpose	Method	N	Population	Sampling
Charania and Tsuji	To identify barriers experienced by healthcare providers and opportunities for improvement during pH1N1 in 3 remote and isolated Subarctic First Nation communities	Semi-directed interviews; community-based participatory approach	13	Key informants from: 1) federal health centres; 2) provincial hospitals; and 3) Band Councils	Purposive
Long	To understand the lived experience of Manitoban Public Health Nurses (PHN) during pH1N1	2 Focus groups (FG), 3 telephone interviews	13	4 urban PHNs (FG), 6 rural PHNs (FG), 3 Northern PHNs (interviews)	Targeted public health regions (urban, rural, and Northern); the study was advertised by posters in the regions' offices and on their websites.
Nhan, Laprise et al.	To describe Quebecois physicians' perceptions of pH1N1 management at physician level and identify areas for improvement.	Web-based needs assessment as a survey with both multiple-choice and open-ended questions.	102/317 (32.2%)	Infectious disease specialists/medical microbiologists, public health/preventive medicine specialists	All physician members of either the Quebec association of infectious diseases and medical microbiologists (AMMIQ) or the Quebec association of public health and preventive medicine (AMSSCQ).

effectiveness of the pH1N1 response, particularly their ability to fulfill their individual role. HCWs noted that ensuring timely and equitable access to supplies is of paramount importance, whether these be laboratory supplies to run diagnostic tests (Nhan, Laprise et al. 2012), supplies and human resources to set-up and run mass immunization clinic (Long 2013), or basic infection control supplies that may be too expensive for some groups to access on their own (Charania and Tsuji 2011). HCWs unanimously noted that the required funding for resources and plans for accessing and distributing them must be in place before the next pandemic. Charania and Tsuji (2011) suggested that stockpiling resources in difficult to access locations may be effective.

In particular, HCWs noted that shortages of human resources influenced the effectiveness of their response. Using lay people for nontechnical support (such as set-up and security at vaccine clinics), implementing rapid training programs to increase personnel able to administer immunizations, and sharing trained personnel among regions with different levels of demand were among interventions found to be effective (Charania and Tsuji 2011). Having trained personnel move to work in more affected regions is not a novel idea. When the first pandemic wave quickly overwhelmed Manitoba's emergency service capacity, the Winnipeg Regional Health Authority (WRHA) declared a state of emergency on June 7th, 2009. In response to the potential HCW shortage, British Columbia and Ontario offered intensive care nurses to Manitoba if required, perhaps also as a show of solidarity, as Manitoba nurses and physicians had gone to British Columbia and Ontario to support their health systems during the 2004 SARS outbreak (Embree 2010). While a

sense of teamwork and community across the country is positive during emergencies, it is important to remember that agreements and decisions about sharing or moving healthcare personnel to other locations or roles should be made in advance of a pandemic or health emergency occurring. The studies found that this also applies to tasks such as vaccine administration during mass immunization clinics (MIC). If healthcare workers such as pharmacists or paramedics are to be trained to administer immunizations, the difficult decisions of when and how should be made before a crisis occurs.

Common themes that emerged include: improving timely availability and access to resources; issues of self-care among healthcare workers; improved communication; improved collaboration and teamwork across disciplines.

Members of Aboriginal communities were affected disproportionately by pH1N1 (Kumar, Zarychanski et al. 2009, Zarychanski, Stuart et al. 2010, Charania and Tsuji 2011). They experienced a 2.8 times higher hospitalization rate after infection with H1N1 and 3 times higher rate of admission into an intensive care unit than non-Aboriginal peoples (Richardson, Driedger et al. 2012), although they were not statistically more likely to die than other populations once infected, according to a study of critical care patients by Kumar, Zarychanski et al. (2009). Additionally, a study

investigating the vaccine response of Aboriginal populations found that vaccination effectively induced protective titres, even among the critically ill (Rubinstein, Predy et al. 2011). However, timely delivery of effective interventions is essential for overall success in response to a pandemic. Charania and Tsuji's qualitative study (2011) specifically set out to identify barriers to care that contributed to the marked vulnerability of First Nations during the 2009 pH1N1. The federal and provincial governments, as well as the Band Council, which consists of the locally elected Chief and Band Council members, share responsibility for healthcare in First Nation communities. However, the authors found a lack of federal funding and inadequate social policies left communities with inadequate primary healthcare, community-level disease surveillance, and community infrastructure, including housing (Charania and Tsuji 2011). While isolation can initially act as a buffer to pathogen exposure during an infectious disease pandemic, once introduced, a pathogen may be transmitted more quickly within communities where overcrowding, impoverished environments, and difficulty transporting supplies occurs. Pandemic responses of remote and isolated First Nation communities may have been affected by the disparities found in the communities themselves, such as crowded living conditions, as well as their geospatial isolation, and unique culture and governance (Spence and White 2010, Charania and Tsuji 2012).

Charania and Tsuji (2011) also cite the responsibility governments have for addressing the needs of vulnerable populations to prevent any injustice that may occur during a public health emergency, and note that the Assembly of First Nations has criticized the lack of inclusion of First Nations' input to

government pandemic plans. There is an ethical obligation to protect vulnerable populations during public health emergencies (Falconi and Fahim 2012, Wynn and Moore 2012), which is consistent with the recognition that pH1N1 disease is influenced by social determinants of health, such as poverty and lack of education, in addition to the more widely accepted clinical factors (O'Sullivan and Bourgoin 2010, Lowcock, Rosella et al. 2012). Qualitative studies in Aboriginal communities outside of Canada have also found that access to timely health services and infection control supplies in already underserved, impoverished communities is critical (Massey, Pearce et al. 2009). For example, similar to issues identified in Canada, challenges in accessing health care were noted to be a concern during focus group discussions with six Aboriginal communities in Australia and recommendations such as stockpiling essential resources (e.g., Tamiflu) and ensuring medical care (e.g., nurses, drivers for transport to hospitals) was available after hours were suggested by the community members (Massey, Pearce et al. 2009).

Personal and professional sense of duty to care

Responding to a pandemic, or any public health emergency, as a HCW on the frontlines can cause stress and bring to light personal convictions and morals. Pandemic readiness plans must take into account HCWs' willingness to report to duty in an emergency and take steps to ensure their protection as much as possible. HCWs in the studies included in this review discussed extreme working conditions, although HCWs who felt supported were also comfortable implementing innovative solutions, such as pairing junior nurses with those that have more experience (Long 2013). That more experienced HCWs make ideal mentors for

younger HCWs is supported by a survey of HCWs' behaviors during pH1N1 in British Columbia where HCWs with more than 11 years of experience were more compliant with using personal protective equipment than those with fewer than 11 years of experience (Mitchell, Ogunremi et al. 2012).

All of the studies included in this review discuss HCWs' concerns regarding not being eligible or having access to vaccination for themselves or their loved ones as a source of stress. Indeed, prioritization of frontline HCWs is a central part of Canada's pandemic response plan (Kendal and MacDonald 2010), as recommended by organizations such as the World Health Organization (WHO) and the Centre for Disease Control (CDC) in the United States (CDC 2009, Zarocostas 2009). Multiple studies and reviews have been conducted to investigate HCWs' willingness to work during pH1N1 (Balicer, Barnett et al. 2010, Wong, Wong et al. 2010, Devnani 2012, Wong, Wong et al. 2012), building on earlier work on HCWs' perceived likelihood that they and colleagues would report to work in an emergency (DeSimone 2009). A study in the US found approximately half of all HCWs were likely to not report for work in an emergency, but that this was linked to feelings of importance in the workplace, such that clinical staff were significantly more likely to report to duty than technical or support staff (Balicer, Omer et al. 2006). As such, HCWs should be recognized as valuable assets for community health and regional health protection plans and involved in planning for the next pandemic. Public recognition and support for their critical role will increase HCWs' ability to feel pride in their profession and identification with their role (Long 2013).

The role of moral distress and ethical decision-making in connection

to willingness to work during a public health emergency among HCWs has been investigated (O'Boyle, Robertson et al. 2006, Oh and Gastmans 2013). Although not specific to pH1N1, a recent qualitative study in Ontario conducted in-depth interviews with public health nurses to explore their expectations of working during a pandemic, specifically with respect to expected conflicts between personal care-giving and family responsibilities (female identity) and professional obligations (professional identity) (Tigert Walters 2010). A grounded theory was developed to explain the evolution of the nurses' self-identity from a core female and professional identity and the subsequent "reassortment" of this identity over their lifetime based on their experiences. Tigert Walters (2010) noted that nurses' dominant self-identity at the time of a pandemic will impact their perception of duty, which has potentially significant relevance to their willingness to work in a public health emergency. This insight to HCWs' identity construction will be valuable for employers, governments, and policy makers when securing a critical workforce for the next pandemic (Tigert Walters 2010).

Finally, all of the HCWs in the studies included in this review recognized the significant influence of contextual factors (e.g., media coverage, limited resources, and inter-disciplinary collaboration) on overall planning and implementation of local pandemic responses. HCWs' flexibility in responding to local contexts and their demonstrated commitment to community health strongly supports the inclusion of HCWs in pandemic response planning and managing implementation of interventions.

Communication quality

All of the included studies highlighted themes of ineffective communication, identifying contradicting messages to HCWs and the public, information from too many sources, questionable decision-making by policy-makers, and information that lacked applicability to local situations. Canadian media coverage of pH1N1 in 2009 was particularly intense, receiving more media attention than all other health issues combined that year and generating approximately double the volume of media as the 2003 SARS crisis (Laing 2011). Long (2013) discussed how media coverage affected PHNs' experiences during pH1N1, particularly influencing the public's demand for vaccination and contributing to the often tense atmosphere of mass immunization clinics. For example, in late October 2009, mixed-messages in the media reported both 1) that H1N1 is of serious concern and 2) that it would be difficult to get a flu vaccine due to prioritization of high-risk groups, long line-ups, and vaccine shortages (Laing 2011), and this was consistent with PHNs reporting increased concern in the public over access to vaccination and confusion surrounding the priority groups for vaccination (Long 2013). Laing's study (2011) of the role of the media in pH1N1 found mistakes made by all three groups analyzed, including public health administration, the media, and the public. Specifically, the public health communication strategy did not respond appropriately to changes in the pandemic progression, creating confusion and mistrust when government messages were inconsistent with media reports and the public's experiences. Additionally, the media often did not support its stories with verified facts, for example negatively portraying the vaccination campaigns based on weak scientific studies and

sensational stories. Finally, the public itself was noted to share the blame as despite receiving considerable information that pH1N1 was a serious threat and being able to obtain credible information to make an informed decision, two-thirds of Ontario residents opted to not get vaccinated for pH1N1 (Laing 2011). Other Canadian studies analyzing pH1N1 communication strategies also found media messaging was often inconsistent, sensationalist, or not clearly supported by reliable facts (Lam and McGeer 2011, Rachul, Ries et al. 2011). This type of messaging from the media created unnecessary panic and confusion in some communities, increasing distrust and making it difficult for HCWs to effectively fulfill their duties (Charania and Tsuji 2011, Long 2013).

In addition to contradicting media reports regarding pH1N1, HCWs in all studies reviewed mentioned contradiction in the information they received from health authorities. For example, PHNs in Manitoba reported that criteria for vaccination priority groups was sometimes changing by the hour during immunization clinics (Long 2013) and physicians in Quebec were exasperated by the over-whelming variability of messages received (Nhan, Laprise et al. 2012). HCWs also reported frustration with a lack of flexibility in policies that restrained their ability to tailor policies to specific local needs. In particular, physicians typically enjoy a great deal of autonomy in decision-making, and may find it difficult to adjust to a new role (i.e. strictly following policy) during a pandemic (Nhan, Laprise et al. 2012). While recognizing the necessity of a top-down style of management during a pandemic (Standards 2010), HCW participants in the studies of this review suggested that accepting a degree of flexibility at the local level would improve the effectiveness

of the pandemic response overall. The benefit of allowing "bottom up" feedback to successfully tailor prevention policies to a specific pandemic situation has been reported by others, for example when addressing university students completing program practicum requirements in healthcare settings during pH1N1 (Drolet, Ayala et al. 2013). Furthermore, a lack of transparency in the decision-making process by public health authorities was also frustrating for HCWs and contributed to suspicion and lack of confidence in the top level of management.

Concerns regarding the transparency and explicitness of decision-making processes were also found to create confusion by a Canadian policy analysis (Rosella, Wilson et al. 2013). Compared to other emergencies such as the 2003 SARS outbreak, pH1N1 was unique in that there had been advance preparation and pandemic plans were in place to provide practical guidance for the response. However, Rosella et al. (2013) note that pandemic plans, developed from complex assumptions and varied evidence, can sometimes constrain policymaking. Indeed, it was discovered that as pH1N1 progressed and evidence indicated that the level of severity did not match that of the models, policymaking continued to be informed by those models. The researchers explain this discrepancy between the original pandemic plan and the new data based on on-the-ground happenings using cognitive dissonance theory (Rosella, Wilson et al. 2013). HCWs have suggested that including more medical specialists, and also HCWs with clinical experience with the disease, in decision-making would allow for greater responsiveness and effectiveness of the pandemic response (Nhan, Laprise et al. 2012, Long 2013).

In Canada and globally, it has been noted that communication during public health emergencies must be understandable and context specific, as well as culturally sensitive and account for Aboriginal traditions, such as attending community funerals and other social gatherings (Massey, Pearce et al. 2009, Charania and Tsuji 2011). In addition, Charania and Tsuji (2011) note that information could be disseminated to communities through means specific to First Nations, such as pandemic awareness and/or planning meetings with attendance mandated by the Band Council. Input from First Nations communities is required to develop and implement pandemic readiness plans to ensure cultural appropriateness (Massey, Pearce et al. 2009, Rubinstein, Predy et al. 2011, Richardson, Driedger et al. 2012).

Communication strategies should be improved through incorporating nurse managers and/or further increasing the involvement of nurses. Long (2013) noted that electronic technology needs to be in place earlier to facilitate providing accurate and timely information about the influenza pandemic to frontline staff so they, in turn, can disseminate the information to their communities. Clear communication from healthcare workers regarding pandemic interventions was essential in instilling and maintaining trust among community workers.

Long (2013) supports this recommendation with the literature, citing Lee and Basnyat that, after vaccination, effective communication by both government and public health officials is the second most critical intervention for responding to a vaccine preventable disease pandemic (Lee and Basnyat 2013). Long also suggests that regional administrators consider the creation of a central information repository to provide timely and consistent

updates to public and health care professionals during a public health emergency. She suggests that a repository could be staffed with existing trained personnel and infrastructure from Health Links-Info Santé, and that messaging and updates could be developed with input from local, regional, and provincial PHN representatives. PHNs would need to be supported by their managers, medical officers of health, and other regional staff members (Long 2013). Several PHNs specifically cited that receiving information and directives from their region assisted them in carrying out their duties at immunization clinics and public health offices. In contrast, PHNs who reported a lack of timely updates appeared to experience greater challenges, such as when enforcing vaccine priority groups (Long 2013). Long notes that it is well-documented in the literature that during infectious disease outbreaks, access to various sources and forms of support is essential for frontline nurses to perform their duties (Bergeron, Cameron et al. 2006, O'Boyle, Robertson et al. 2006) and that employers and their administrators have a responsibility to prepare nurses both professionally and ethically to respond to public health emergencies (Balicer, Omer et al. 2006, Jakeway, LaRosa et al. 2008).

Interdisciplinary teamwork

Together with improved quality and consistency of communication, the studies reviewed in this paper recommend the capacity for interdisciplinary teamwork should be strengthened. In addition to increased collaboration among healthcare workers (such as physicians, nurses, social workers, pharmacists, first responders), one study (Long 2013) called for increased multi-disciplinary collaboration within academia and clinical healthcare. Surprisingly,

given the zoonotic origin of the virus, none of the studies reviewed here directly advocate for improved collaboration across human and animal health sectors. Greater awareness of the benefits of interdisciplinary teamwork and encouragement of a "One Health" culture in research and surveillance efforts would likely improve prevention, detection, and mitigation of infectious diseases (Meslin, Stohr et al. 2000, Merianos 2007).

Collaboration within the healthcare system

All of the studies reviewed here discussed a need for greater collaboration and improved definition of roles and responsibilities within the healthcare system, which is consistent with earlier work investigating disease outbreak emergencies (Johnson, Bone et al. 2005). Although some groups of HCWs are accustomed to working with other healthcare professions, such as public health nurses (PHNs), others may not be and training provided in advance of an emergency situation would allow HCWs to better understand the abilities of other professions (Long 2013). Indeed, Long (2013) found that PHNs cited the formation of new working relationships with colleagues from other departments and other cities as a positive outcome of pH1N1. However, when working with new groups, roles and responsibilities change and some HCWs found it difficult to adjust to their new role during pH1N1 (Nhan, Laprise et al. 2012, Long 2013). In addition to HCW teams, increased collaboration was found to be required across different government groups responsible for healthcare, such as diagnostic laboratories, epidemiological investigation units, and primary care providers (Nhan, Laprise et al. 2012) and federal, provincial, and Band Council governments serving First

Nations communities (Charania and Tsuji 2011).

A model for HCW collaboration was demonstrated between public health and primary care providers in southeastern Ontario, where an effective response to pH1N1 occurred when integrated, interdisciplinary family health teams (FHT) were used as the primary care providers (PCP) (Wynn and Moore 2012). FHTs are described as including physicians, nurse practitioners, social workers, pharmacists, and dieticians, and they promote rapid, timely, and efficient communication between physicians and public health leaders. Pandemic H1N1 was the first public health emergency that used the FHT structure to facilitate collaboration between primary care and public health and its success indicates this model has great potential for scale-up in other regions. In particular, because PCPs could easily communicate their patients' needs to public health, the two sectors were then able to work together to coordinate care for all citizens. This mindful coordination promotes equality in healthcare opportunities, making this an especially potentially useful model for vulnerable populations such as First Nations communities (Wynn and Moore 2012).

Collaboration with academia

As Long (2013) suggested, interdisciplinary teamwork and inter-sectoral collaboration between academia and the health sector could potentially have significant positive impacts on a pandemic response. However, few studies exist that examine the role of disciplines outside of the traditional medical care-based sector. One exception is Drolet, Ayala et al. (2013), who used a web-based survey of Canadian social work field directors and coordinators to investigate the impact of pH1N1 on social work

student practica. The researchers recognize that universities are potentially of particular concern during pandemic influenza because of the large congregation of young adults who typically have high levels of close social contact. Collaboration between academia and field agencies was found to increase effectiveness of interventions to ensure student safety and limit viral transmission (Drolet, Ayala et al. 2013).

Participants identified two primary sources of pandemic information (such as policies detailing absenteeism, sneezing/coughing etiquette, existing school/agency protocols, and vaccination) for students: 1) the university, through field directors and faculty liaisons; and 2) through the field agency itself. Less than half of the participants recommended H1N1 vaccination before a practicum. Field directors and coordinators particularly emphasized communication of pH1N1 precautions as students also reported accessing information on the Internet that pH1N1 was not as serious as reported and that vaccination was either ineffective or harmless. Overall, more than one-third of respondents said that practicum activities were altered by pH1N1 and social work field education programs were found to have taken on the responsibility of preparing students, through increasing awareness and developing appropriate policies and educational materials.

This study highlights the importance of collaboration between academia and field agencies during public health emergencies via exploring the experiences of social work faculty and field instructors during pH1N1. As discussed earlier, although top-down management of human pandemics is the norm (Barnett, Balicer et al. 2005, Kendal and MacDonald 2010), bottom-up responses by post-secondary institutions and their partner agencies are essential in

tailoring pandemic responses to be effective within their specific context (Drolet, Ayala et al. 2013). Although the role of academia in pandemic preparedness and response seems to be neither widely understood nor optimized in Manitoba, Long (2013) advocates for further collaboration between faculty with technical expertise and healthcare providers. Long (2013) suggests that academia and health regions could jointly perform real time research during emergency planning and response-related activities. She believes that the knowledge generated from such collaborative work could inform both public health nursing practice and curricula in post-secondary institutions in ways that surpass the documented barriers to this type of collaboration, such as lack of awareness of each others' organizational capacities, differences and competitiveness in the institutional culture, financial restraints, and legal technicalities between public health and academia (Dunlop, Logue et al. 2012).

Long also proposes that nursing faculties could also work to increase awareness of the importance and benefits of interdisciplinary groups among student nurses, potentially via invited guest speakers such as PHNs with pH1N1 experience.

Collaboration through "One Health"

Despite the well-know animal origin of this novel influenza virus (Smith, Vijaykrishna et al. 2009, Pasma 2011, Smith, Harper et al. 2011, Vijaykrishna, Smith et al. 2011), relatively few Canadian studies investigate the potential for virus transfer between pigs and humans. Modern swine production brings together humans and concentrated populations of pigs, which are known to have potential as "mixing vessels" for creating novel influenza viruses through hosting, and allowing the re-assortment of, swine,

human, and avian influenza viruses (Ma, Kahn et al. 2009, Haque, Bari et al. 2010). Support for the “One Health” ethos will improve collaboration between human, animal, and environmental health practitioners improving efficiency of policy decisions (Tanner and Zinsstag 2009).

An Albertan study investigated the transmission of pH1N1 between swine workers and pigs on Hutterite colonies and found that, although the pH1N1 influenza virus is thought to have reassorted in swine, the swine herds in this study were likely infected via anthroponosis (Russell, Keenlside et al. 2009). The continued emergence of novel pathogens from animal vectors warrants increased surveillance in zoonotic disease transmission, particularly in potentially high-risk situations (Morse 1995, Jones, Patel et al. 2008). Including qualitative research methods in studies of anthrozoontic diseases will increase understanding of how transmission occurs by investigating knowledge and attitudes of workers directly handling swine and the subsequent impacts on their behavior.

A recent qualitative study has been conducted to identify challenges and opportunities for the prevention, early detection, and mitigation of zoonotic influenza. In this study, key Canadian stakeholders in swine production and health, human health, diagnosticians, and virologists participated in key informant interviews and the author makes suggestions to improve prevention, detection, and mitigation of a novel virus at the human-animal interface (Wisener 2013). Ensuring adequate qualitative methodology will permit effective integration of knowledge, attitudes, and practices associated with influenza transmission of the farm and abattoir workers and private and public practice veterinarians who handle swine,

and the primary care physicians and public health staff who may interact these groups. These studies could further inform both surveillance and early response policies to assist in preventing novel zoonotic disease outbreaks.

Limitations

Although an extensive search was conducted for relevant studies, it is possible that one or more studies may have been overlooked as the subject concerns multiple disciplines and studies may appear in various publications and/or databases. Non-English studies may also exist.

Conclusions

While responses to pH1N1 across Canada varied depending on their individual context, the HCW participants identified common ways for pandemic response plans to be strengthened in preparation for future pandemics. Ensuring timely access to required resources (both human and material supplies), recognizing and preparing for issues such as moral distress among HCWs, improved communication strategies, and improved collaboration and teamwork across disciplines, were all recognized as areas with opportunities for improvement to ensure the response to the next pandemic is even more effective. Overall, within Canada and globally, there is a sense of relief that pH1N1 was not more severe and responses to pH1N1 are being carefully analyzed to identify weaknesses and address knowledge gaps. HCWs who were on the frontlines are a valuable source of information and further qualitative studies should be done to better understand their unique perceptions of Canada’s response to the 2009 pH1N1.

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