

Investigation of a Pandemic H1N1 Influenza Outbreak in a Remote First Nations Community in Northern Manitoba, 2009

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ABSTRACT

Objectives: First Nations communities in Manitoba were significantly affected by the pandemic H1N1 influenza virus (pH1N1) in 2009. Our objective was to conduct an epidemiologic investigation of a pH1N1 outbreak in one remote First Nations community (population 3,300) in northern Manitoba to inform a timely public health response and provide recommendations for preventing future outbreaks.

Methods: Chart reviews were conducted at the nursing station for patients meeting the influenza-like illness (ILI) case definition during the study period (April 20 to June 11, 2009). Descriptive analyses examined age, gender, clinical presentation, management, outcomes and risk factors. Comparisons were made for hospitalized versus non-hospitalized cases and laboratory-confirmed versus possible cases using Pearson's chi-square test for gender and symptoms and using a t-test for age.

Results: There were 180 ILI cases, including 23 laboratory-confirmed cases of pH1N1. Forty percent of children <1 year old in the community and 9.4% of pregnant women presented to the nursing station with ILI. Most ILI cases were managed through the community nursing station, although 18.3% of cases (n=33) were medically evacuated and 16.1% (n=29) were hospitalized. There were no differences between hospitalized versus non-hospitalized or laboratory-confirmed versus possible cases. Risk factors identified in a subset of cases included exposure to an individual with ILI prior to illness onset, overcrowding and inadequate access to household water.

Conclusions: Early arrival and rapid transmission of pH1N1 rendered usual non-pharmacological control measures largely ineffective. Recommendations for prevention of future outbreaks include an effective communications strategy and daily surveillance for disease detection and monitoring. Key determinants of health should be addressed in remote First Nations communities to prevent disease and protect the health of these populations.

Key words: First Nations; Manitoba; remote community; pH1N1; outbreak; epidemiology

La traduction du résumé se trouve à la fin de l'article.

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During the first wave of the 2009 pandemic H1N1 influenza virus (pH1N1) in the province of Manitoba, Canada, there were 892 laboratory-confirmed cases of pH1N1;¹ of these cases, 156 (17.5%) were in northern remote First Nations communities served by nursing stations (total population 45,000) (First Nations and Inuit Health Manitoba Region, Winnipeg, Manitoba Health Surveillance and Analysis, personal communication, 2009). First Nations ethnicity has been associated with increased severity of pH1N1.²

Health staff in a remote First Nations community in Manitoba identified an outbreak of influenza-like illness (ILI) in late April 2009, with subsequent laboratory confirmation of pH1N1 circulation. A field investigation of this pH1N1 outbreak was undertaken in June 2009. The objectives were to contribute to the understanding of the epidemiology of pH1N1 in this community, to inform a timely public health response and to make recommendations for the subsequent response to pH1N1 in other communities.

METHODS

This investigation was conducted in a remote First Nations community (population 3,300) in northern Manitoba. The community is served by daily flights, but lacks an all-weather road. Primary nursing care and public health services are provided at the community nursing station. Itinerant primary care and specialist physicians provide care to this community on a scheduled basis. The study period was April 20 to June 11, 2009. April 20 was chosen as

the beginning of the study period based on observations by nursing staff of increasing ILI occurring in the community and on the start date of the first wave of pH1N1 as declared by the province of Manitoba. June 11 was the last day that the study team was in the community for the purpose of data collection. Study data were collected for all of the laboratory-confirmed cases of pH1N1 in this community.

The ILI case group comprised both the pH1N1 laboratory-confirmed and possible cases. Case definitions were agreed upon by the study team. The possible case definition was in accordance with the ILI case definition from Manitoba Health and Healthy Living, which stated that fever and/or cough may not be prominent in children <5 years of age.

1. Confirmed: Laboratory confirmation of novel influenza A (pH1N1) virus taken from a clinical specimen collected on or

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Conflict of Interest: None to declare.

Table 1. A Comparison of 151 Non-hospitalized Versus 29 Hospitalized Cases of Influenza-like Illness in a Remote First Nations Community in Northern Manitoba from April 20 to June 11, 2009

Characteristic	Nursing Station Consultation Without Hospital Admission (n=151)	Hospital Admission (n=29)	P-value	Total (n=180)
Gender	n (%)	n (%)		n (%)
Male	77 (51.0)	12 (41.4)	0.34	89 (49.4)
Female	74 (49.0)	17 (58.6)		91 (50.6)
Age*				
Mean (SD)	6.0 (11.0)	7.0 (11.0)	0.64	6.1 (11.0)
Median (Range)	2.2 (0-54.8)	1.1 (0-34.5)		1.9 (0-54.8)
Symptoms†	n (%)	n (%)		n (%)
Cough‡	144 (95.4)	28 (100)	0.25	172 (96.1)
Fever‡	105 (69.5)	24 (85.7)	0.08	129 (72.1)
Anorexia	81 (53.6)	11 (39.3)	0.16	92 (51.4)
Vomiting	77 (51.0)	14 (50.0)	0.92	91 (50.8)
Rhinorrhoea	53 (35.1)	10 (35.7)	0.95	63 (35.2)
Diarrhea	36 (23.8)	11 (39.3)	0.09	47 (26.3)
Earache	34 (22.5)	6 (21.4)	0.90	40 (22.3)
Sore throat	33 (21.9)	5 (21.7)	0.64	38 (21.2)

* Age calculations performed in months, then converted to years.

† n=179.

‡ Children <5 years old were not required to have fever or cough to meet the ILI case definition.

after April 20, 2009 in an individual who resides in the community.

2. Possible: An individual presenting to the community nursing station from April 20 to June 11, 2009 with ILI defined as: i) fever >38° C AND ii) cough AND iii) one or more of sore throat, arthralgia, myalgia, prostration, or for children <5 years of age a gastrointestinal symptom.

Case finding occurred through a review of the nursing station daybooks, which utilize syndromic codes assigned during the clinic visit. Chart reviews were conducted for all patients seen at the clinic between April 20 and June 11 for at least one of: respiratory illness, fever or earache. If these patients met the possible case definition, an investigation form was completed. Additional case finding included reviews of chest x-ray and medical evacuation records, as well as charts for all pregnant women being followed at the nursing station. The total number of pregnant women in the community was estimated from community birth records. Nasopharyngeal swabs were collected and analyzed by PCR. Laboratory results were obtained from Cadham Provincial Laboratory and from Manitoba Health and Healthy Living. Hospital records were reviewed in Winnipeg to determine outcomes for those patients medically evacuated from the community.

In-person interviews were conducted in the community with a convenience sample of ILI cases to elicit risk factor information, including: access to household water, household occupancy, attendance at community gatherings, and exposure to others with respiratory illness in the household. Adult caregivers were used as proxy respondents for young children.

Descriptive epidemiologic analyses were conducted using SPSS (SPSS version 16.0, USA 2007). Counts and proportions were determined for categorical variables. Mean, median and range values were calculated for continuous variables. Comparisons were made for hospitalized versus non-hospitalized cases and laboratory-confirmed versus possible cases using Pearson's chi-square test for gender and symptoms and using a t-test for age. Age-specific attack rates were calculated using denominator data from the Status Verification System (SVS) database for the ≥1 year age groups; however, community denominator data obtained from nursing station records were used for the <1 year age group in order to account for delays in reporting of births to the SVS.

This epidemiologic investigation was integral to public health's response to this outbreak and ethical approval was not required. However, regular updates were provided to community leaders during the investigation.

RESULTS

Chart reviews were conducted for 628 individuals and 180 of these were classified as ILI (28.7%). Females comprised just over half (50.6%) of the ILI case group. The mean age was 6.1 years (median = 1.9 years). ILI case data are presented in Tables 1 and 2. The ILI case group included laboratory-confirmed and possible cases. There were 23 laboratory-confirmed (12.8%) and 157 possible (87.2%) cases in the ILI case group. The <5 year age group comprised 73.9% of the laboratory-confirmed cases.

There were 409 clinic visits related to ILI over the study period. The median number of clinic visits per case was 2.0 visits and the median number of days between symptom onset and first clinic visit was 2.0 days. Cough and fever were reported in 96.1% and 72.1% of the ILI case group, respectively. Gastrointestinal symptoms were also prominent: 51.4% of the ILI cases reported anorexia and 50.8% reported vomiting.

Of the 180 ILI cases, 34 (18.9%) had at least one co-existing health condition, among these being 8 pregnant women (4.4%), 8 patients with lung disease (4.4%), and 6 patients with diabetes (3.3%). Data on smoking and obesity were not collected from the patient charts. Approximately 9.4% of all pregnant women in the community had ILI. Six of the pregnant women were medically evacuated from the community during the study period because of ILI.

Eighteen ILI patients (10.0%) were prescribed oseltamivir, including 8 patients in the community nursing station, and 10 in Winnipeg hospitals. Of the 8 cases prescribed oseltamivir in the community, 5 remained in the community with follow-up at the nursing station and 3 were medically evacuated. Oseltamivir was prescribed in the nursing station as per the Manitoba Health and Healthy Living policy at that time.

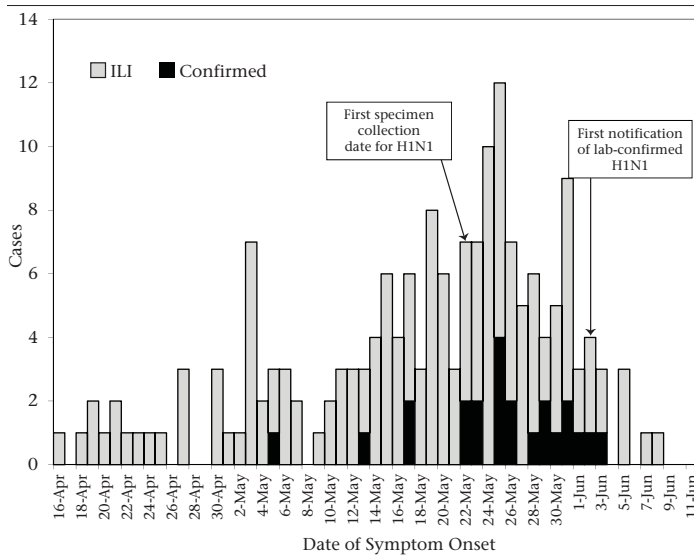
The majority of ILI cases were managed at home with ongoing support from the nursing station staff. Individuals requiring inpatient care were medically evacuated from the community for further assessment at a Winnipeg hospital. Thirty-three ILI cases

Table 2. A Comparison of 157 Possible Versus 23 Laboratory-confirmed Cases of pH1N1 in a Remote First Nations Community in Northern Manitoba from April 20 to June 11, 2009

Characteristic	Possible Cases (n=157)	Lab-confirmed Cases (n=23)	P-value	Total (n=180)
Gender	n (%)	n (%)		n (%)
Male	81 (51.6)	8 (34.8)	0.13	89 (49.4)
Female	76 (48.4)	15 (65.2)		91 (50.6)
Age*				
Mean (SD)	6.1 (11.3)	6.1 (9.2)	0.98	6.1 (11.0)
Median (Range)	2.2 (1-54.8)	0.9 (0-24.5)		1.9 (0-54.8)
Symptoms†	n (%)	n (%)		n (%)
Cough‡	150 (96.2)	22 (95.7)	0.91	172 (96.1)
Fever‡	107 (68.6)	22 (95.7)	0.01	129 (72.1)
Anorexia	84 (53.8)	8 (34.8)	0.09	92 (51.4)
Vomiting	83 (53.2)	8 (34.8)	0.10	91 (50.8)
Rhinorrhoea	57 (36.5)	6 (26.1)	0.333	63 (35.2)
Diarrhea	40 (25.6)	7 (30.4)	0.63	47 (26.3)
Earache	35 (22.4)	5 (21.7)	0.94	40 (22.3)
Sore throat	35 (22.4)	3 (13.0)	0.31	38 (21.2)

* Age calculations performed in months, then converted to years.
 † n=179.
 ‡ Children <5 years old were not required to have fever or cough to meet the ILI case definition.

Figure 1. Cases of influenza-like illness by date of symptom onset in a remote First Nations community in northern Manitoba from April 16 to June 11, 2009 (n=175)*



* n=5 cases: symptom onset date not available.

(18.3%) were medically evacuated and 29 of these (16.1%) were admitted to hospital. Fewer than 5 patients required additional support in the ICU. The mean length of stay in hospital was 6.8 ± 7.3 days and the median was 3.5 days.

Statistical testing to compare hospitalized versus non-hospitalized cases (Table 1) and laboratory-confirmed versus possible cases (Table 2) for gender, age and symptoms showed no differences between these groups.

Age-specific attack rates were calculated for the ILI case group as shown in Table 3. The majority of ILI cases (78.3%) were in the <5 year age group with the highest age-specific attack rate in the <1 year age group. The attack rate in the <1 year age group was 1.5 times and 23.5 times higher, respectively, than in the 1-4 year and the 5-19 year age groups.

Table 3. Age Distribution for 180 Cases of Influenza-like Illness in a Remote First Nations Community in Northern Manitoba from April 20 to June 11, 2009

Age Group (Years)	n	% of ILI	Attack Rate Within Age Group* (%)
<1	46	25.6	40.0
1-4	95	52.8	26.2
5-19	19	10.6	1.7
20-44	14	7.8	1.1
45-64	6	3.3	1.5
≥65	0	0	0

* Population counts are based on the Status Verification System database (Health Canada) for all age categories except the <1 year age group, which is based on Nursing Station data.

The epidemic curve depicted in Figure 1 shows the number of laboratory-confirmed and possible cases by date of symptom onset during the study period. The curve illustrates at least two waves of ILI in the community during the investigative period, the first peaking on May 3 and the second on May 25. The first symptom onset date for an ILI case was on April 16.

In-person interviews were conducted with 23 ILI cases, including 15 laboratory-confirmed cases. Most interviewees (87.5%) reported exposure to someone with ILI prior to becoming sick themselves. The mean number of individuals regularly sleeping in a household was 7.0 ± 2.6. Almost 70% of interviewees obtained their household water from a community standpipe.

DISCUSSION

Pandemic H1N1 travelled from Mexico to this remote First Nations community very quickly, likely arriving near the end of April, 2009. Flights to this isolated community travel from one airport in Winnipeg to the small community airport, providing a portal for the introduction of pH1N1 and other pathogens.³ Once introduced, pH1N1 spread rapidly and efficiently through this community, as demonstrated by the epidemic curve. This investigation was unique as data were collected for all patients presenting to a remote nursing station with ILI during a pH1N1 outbreak. There were no significant differences between laboratory-confirmed and possible cases for the variables gender, age and symptoms, indicating that most ILI cases were likely pH1N1.

Young children were disproportionately affected by ILI in this community. A US study of household transmission of pH1N1 reported that household contacts ≤18 years were twice as likely as those 19 to 50 years of age to develop respiratory illness.⁴ During an outbreak of pH1N1 at a New York school, 35% of student respondents and 10% of employee respondents reported having ILI.⁵ However, the data presented for the current study demonstrate an attack rate of 40% in the <1 year age group and 26% in the 1-4 year age group, rates that have not been reported elsewhere. There are several possible explanations. The majority of community members are <25 years of age, providing a large population susceptible to pH1N1. In this study population, young children appeared to be the sickest and therefore most likely to be brought to the nursing station for care. One Canadian study proposed that Aboriginal children were more involved in pH1N1 in Manitoba because of the isolated nature of their communities and thus a lower threshold for medical transfer and admission of children.⁶

The majority of interviewees reported exposure to a contact with ILI prior to becoming ill, suggesting person-to-person transmission

played a key role. Limited access to water in homes and overcrowded households may also have contributed to the rapid and extensive transmission of pH1N1 in this community. Housing conditions can present a unique challenge in dealing with an influenza pandemic in remote communities,⁷ and overcrowding has been associated with an increased risk of hospitalization from lower respiratory tract infections in Inuit children.⁸

This study is subject to several limitations. Age-specific attack rates were calculated based on individuals who presented to the nursing station. It is possible that children were more likely to present to the nursing station than adults, not because they were sicker, but because adults tended to stay home when ill. A second limitation is that risk factor information was only collected on a subset of ILI cases and there was no comparison group. The small sample size makes it difficult to determine whether the data collected are representative. Finally, it was not possible to ascertain a definitive pH1N1 outbreak start date because another respiratory pathogen may also have been circulating in the community in April.

The timely response of this community to the arrival of pH1N1 demonstrates the resilience and capacity of First Nations communities and their leaders to respond to emergent situations. Prevention and control measures were coordinated and supported by the Chief and Council of this community. Additional nurses and physicians were rapidly mobilized to the community by First Nations and Inuit Health, Manitoba Region as daily workloads increased for existing health care staff. Daily monitoring of patient numbers and disease trends occurred. Infection control measures such as fit testing, mask distribution, cough hygiene and hand washing were emphasized in the community, including at the nursing station, through extensive public messaging. Schools were closed and social gatherings suspended. While there can be substantial variability in the understanding of,⁹ and compliance with,¹⁰ preventive recommendations, such measures have been shown to be effective elsewhere.¹¹ However, non-pharmacological measures appeared to be largely ineffective in this community, likely because pH1N1 was already widespread. Although broad use of antiviral agents was not an intervention in this community, one UK study demonstrated that timely use of antiviral agents for primary cases was effective in protecting household contacts.¹²

Preparations for remote First Nations communities prior to future outbreaks should include ongoing infection prevention and control measures, an effective communications strategy, an established surveillance system for daily monitoring and detection of disease, and attention to fundamental health determinants, including housing conditions such as overcrowding, access to potable water, and sanitation. Addressing the impacts of similar outbreaks on young children and other vulnerable groups within these remote communities should remain a priority.

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RÉSUMÉ

Objectifs : Les communautés des Premières nations du Manitoba ont été significativement touchées par le virus de l'influenza pandémique H1N1 (pH1N1) en 2009. Nous avons voulu mener une enquête épidémiologique sur une éclosion de pH1N1 dans une communauté des Premières nations éloignée (3 300 habitants) dans le Nord du Manitoba pour étayer une riposte de santé publique rapide et formuler des recommandations afin de prévenir de futures éclosions.

Méthode : Nous avons examiné les dossiers des patients du poste de soins infirmiers local qui répondaient à la définition de cas du syndrome grippal (SG) durant la période à l'étude (20 avril au 11 juin 2009). Nos analyses descriptives ont tenu compte de l'âge, du sexe, du tableau clinique, de la prise en charge, des résultats et des facteurs de risque. Nous avons comparé les cas hospitalisés et non hospitalisés, ainsi que les cas confirmés en laboratoire et les cas possibles, à l'aide du test du khi-carré de Pearson (pour le sexe et les symptômes) et d'un test t (pour l'âge).

Résultats : Il y a eu 180 cas de SG, dont 23 cas de pH1N1 confirmés en laboratoire. Quarante p. cent des enfants <1 an dans la communauté, et 9,4 % des femmes enceintes, se sont présentés au poste de soins infirmiers avec un SG. La plupart des cas de SG ont été pris en charge par le poste de soins infirmiers local, mais 18,3 % des cas (n=33) ont nécessité une évacuation médicale, et 16,1 % (n=29) ont été hospitalisés. Il n'y avait aucune différence entre les cas hospitalisés et non hospitalisés, ni entre les cas confirmés en laboratoire et les cas possibles. Les facteurs de risque cernés dans un sous-ensemble de cas incluait l'exposition à une personne présentant un SG avant l'apparition de la maladie, le logement surpeuplé et l'accès insuffisant à l'eau domestique.

Conclusion : L'arrivée précoce et la transmission rapide du pH1N1 ont rendu les mesures de contrôle non pharmacologiques habituelles inefficaces pour la plupart. Pour prévenir les éclosions futures, il est recommandé d'avoir une stratégie de communication efficace et d'assurer une surveillance quotidienne pour déceler et contrôler la maladie. Il faut aussi aborder les grands déterminants de la santé dans les communautés des Premières nations éloignées afin de prévenir les maladies et de protéger la santé de ces populations.

Mots clés : Premières nations; Manitoba; communauté éloignée; pH1N1; flambées épidémiques; épidémiologie