

The Impact of Influenza on the Canadian First Nations

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ABSTRACT

In March and April 2009, pandemic H1N1 2009 influenza A virus (pH1N1 2009) emerged among residents of and travelers to Mexico, the United States and Canada. During the 2009 pandemic, cases of pH1N1 2009 infection were reported from over 214 countries, with at least 18,449 recorded deaths. In Canada, over 8,500 cases were hospitalized, 16.8% of which required intensive care. A particularly concerning occurrence was the spread of pH1N1 2009 into First Nations communities in Canada. Although Aboriginal peoples constitute only 3.8% of Canada's population, members of the First Nations were 6.5 times more likely to be admitted to an ICU with pH1N1 2009 influenza than non-First Nations, and had rates of hospitalization nearly triple that of the national cumulative crude rate for all Canadians. We herein provide a succinct review of our current understanding of the risk of influenza among First Nations populations in Canada.

Key words: Aboriginal populations; First Nations; influenza; pandemic H1N1 2009 influenza; respiratory tract infection

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In March and April 2009, pandemic H1N1 2009 influenza A virus (pH1N1 2009) emerged in Mexico, the United States and Canada. As of August 6, 2010, more than 214 countries officially reported laboratory-confirmed cases of pH1N1 2009 infection, including 18,449 deaths.¹ Of these, 8,678 laboratory-confirmed hospitalized cases of pH1N1 2009 had been reported in all provinces and territories in Canada, including 1,473 ICU admissions and 428 deaths.² Of special concern has been the morbidity and mortality burden of this virus in First Nation and other Aboriginal communities. While Aboriginal peoples constitute only 3.8% of the Canadian population, from April 2009 to April 2010, they accounted for 7.4-10% of hospitalizations due to pH1N1 2009, 7.8-10.4% of ICU admissions and 7.1-10.4% of deaths.² These numbers were even higher during the first wave of the pandemic (April 12-August 29, 2009), when the rate of hospitalization of First Nations was 72 per 100,000 population, compared to a national cumulative crude hospitalization rate of 25.7 per 100,000 population.² In a study of 168 critically ill patients with pH1N1 2009 influenza in Canada during wave 1, Aboriginal peoples accounted for 25.6% of cases.³ As of mid-June 2009 during the first wave of the pandemic, 24 Manitobans were on respirators in Winnipeg intensive care units, more than two thirds of whom were First Nations people. We herein describe what is currently known regarding the risk of influenza among First Nations people in Canada.

METHODS

We undertook a literature search using MEDLINE, EMBASE, PsycINFO, CAB Abstracts, and the Arctic Health Publication Database without language restriction from inception to December 1, 2010, with combinations of the subject headings "First Nations", "Canadian Aboriginals", "hospital admissions", "pneumonia" and "influenza". Pertinent material was also identified from biblio-

graphic and standard reference reviews. We included literature that referenced "Canadian Aboriginal peoples" as a group, understanding that FN comprise the majority of individuals in this group (FN=60%, Metis=33%, Inuit=4%, Other=3%). We included literature reporting original epidemiologic or case series data on hospital admissions, pneumonia and influenza in FN. In Canada, "wave 1" of the pandemic occurred from April 12 to August 29, 2009, and "wave 2" from August 30, 2009 to April 3, 2010.

Morbidity and mortality among Canadian First Nations

It has been previously observed that Canadian First Nations (FN) experience an excess mortality and illness burden compared to non-FN Canadians.^{4,7} FN men residing on Canadian reserves have a 65% excess annual mortality rate compared to their non-FN counterparts, and FN women have an excess annual mortality rate of 93%.⁶ In 2000, life expectancy at birth for the Registered Indian population was estimated at 68.9 years for males and 76.6 years for females.⁸ This reflects differences of 7.4 years and 5.2 years, respectively, from the 2001 Canadian population life expectancies.⁸ Annual age-standardized all-cause mortality rates among residents

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of Canadian reserves from 1979 to 1983 were 561 per 100,000 and 335 per 100,000 for FN men and women, respectively, compared to 340 per 100,000 and 173 per 100,000 for non-FN Canadians.⁵ In comparison to non-FN Canadians, members of the FN and other Canadian Aboriginal groups have an increased risk of death from alcohol-related diseases, homicide, suicide and pneumonia.⁵

FN infant mortality also exceeds that in the general population.⁷ From 1986 to 1990, infant mortality rates were 13.8 per 1000 live births among Indian infants, 16.3 per 1000 live births among Inuit infants, and 7.3 per 1000 live births among non-Native Canadian infants.⁵ A study of FN mortality in five provinces observed a 40% excess in neonatal mortality, and a fourfold excess of postnatal mortality.⁷

In their study of hospital admission rates among members of the Mi'kmaq Nation in Nova Scotia, Webster et al. observed an age-standardized admission rate of 29,347 per 100,000 Mi'kmaq versus 20,951 per 100,000 reference Nova Scotians in the year 1999, yielding an age-adjusted relative risk (AARR) for total hospital admissions of 1.40.⁴ Specific excess morbidity was noted among FN for admissions related to circulatory diseases, diabetes, respiratory diseases and pneumonia/influenza.⁴

Respiratory illness morbidity among Canadian First Nations

From the study period 1996-1999, respiratory disease was the single leading cause of hospitalization among Mi'kmaq, with AARRs far in excess of what was observed for non-Mi'kmaq Nova Scotians.⁴ Pneumonia and influenza accounted for more than half of respiratory admissions versus one quarter of respiratory admissions in the reference population.⁴ In 1999, pneumonia and influenza accounted for 1,474 hospital admissions per 100,000 Mi'kmaq versus 337 hospital admissions per 100,000 non-Mi'kmaq Nova Scotians, yielding an AARR of 4.37.⁴ Stated differently, pneumonia and influenza accounted for 5.3% of age-standardized hospital admissions among Mi'kmaq compared to only 1.6% of admissions in the reference population.⁴ FN residing in Alberta had an age- and sex-adjusted hospitalization rate for community-acquired pneumonia that was 5 times greater than that of non-FN Albertans.⁹ FN were also 1.4-fold more likely than non-FN Albertans to require readmission for community-acquired pneumonia within 30 days of discharge.⁹ In FN infants, the rate of hospital admission for lower respiratory tract infection (LRTI) has been observed to be as high as 19.8 per 100 person-years compared to 3.4 per 100 person-years in non-FN infants, yielding a RR of 5.8.¹⁰

In addition to demonstrable excesses in hospital admission rates due to influenza and pneumonia among members of FN, the overall severity and frequency of these infections in FN children and adults also exceed those of the general population.^{7,11} In their 3-year prospective study of pneumonia in hospitalized children, Houston et al. found that FN children with pneumonia were more severely ill, had more prolonged clinical symptomatology, more associated diarrhea, and longer duration of hospitalization compared to "white" children.¹¹ Of 21 children <14 years of age whose chest x-rays worsened during hospitalization for pneumonia, 20 were FN children.¹¹ In addition, none of 64 "white" children died of pneumonia during their hospitalization, compared to 4 of 102 FN children.¹¹ Similar findings have been observed in studies of non-FN Aboriginal Canadians: in a prospective study of Inuit infant

hospitalizations due to lower respiratory tract infection on Baffin Island, 12% required intubation and mechanical ventilation,¹² which is higher than for their non-Aboriginal counterparts.¹¹ For Inuit children of Baffin Island <6 months of age, LRTIs are the primary cause for hospital admission, medical evacuation, and overall health-related expenditures.^{13,14}

In addition to more severe respiratory tract infections, FN children have been observed to have more frequent respiratory tract infections. Over a 1-year period, 97 FN and Inuit children studied prospectively suffered 112 episodes of non-tuberculous pneumonia severe enough to warrant presentation to hospital in Edmonton.¹⁵ Of these, 2 children had a history of >6 previous episodes of pneumonia, and 34 had a history of 3-6 previous episodes, which is higher than that observed for "white" children.¹⁵ The age distribution correlated well with that of all pediatric patients admitted with pneumonia during the 12-month period studied,¹⁵ thus, confounding by age is an unlikely explanation for the pattern observed. In their cohort study of 99 FN and 316 non-FN Canadian infants in southern Ontario, Evers et al. observed that FN infants were 13 times more likely to suffer multiple episodes of pneumonia during their first year of life.¹⁰ FN infants had twice as many episodes of upper respiratory tract infections and otitis media as their non-FN counterparts.¹⁰

Several risk factors for increased rates of acute respiratory infections in Canadian Aboriginal populations, including FN and Inuit, have been postulated, including smoking, maternal smoking during pregnancy, exposure to second-hand smoke, feeding practices, and socio-economic factors such as low education, housing, residential crowding, and family size.^{11,13-15} In their case-control study of risk factors for hospital admission due to viral LRTI among the Inuit children of Baffin Island, specifically, Banerji et al. found that the risk of admission was increased 4-fold in association with maternal smoking during pregnancy, 3.6-fold in association with lack of breastfeeding, and 2.5-fold in association with overcrowding at home.¹⁴ High rates of recurrent pneumonia in FN children were also attributed to socio-economic and environmental factors including poor diet, crowded living conditions, geographic isolation, and lack of parental education, as chronic illnesses which could have accounted for the recurrent episodes, such as asthma, cystic fibrosis, hypogammaglobulinemia, leucopenia, or structural lung disease, were excluded.¹⁵

Influenza morbidity among Canadian First Nations

New data on the burden of pH1N1 2009 influenza, specifically in the FN and Aboriginal communities, have emerged. In their study of 168 critically ill patients with pH1N1 2009 influenza, Kumar et al. observed that young, female, and Aboriginal patients without major comorbidities were over-represented among the cohort.³ When present, the most common comorbidities were lung disease, obesity, hypertension, smoking, and diabetes, all of which are known to be disproportionately represented among Aboriginal peoples.^{4,6} A second Manitoba study confirmed that FN ethnicity was independently associated with an increased risk of both mild and severe pH1N1 2009.¹⁶ For 588 infections where ethnicity was known, FN accounted for 28% of community cases, 54% of hospitalized cases, and 60% of those admitted to the ICU.¹⁶ FN were over-represented among cases of severe pH1N1 2009 after adjusting for age, sex, comorbidities, rural residence, income level and treatment

interval.¹⁶ FN were 6.5 times more likely to be admitted to an ICU.¹⁶ Crude hospital admission and mortality rates for pH1N1 2009 in FN also exceed those of the general Canadian population. In the first wave of the pandemic, the hospitalization rate was 72 per 100,000 for FN compared to a national crude hospitalization rate of 25.7 per 100,000,² and the mortality rate was 0.7 per 100,000 in FN² compared to 0.1 per 100,000 nationally.² Overall, pH1N1 2009 was associated with a 3- to 8-fold elevated risk of hospitalization and death in Canadian Aboriginal populations (including FN). Similar findings were reported for indigenous populations of the United States, Australia, New Zealand, and other parts of Oceania.

CONCLUSION

These data summarize the published evidence regarding risk and proportionate morbidity attributable to respiratory illness, and in particular, pneumonia and influenza, in Canadian FN populations. Because testing for viral causes of respiratory infection is rarely performed, especially in adults, it is impossible to assess the extent to which seasonal influenza specifically contributes to the increased burden of respiratory illness. However, the pandemic experience of excess illness, combined with the knowledge that the burden of influenza can be effectively mitigated with vaccination, antiviral agents, and non-pharmaceutical interventions (e.g., hand hygiene, social distancing), suggests that a systematic public health approach to defining the burden of illness, and the effect of interventions to reduce this burden, is important.

Consultation with Aboriginal peoples has identified several challenges and solutions specific to pandemic influenza mitigation in their communities.¹⁷ Reported reasons for a successful pH1N1 2009 vaccination campaign in one FN community included community awareness, support at the chief and council level, additional personnel and fiscal resources, and teaching efforts.¹⁸ Uptake of pH1N1 2009 vaccine in FN communities ranged from 59-111%,^{12,18} with rates above 100% accounted for by off-reservation residents returning to their communities for immunization. Implementing mitigation strategies, including vaccination campaigns, in a culturally sensitive and appropriate manner with community engagement under the direction of Aboriginal peoples and key stakeholders should be a priority.

Although social determinants of health are strongly associated with influenza incidence and burden, and may explain the vulnerability of FN populations to severe disease due to pandemic influenza, the spectre of underlying genetic susceptibilities to influenza and other respiratory diseases in FN populations is often raised.³ Indigenous populations around the world have been disproportionately affected by pH1N1 2009 as they were during the 1918 and 1957 pandemics. While immunogenetic data exist to support genetic susceptibilities to several intracellular pathogens, such as *Mycobacterium tuberculosis*, HIV, and hepatitis B and C virus,¹⁹ these susceptibilities are not broadly racially based, and no data exist to provide support for the hypothesis that genetic factors explain the over-representation of complicated influenza infection among indigenous populations in general, or Canadian Aboriginal peoples in particular. Adverse social determinants of health are associated with FN ethnicity and influenza incidence and burden, and may better explain the observed ethnic disparities.

The available literature suggests that FN persons are at least 4-5 times more likely to be hospitalized for influenza and pneumonia,

and were up to 8 times more likely to be hospitalized for pH1N1 2009, than non-FN Canadian counterparts. This level of risk has resulted in the Canadian National Advisory Committee on Immunization including Aboriginal peoples in those populations considered at significantly increased risk of influenza complications, and therefore recommended as priority for vaccination programs.²⁰ While ongoing influenza surveillance and continued investigation into biological and socio-environmental predictors of complicated influenza infection in Aboriginal populations are clearly needed, priority should be given to establishing effective influenza vaccination programs in a culturally appropriate manner with active community engagement, as was successfully achieved in many FN communities during pH1N1 2009.^{12,18} Future pandemic planning at all levels in Canada should ensure that the substantially elevated risk of serious illness in Aboriginal communities, particularly those that are remote and isolated, is taken into consideration, and that pandemic plans for Aboriginal communities are appropriately prioritized.

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RÉSUMÉ

En mars et avril 2009, le virus de la grippe pandémique A-H1N1 de 2009 (pH1N1 2009) s'est manifesté chez des résidents du Mexique, des États-Unis et du Canada et chez des voyageurs dans ces pays. Durant la pandémie de 2009, des cas d'infection à pH1N1 2009 ont été déclarés dans plus de 214 pays, avec au moins 18 449 décès enregistrés. Au

Canada, plus de 8 500 cas ont été hospitalisés, dont 16,8 % aux soins intensifs. La propagation du virus pH1N1 2009 dans les communautés des Premières nations du Canada a été particulièrement inquiétante. Les Autochtones ne constituent que 3,8 % de la population canadienne, mais les membres des Premières nations étaient 6,5 fois plus susceptibles d'être hospitalisés aux soins intensifs en raison de la grippe pH1N1 2009 que les non-membres des Premières nations, et leurs taux d'hospitalisation étaient près de trois fois supérieurs au taux brut national cumulé pour l'ensemble des Canadiens. Nous présentons une brève analyse de l'état actuel des connaissances sur le risque de grippe dans les populations des Premières nations au Canada.

Mots clés : populations autochtones; Premières nations; grippe humaine; virus A de la grippe sous-type H1N1; infections de l'appareil respiratoire



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