CONCISE COMMUNICATION

Laboratory-Confirmed Pandemic H1N1 Influenza in Hospitalized Adults: Findings from the Canadian Nosocomial Infections Surveillance Program, 2009–2010

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Surveillance for pandemic H1N1 influenza was conducted between June 1, 2009, and May 31, 2010, among adults at 40 participating hospitals in the Canadian Nosocomial Infection Surveillance Program. The first wave was characterized by a higher proportion of Aboriginals and pregnant women as well as severe outcomes, compared to the second wave.

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In response to the spread of the pandemic H1N1 (pH1N1) influenza virus in 2009, the Canadian Nosocomial Infection Surveillance Program (CNISP) extended its seasonal influenza surveillance to year-round reporting in order to describe the epidemiology and outcomes of pH1N1 in hospitalized adults. This report describes the findings of the surveillance program during the first year of pH1N1 influenza.

METHODS

The surveillance period was from June 1, 2009, to May 31, 2010. An influenza case was defined as any adult inpatient (16 years or older) with a positive influenza laboratory test result (confirmed by rapid antigen test, polymerase chain reaction, or culture) from a specimen collected during the surveillance period. Patients seen in outpatient clinics, ambulatory care, and emergency departments whose visits did not result in hospitalization were excluded.

Cases were identified by concurrent or retrospective chart review. Infection control professionals manually completed the questionnaires that included patient laboratory information, patient demographics, risk factors, and 30-day patient outcome. Patients who had died at 30 days were reviewed on a case-by-case basis by a physician to determine whether the death was directly related, indirectly related, or unrelated to influenza.

Demographics and outcomes for the patients were examined and compared between pandemic waves. We looked at risk of severe outcomes, specifically intensive care unit (ICU) admission and 30-day mortality, by Aboriginal status, and pregnancy. Differences were assessed for continuous and categorical variables using Student t test or Chi-squared test as appropriate. Multivariate logistic regression was performed to determine independent factors associated with ICU admission and 30-day mortality. The factors included in the model were age, Aboriginal status, pregnancy, and any comorbidity. Associations were given as odds ratios (ORs). Confidence intervals (CIs) and P values reflect a 2-tailed α level of 0.05. Missing or unknown data were removed from all calculations. Data were analyzed using Stata software (ver. 11; StataCorp).

RESULTS

The incidence of pH1N1 influenza was 2.08 cases per 1,000 patient admissions. Forty hospitals reported 1,083 cases of pH1N1 over 2 waves; the first wave consisted of 115 cases and occurred in June 2009, and the second wave peaked in November 2009 and consisted of 968 cases (Figure 1). For the 953 cases in which source of infection was reported, 93% (n = 887) were community associated, and 7% (n = 66) were healthcare associated. Differences between patient characteristics and outcomes by pandemic wave are presented in Table 1.

There was a median of 4 days (interquartile range [IQR], 2–6) between symptom onset and hospital admission for patients who were admitted to the ICU compared to a median of 3 days (IQR, 1–5) for patients not admitted to the ICU (P = .3). There were 14 Aboriginals (74%) admitted to the ICU in the first wave compared to 16 Aboriginals (36%) in the second wave (P = .005). Aboriginal status was independently associated with an increased risk of admission to the ICU (OR, 3.01; 95% CI, 1.82–5.23) even when other risk factors were considered. Eleven pregnant women (17%) were admitted to the ICU for influenza-associated complications. A higher proportion of pregnant women in the first wave (40%, n = 6) required admission to the ICU for influenza complications than in the second wave (10%, n = 5; P = .007). Univariate analysis showed that there was no association between age (P = .095), presence of an underlying medical condition (P = .965), or pregnancy (P = .906) and admission to the ICU.

Sixty-six deaths were reported. The median age at death was 53 years (IQR, 43–63). The time between symptom onset and hospital admission was not significantly different between the cases who died (3.5 days) and those who survived (3 days; P = .9). In total, 21% (n = 56) of the patients admitted to the ICU for influenza-associated complications died. Six of the Aboriginal patients died, for all-cause mortality in the

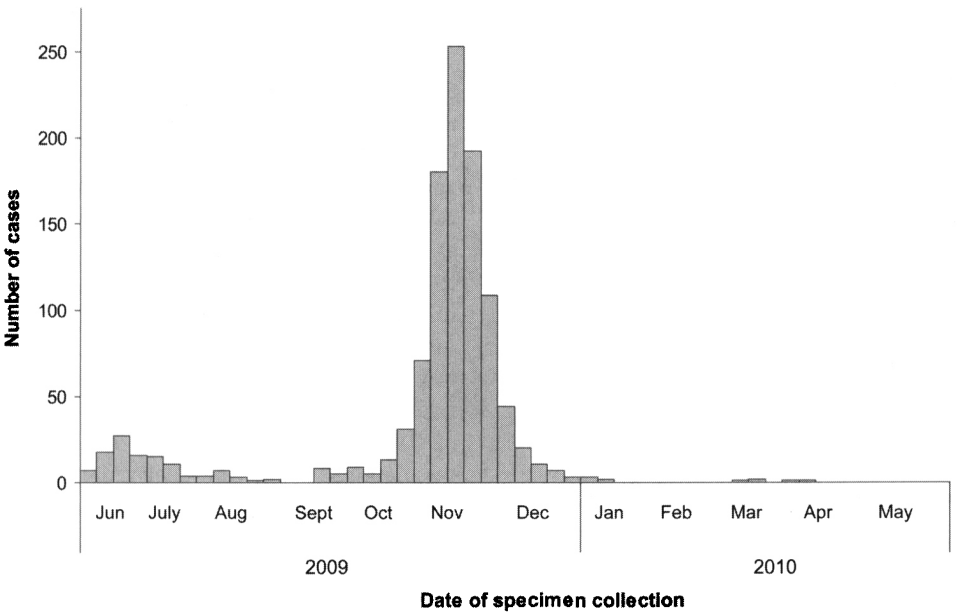

FIGURE 1. Laboratory-confirmed pandemic H1N1 influenza in adult inpatients at participating CNISP hospitals, June 1, 2009, to May 31, 2010 (n = 1,083).

Aboriginal cohort of 9%; influenza was the primary cause of death for 3 cases and contributed to death in 2 cases, for an influenza-attributable mortality of 8%. The median age at death attributable to influenza was 37 years for this group, which was younger than 51 years for the non-Aboriginal group (P = .13). No deaths among pregnant women were reported. Univariate analysis showed that there was no association between any comorbidity (P = .105) or Aboriginal status (P = .077) and 30-day mortality. Age was independently associated with an increased risk of 30-day mortality (OR, 1.02; 95% CI, 1.00–1.04) even when other risk factors were considered.

DISCUSSION

Our findings show that patients in the 2 waves did not differ significantly by age, sex, or the presence of a comorbidity. However, there was a higher proportion of Aboriginal cases in the first wave compared to the second wave. The overrepresentation of Aboriginals in the first wave may be explained in part by the increased awareness of pH1N1 risks associated with severe outcomes in this group by the start of the second wave, as well as the earlier prescription and increased use of antivirals observed in the second wave. Aboriginal status was also found to be associated with an increased risk of admission to the ICU. A case-control study from Manitoba during the first wave of pH1N1 also reported that First Nations ethnicity was associated with severe disease.[1] The severe outcomes seen in the Aboriginal population, especially during the first wave, may be attributed to confounding factors such as socioeconomic status or genetic susceptibility.[2]

Early reports indicated that pregnant women might also be at increased risk for severe outcomes. Similar to the Aboriginal cohort, pregnant women in the first wave accounted for a greater proportion of women between the ages of 16 and 44; however, pregnancy was not associated with an increased risk of admission to the ICU. Another Canadian study comparing the 2 waves observed a similar proportion of pregnant women in the first wave (45.9%) and saw no increased admission to the ICU, compared to nonpregnant women of reproductive age.[2]

Although obesity was postulated as a risk factor for severe outcomes, we were not able to evaluate this because height and weight variables were added to the questionnaire in December 2009 after the peak of the pandemic and were known for less than 10% of the cases. Information on receipt of influenza vaccination was only available for 481 cases (44%) and therefore not reported here.

This study had some limitations. To be identified as a case, laboratory confirmation of influenza was required. It is possible that patients with influenza were not always tested and therefore not captured in this surveillance. As this study was limited to hospitalized cases, a selection bias for more severe cases is likely present. It was assumed that cases after September 1, 2009, that did not have subtyping results were pH1N1, which may have led to misclassification of some cases. However, in Canada, between August 30, 2009, and June 5, 2010, of the 38,982 influenza A positive strains tested in Provincial Laboratories, 33,520 (86%) were pH1N1, and

TABLE 1. Characteristics and Outcomes of Inpatients with Laboratory-Confirmed Pandemic H1N1 Influenza in CNISP Hospitals by Pandemic Wave (June 1, 2009, to May 31, 2010; n = 1,083)

Characteristic	Wave 1 (n = 115)	Wave 2 (n = 968)	P value
Age in years			
Mean (SD)	45.4 (16.5)	46.8 (16.3)	.39
Median (IQR)	46.5 (30–56.8)	48.4 (33.9–57.6)	
Male	45 (39.1)	452 (46.7)	.12
Aboriginal	n = 84	n = 800	
	19 (22.6)	46 (5.8)	<.001
Any comorbidity[a]	n = 115	n = 960	
	101 (87.8)	776 (80.8)	.07
Lung disease	43 (37.4)	331 (34.2)	.50
Chronic heart disease	10 (8.7)	133 (13.7)	.13
Immune suppression	16 (13.9)	111 (11.5)	.44
Diabetes	18 (15.7)	150 (15.5)	.97
Kidney disease	7 (6.1)	63 (6.5)	.86
Pregnancy[b]	n = 33	n = 242	
	15 (45.5)	50 (20.7)	.002
Antiviral prescribed	n = 106	n = 958	
	84 (79.3)	869 (90.7)	<.001
Oseltamivir	83 (78.3)	864 (90.2)	.0002
Zanamivir	1 (0.9)	2 (0.2)	NA
Other	0	3 (0.3)	NA
Days between symptom onset and antiviral			
Mean (SD)	5.3 (4.6)	3.6 (3.3)	<.001
Median (IQR)	4 (2–7)	3 (1–5)	
ICU admission	n = 114	n = 962	<.001
	45 (39.5)	228 (23.7)	
Intubation or mechanical ventilation	n = 115	n = 963	.003
	37 (32.2)	193 (20.0)	
Death	10 (8.7)	56 (5.8)	.22
Primary cause	4 (3.5)	20 (2.1)	.37
Contributing cause	6 (5.2)	27 (2.8)	.15

NOTE. Data are no. (%) unless otherwise indicated. Wave 1 = June 1, 2009, to August 31, 2009. Wave 2 = September 1, 2009, to May 31, 2010. CNISP, Canadian Nosocomial Infection Surveillance Program; ICU, intensive care unit; IQR, interquartile range; NA, not available; SD, standard deviation.

[a] Lung disease, coronary heart disease, immune suppression, diabetes, kidney disease, pregnancy, other.

[b] Women of child-bearing age (16–44 years old).

5,398 (14%) were not subtyped.[3] This study is limited to large, tertiary care hospitals in Canadian cities and is not representative of smaller community hospitals.

Pandemic H1N1 influenza appeared outside of the classic Canadian influenza season. The first wave was characterized by a higher proportion of Aboriginals and pregnant women than the second wave, and outcomes in the first wave were more severe. This pandemic highlights the need for monitoring of influenza in Canadian adult inpatients.

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