Barrie
15 Sperling Drive
Barrie, Ontario

Phone: (705) 721-7520
Fax: (705) 721-1495
www.simcoemuskokahealth.org

2009 PANDEMIC INFLUENZA A (H1N1): ACTIVITY AND IMPACTS

Simcoe Muskoka District Health Unit

April 2010

simcoe muskoka
DISTRICT HEALTH UNIT

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Authors: John Barbaro, Epidemiologist
Dr. Charles Gardner, Medical Officer of Health
Stephanie Wolfe, Epidemiologist
Dr. Colin Lee, Associate Medical Officer of Health
Dr. Susan Surry, Associate Medical Officer of Health
Dr. Jim Pfaff, Associate Medical Officer of Health

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Simcoe Muskoka District Health Unit
15 Sperling Drive
Barrie, Ontario
L4M 6K9
Tel: (705) 721-7520
Fax: (705) 721-1495

EXECUTIVE SUMMARY

The aim of this report is to provide a summary of the level of activity and severity of illness experienced in Simcoe Muskoka resulting from the 2009 influenza A (H1N1) pandemic. An additional objective of the report is to compare the local impacts of the pandemic relative to the rest of the province, seasonal influenza in Simcoe Muskoka and our pandemic plan.

The first influenza pandemic of the 21st century began some time in March of 2009 in central Mexico. The virus quickly spread to the rest of North America, South America and Europe. The World Health Organization (WHO) identified this new influenza virus as pandemic influenza A (pH1N1) 2009. On June 11, 2009, the WHO raised the pandemic alert to level six, recognizing that a global influenza pandemic already was underway. By the end of 2009, over 200 countries world wide had laboratory-confirmed cases of pH1N1.

Cases of pH1N1 were first identified in Ontario in early April of 2009. Many of the early cases were linked to travel to Mexico. However, sustained community spread was evident within a few weeks. Simcoe Muskoka was among the first health units in Ontario to have a laboratory-confirmed case of pH1N1. Ontario experienced two waves of pH1N1 activity in 2009, the first wave in late spring/early summer and the second in the fall. The spread of the virus and intensity of activity across the province varied. Certain areas were relatively spared during the first wave, but were harder hit in the second wave. Timing of activity was also variable with some areas having more activity early on, while others did not see cases until later in the wave.

Overall, our experience in Simcoe Muskoka with pH1N1 was consistent with that of the province and with the international experience:

- a dramatic increase in ambulatory cases at periods of time atypical for seasonal influenza,
- a dramatic reduction in mortality in seniors compared with past influenza seasons, with a resultant decrease in overall mortality,
- an increase in illness severity in younger populations, particularly those with pre-existing medical conditions or pregnancy.

This pandemic was much more moderate in terms of severe outcomes and societal disruption than was anticipated in our pandemic plan. However, due to delays in receiving final coded hospitalization and mortality data, the true extent of deaths and hospitalizations associated with pH1N1 will likely not be known for several years to come. The timing of the introduction of the vaccine made it difficult to assess the true impact it had on reducing severe outcomes during the second wave. Locally, we didn't have any reported cases of vaccine failure among our fatal or hospitalized cases, which suggests that the vaccine was effective. However, given the late availability of the vaccine, the impact of the program in preventing cases almost certainly was reduced.

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INTRODUCTION

In April of 2009, the Public Health Agency of Canada issued alerts concerning clusters of individuals in Mexico with severe respiratory illness (SRI). Subsequent investigations revealed that a new strain of a swine influenza virus was causing illness in Mexico and the United States (US) as early as March of 2009[1]. The virus quickly spread to the rest of North America, South America and Europe. The World Health Organization (WHO) identified this new influenza virus as pandemic influenza A (pH1N1) 2009. On June 11, 2009, the WHO raised the pandemic alert to level six, recognizing that a global influenza pandemic already was underway. By the end of 2009, more than 200 countries world wide had laboratory-confirmed cases of pH1N1[2].

Cases of pH1N1 were first identified in Ontario in early April of 2009. Many of the early cases were linked to travel to Mexico. However, sustained community spread was evident within a few weeks. Simcoe Muskoka was among the first health units in Ontario to have a laboratory-confirmed case of pH1N1. Ontario experienced two waves of pH1N1 activity in 2009, the first wave in late spring/early summer and the second in the fall. The spread of the virus and intensity of activity across the province varied. Certain areas were relatively spared during the first wave, but were harder hit in the second wave. Timing of activity was also variable with some areas having more activity early on, while others not seeing cases until later in the wave.

The Simcoe Muskoka District Health Unit (SMDHU) has been engaged in pandemic influenza planning as an agency for the past decade. The health unit completed its first pandemic influenza plan in 2000. The original plan underwent a number of revisions since that time, with the most recent version of the plan completed in 2006[3]. The intent of the plan is to provide an integrated response framework for public health services in our jurisdiction with the goals of minimizing serious illness, deaths and societal disruption that may result from an influenza pandemic.

The aim of this report is to provide a summary pH1N1 activity in Simcoe Muskoka during the first two waves of the pandemic in terms of the level activity and severity of illness. An additional objective of the report is to compare the local impacts of the pandemic relative to the rest of the province, seasonal influenza and our pandemic plan.

A number of key surveillance indicators derived from a variety of data sources were used to provide a picture of the epidemiology of the pandemic in Simcoe Muskoka. A full list of data sources used in this report can be found at the end of the report in Appendix 1.

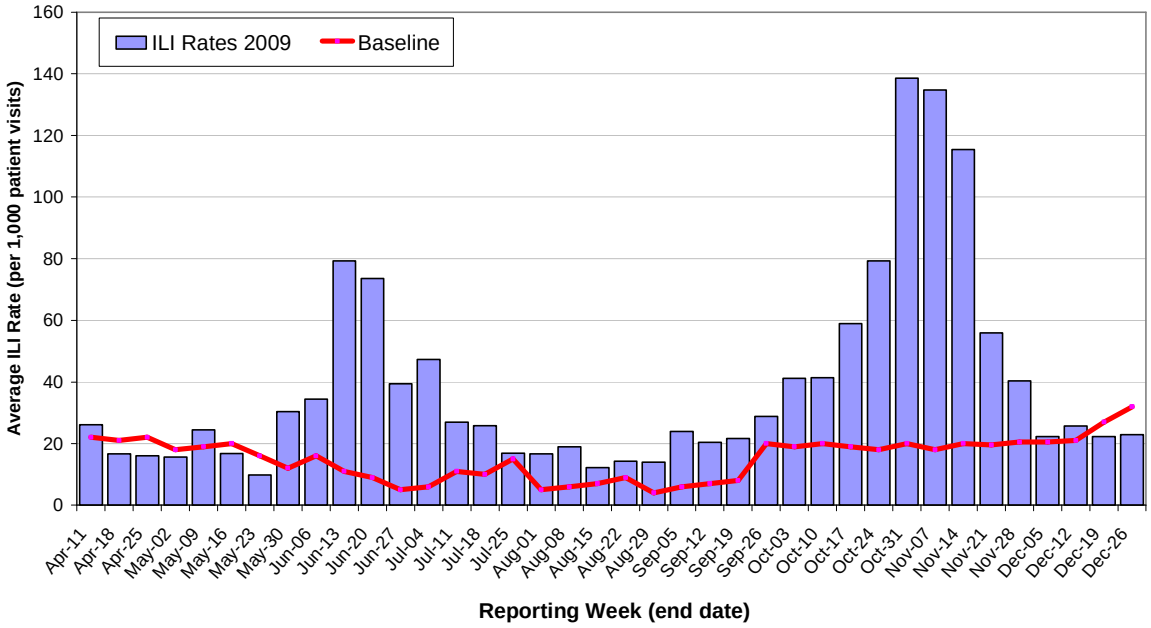
SURVEILLANCE INDICATORS

Influenza-Like Illness (ILI) Rates

- Influenza-like illness (ILI) in the province, at the peak of the pandemic, was seven times higher than the expected baseline level for the same time of year and three to four times higher than what is normally seen at the peak of seasonal influenza activity. The timing of the peaks of influenza activity over the course of the pandemic did not follow what is usually seen with seasonal influenza in Ontario, which peaks between December and April.
- Figure 1 displays the weekly ILI consultations rate (per 1,000 patient visits) for the first two waves of the pandemic from the more than 100 sentinel physicians in Ontario that participated in the Public Health Agency of Canada (PHAC) FluWatch program[4]. The peaks in ILI consultations were in mid June and late October, which correspond with the peaks in the other influenza surveillance indicators. Similar increases in ILI consultation rates were observed in other parts of Canada[4], in the US[5] and in New Zealand[6].

Figure 1: Average ILI Rates

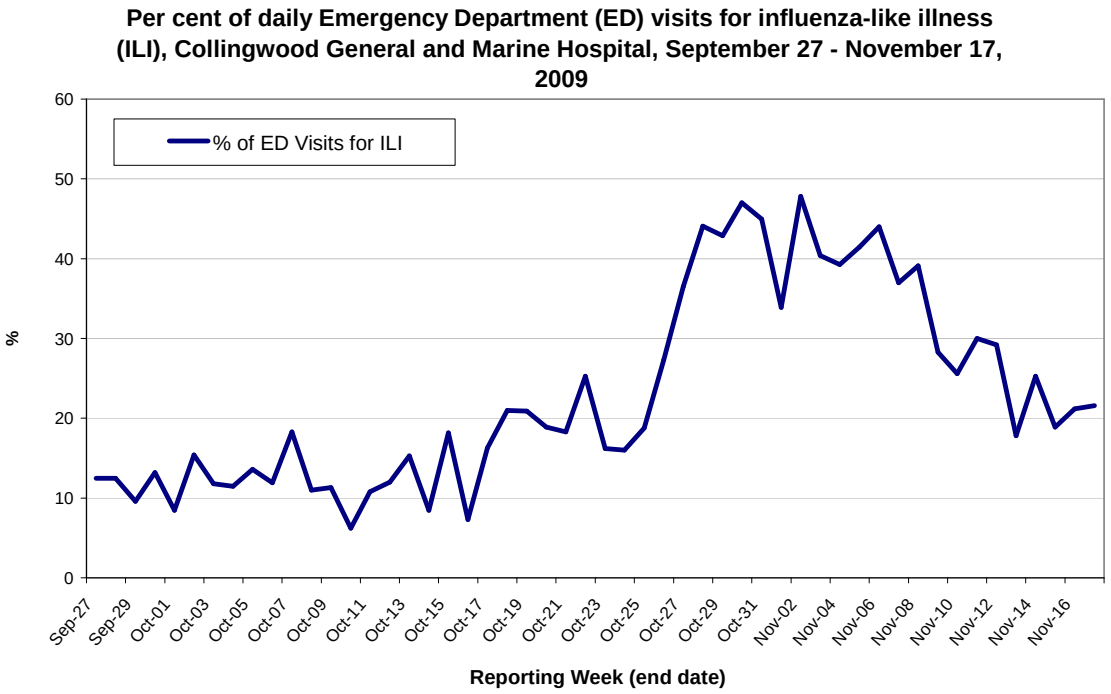
Influenza-like illness (ILI) consultation rate (per 1,000 patient visits) reported by sentinel physicians in Ontario from April 5 to December 26, 2009, compared to the seasonal baseline average for Ontario (1999 to 2008).



Source: Sentinel physician information is reported to Public Health Agency of Canada. Baseline rates for weeks 21 to 39 only include data from 2005 to 2008. Adapted from the Ministry of Health and Long-Term Care Ontario Influenza Bulletin.

- Over the course of the pandemic the health unit had regular teleconferences with local health care providers including hospitals, local Family Health Teams, Community Health Centers and other key stakeholders. These teleconferences provided the health unit with opportunities for timely communication of key public health messages. This venue also supplied the health unit with valuable information on the impact the pandemic was having on the ambulatory and acute health care providers in the area.
- Figure 2 is an example of local ILI data provided to the health unit from one of our area hospitals. Collingwood General and Marine Hospital tracked the percentage of daily Emergency Department (ED) visits for ILI for most of the second wave of the pandemic. There was a noticeable jump in the percentage of ED visits related to ILI in late October and early November, peaking at nearly half of all ED visits. This indicator also matched closely with the other indicators of influenza activity for our area.

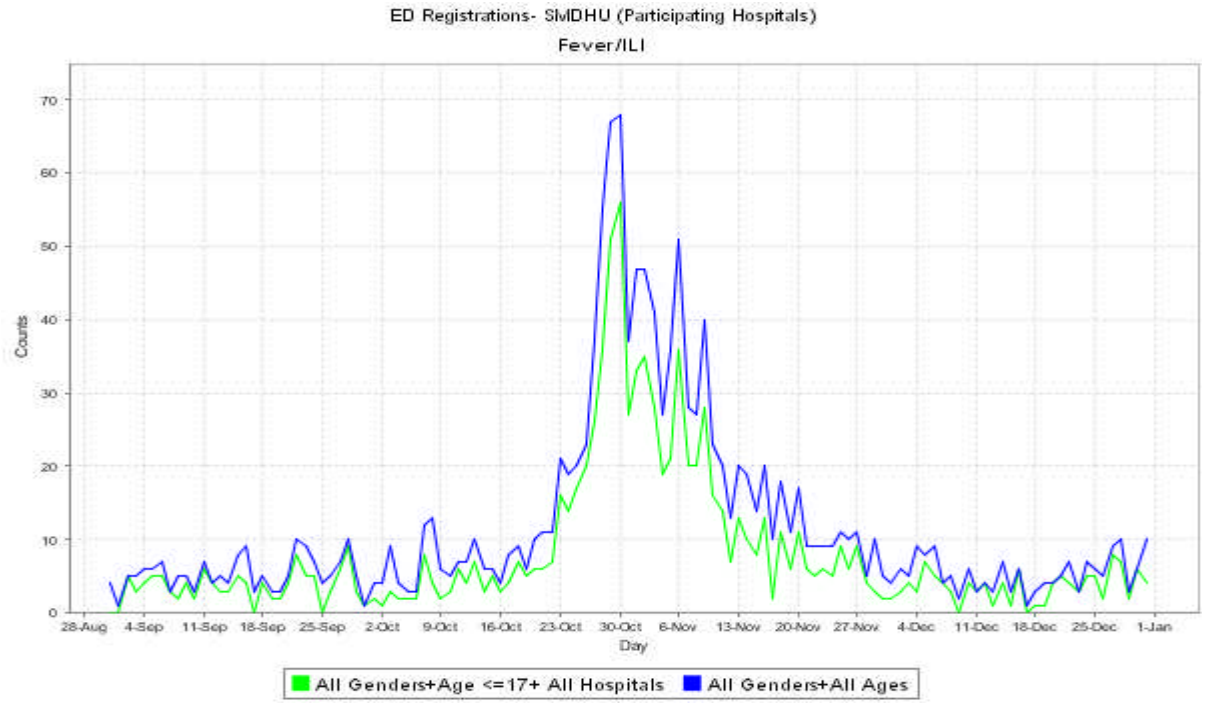
Figure 2: Per Cent of Daily Emergency Department (ED) Visits for ILI (CGMH)



Source: Collingwood General and Marine Hospital

- Early in 2010, three hospital corporations in Simcoe Muskoka which cover Muskoka and most of Northern Simcoe County, joined the Emergency Department Syndromic Surveillance (EDSS) managed by Queens University Emergency Syndromic Surveillance Team (QUESST)[7]. This system is able to monitor Emergency Department (ED) visits in 'real-time' by classifying them into one of a number of different syndromes using the data entered during patient registration. Although the EDSS was not operational in our area during the second wave of the pandemic, retrospective data for participating hospitals was available for this time period.
- Figure 3 shows the daily count of fever/ILI visits during the second wave (September to December). Fever/ILI is the syndrome that is most closely associated with influenza in the EDSS and is defined as undifferentiated fever, chills, myalgias, joint pain, or influenza-like illness (excluding post-operative or cancer patients). The chart displays the number of daily fever/ILI registrations for all patients (blue line) compared with children 17 years or younger (green line) for the participating hospitals. The trend in fever/ILI ED visits in these hospitals was very consistent with other indicators of influenza activity, with the peak occurring in late October. Children accounted for the large majority of fever/ILI ED visits during the time period.

Figure 3: Daily Emergency Department (ED) Registrations for Fever/ILI

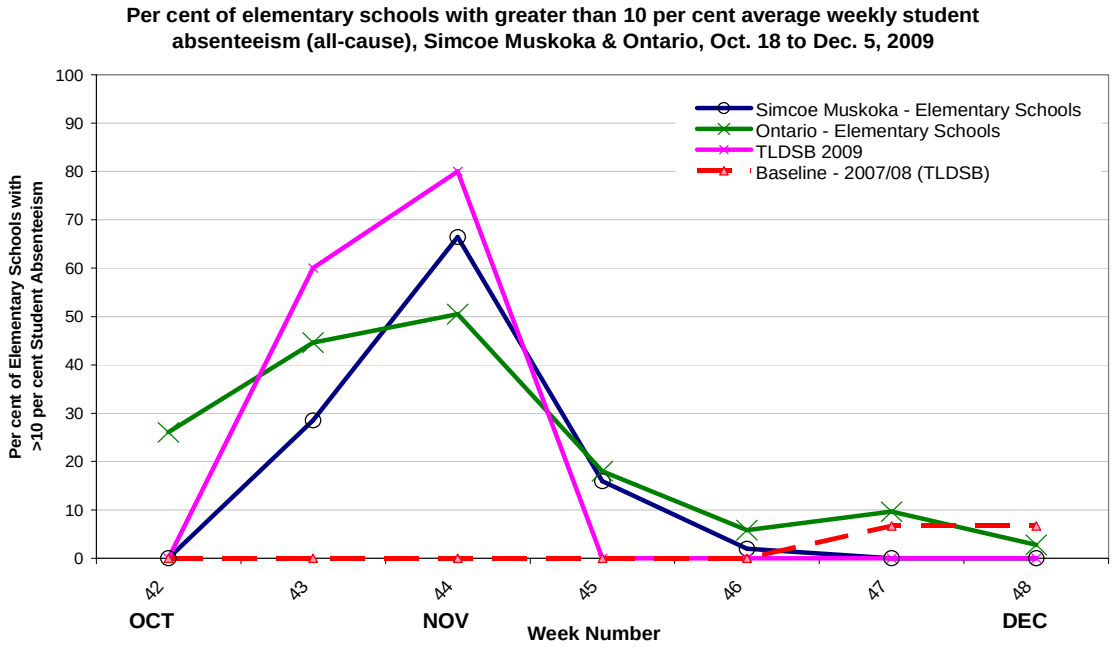


Source: Emergency Department Surveillance System, Queens University Emergency Syndromic Surveillance Team. Participating Hospitals include: Muskoka Algonquin Healthcare (South Muskoka Memorial Hospital in Bracebridge and Huntsville District Memorial Hospital), Georgian Bay General Hospital (Huronia District Hospital in Midland) and Orillia Soldiers Memorial Hospital.

School Absenteeism Rates

- School absenteeism rates during the second wave of the pandemic were monitored by the health unit at both the elementary and high school levels. The primary indicator of school absenteeism used by the health unit was the percentage of schools reporting all-cause student absenteeism of greater than 10 per cent. This indicator proved to be more sensitive at the elementary school level than the high school level. However, only a limited amount of baseline data for this indicator was available, which limits our ability to make comparisons to previous years. In Australia the reported rates of absenteeism from work and school were similar to 2007, which was one of the more severe influenza seasons they have experienced in recent times[8].
- Figure 4 compares the per cent of elementary schools that reported weekly student absenteeism of greater than 10 per cent in Simcoe Muskoka (the blue line) and Ontario (the green line) between October 20 (week 42) and December 5 (week 48). A baseline was provided by the Trillium Lakelands District School Board (TLDSB) for the elementary schools in Muskoka for 2007 and 2008. To assist this comparison, the TLDSB portion of the Simcoe Muskoka rate was plotted separately (the pink line) on the chart. The pattern of student absenteeism closely follows the trend of ILI and other influenza activity indicators both locally and provincially.

Figure 4: Weekly Elementary Student Absenteeism Rate

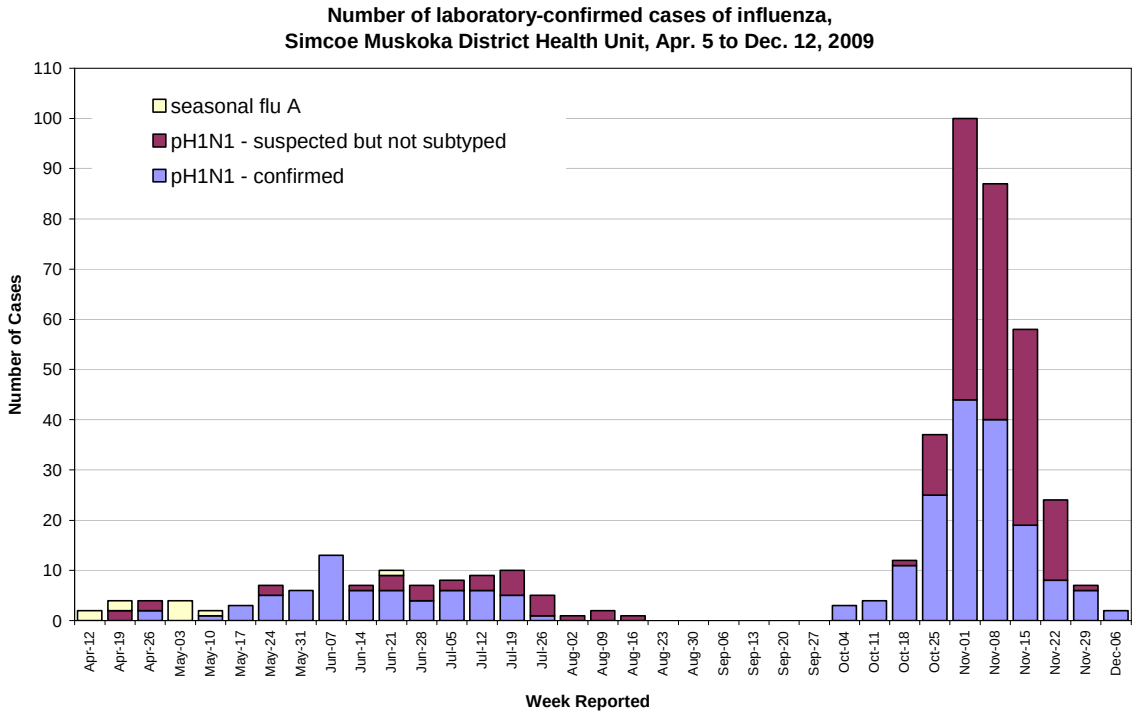


Source: Ontario data provided in the Ministry of Health and Long-Term Care Weekly Assessment of Influenza Activity in Ontario, which is based on heath unit reporting in Appendix C of the Provincial Influenza Activity Report. Simcoe Muskoka data based on the weekly electronic reports the health unit receives from local school boards and participating private schools. Baseline based on data provided by Trillium Lakelands District School Board (TLDSB) for 2007 and 2008. TLDSB has 15 elementary schools with in health unit's boundaries.

Laboratory-Confirmed Cases

- There were more than 400 laboratory-confirmed cases of influenza A reported to the health unit over the course of the pandemic, half of which were confirmed with the pH1N1 subtype. This is more than twice the number of annual influenza A cases typically reported to the health unit. Due to limits in laboratory capacity, not all influenza A specimens were tested for the pH1N1 subtype; however, virtually all influenza A circulating between April and December were pH1N1[9].
- Figure 5 shows the weekly number of laboratory-confirmed influenza A cases reported to the health unit over the course of the pandemic. There were more than twice as many cases reported during the second wave than during the first wave. Activity in the second wave was also much more concentrated in time than in the first wave with the majority of cases reported between October 25 and November 21. The peak in reported laboratory-confirmed influenza A cases occurred during the first week of November, which was consistent with the other indicators in this report.

Figure 5: Weekly Number of Lab-Confirmed Influenza A Cases

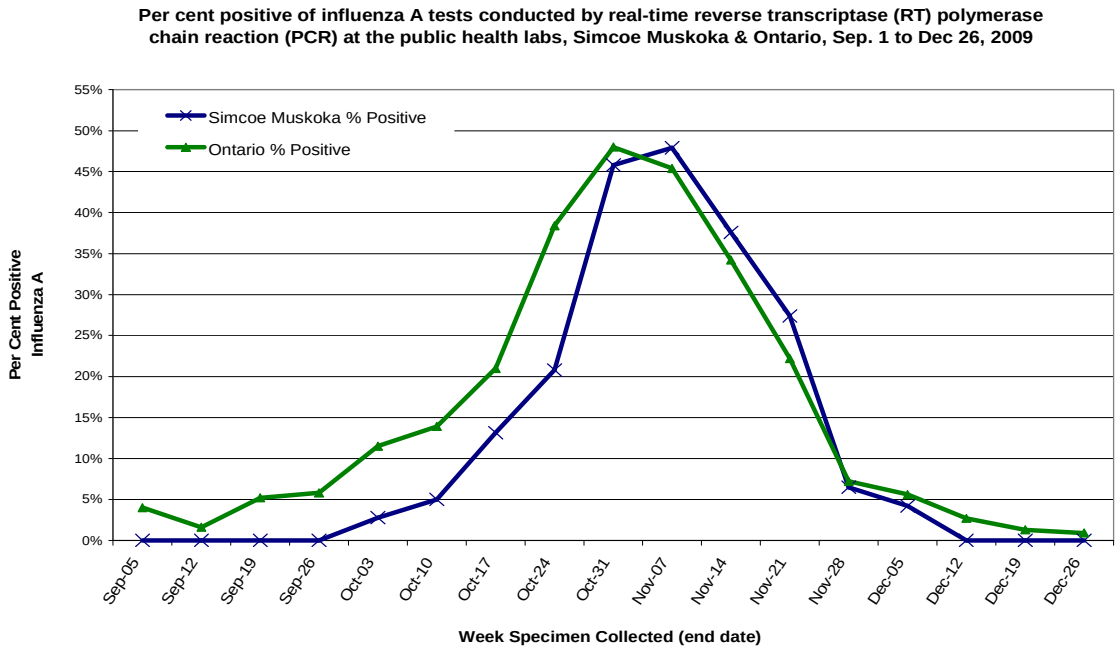


Source: iPHIS, MOHLTC.

Per Cent Positive Influenza Laboratory Tests

- Laboratory-confirmed cases of influenza are heavily influenced by the testing practices of health care providers and the testing policies of the public health laboratories. Appendix 2 provides a timeline of the changes to the laboratory testing policies over the course of the pandemic. These changes in testing practices limit the usefulness of the number of laboratory-confirmed cases of influenza as a reliable indicator of influenza-activity. Alternatively, the per cent of specimens submitted for influenza testing that end up testing positive are less subject to these testing biases and along with the laboratory-confirmed cases, provide a very good early warning indicator of influenza-activity in the community[10].
- Figure 6 shows the per cent of specimens submitted for influenza A testing by real-time reverse transcriptase polymerase chain reaction (RT-PCR) that were positive in Simcoe Muskoka (the blue line) and Ontario (the green line) for the second wave of the pandemic. This chart shows lower influenza activity in Simcoe Muskoka compared with Ontario in September and October and higher activity in November. It also appears that influenza activity in the second wave in Simcoe Muskoka peaked about a week later than it did in Ontario as a whole. It should be noted that these data are based on influenza virus testing conducted at Ontario public health laboratories and exclude all tests done in hospitals or private laboratories.

Figure 6: Per Cent Positive Influenza A Laboratory Tests

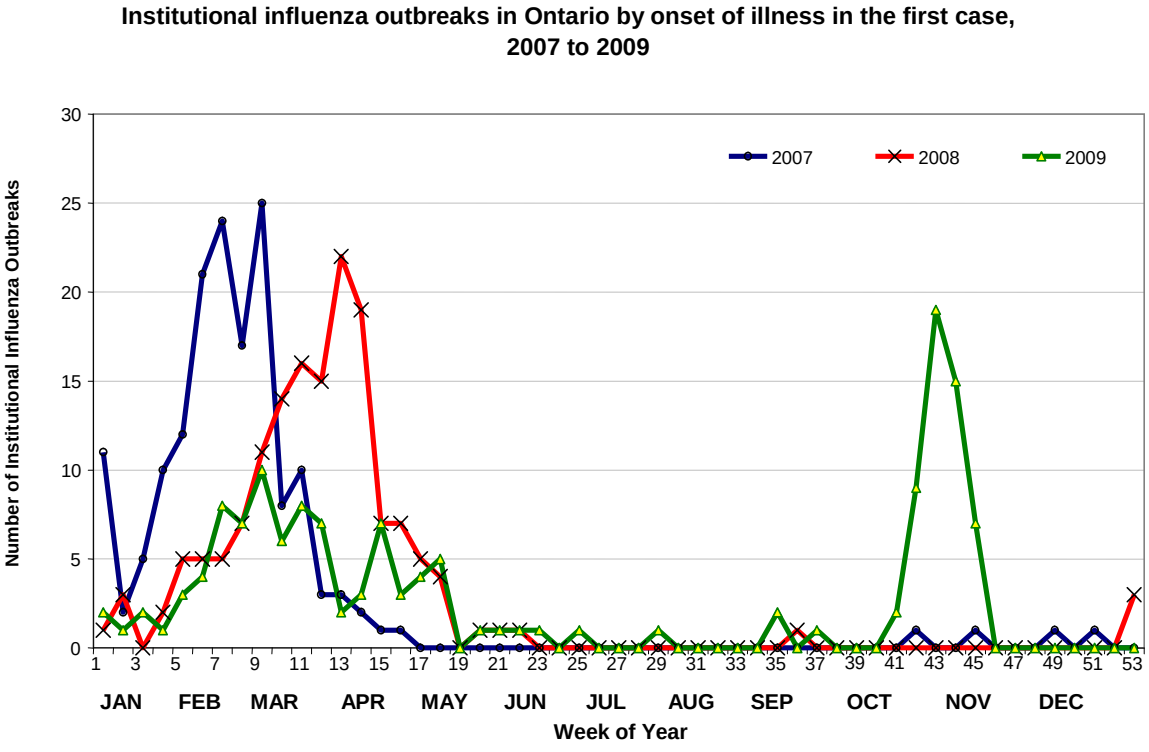


Source: Ontario Agency for Health Protection and Promotion (OAHPP) Laboratory Pandemic H1N1 Surveillance Report.

Institutional Outbreaks

- Outbreaks of influenza in institutional settings are declared by the local Medical Officer of Health (MOH) or designate with the aim of minimizing serious illness among these often high-risk populations[11]. There were eight influenza outbreaks declared in Simcoe Muskoka over the course of the pandemic, including five outbreaks at recreational children's summer camps in the first wave and three institutional outbreaks in the second wave. This number was within the range of influenza outbreaks declared in Simcoe Muskoka during a typical influenza season. The recreational camp outbreaks were a highly atypical setting for an influenza outbreak and occurred outside of the typical influenza season (October to April).
- Figure 7 shows the pattern of influenza A outbreaks declared across Ontario for the past three years. During the pandemic the number of outbreaks peaked in the last week of October, which was consistent with other indicators of influenza activity during the second wave of the pandemic. The number of outbreaks declared during the second wave was quite high for the time of year; however, relatively few outbreaks were declared overall during the pandemic when compared to the previous two years.

Figure 7: Weekly Number of Institutional Influenza Outbreaks

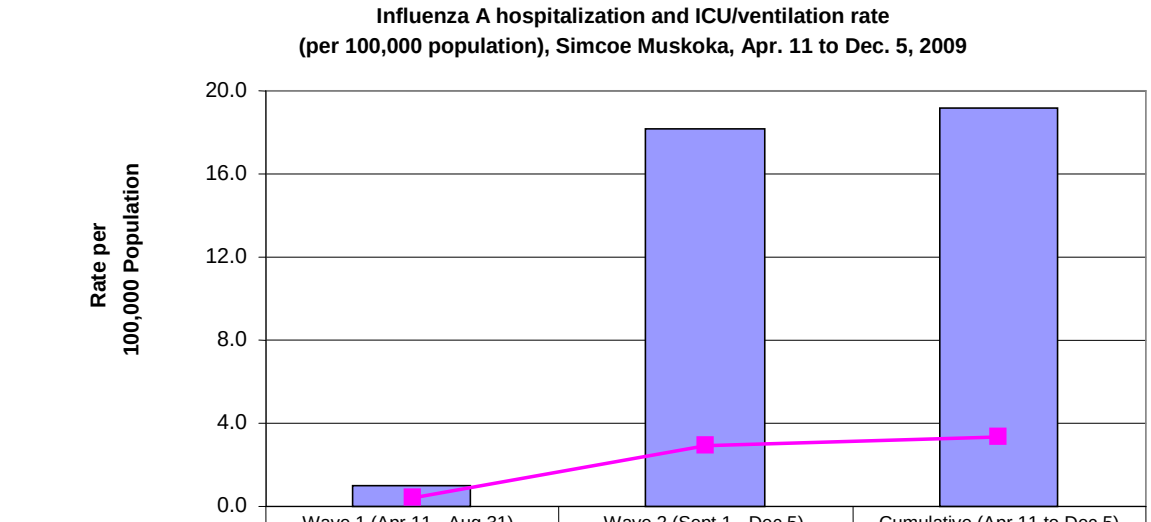


Source: Ministry of Health and Long-Term Care Ontario Influenza Bulletin.

Hospitalizations and Deaths

- For the pandemic period, the rate of laboratory-confirmed influenza hospital admissions is the indicator that best represents the level of influenza activity in the community. This is because the hospitalization rate is calculated using the size of the population to assess the impact the virus had on the community. Whereas the other indicators, such as lab-confirmed cases or per cent positive influenza tests, do not take the population size into account and are influenced by testing policies[10].
- In Simcoe Muskoka, there were a total of 98 hospital admissions for influenza A over the course of the pandemic, including 17 admissions to Intensive Care Units (ICU). The rate of hospital admission in Simcoe Muskoka for the second wave was nearly 20 times higher than in the first wave. The overall hospitalization rate for influenza A during the pandemic was within the expected range for seasonal influenza; however, ICU admissions for influenza A appear to be about twice as high as expected[12]. The impact estimates included in the health unit pandemic plan called for between 300 and 1,000 influenza-related hospitalizations[8].
- Figure 8 displays the influenza A hospitalization rate (the blue bars) and the combined ICU and ventilator use (the pink line), per 100,000 population, for Simcoe Muskoka for the first two waves of the pandemic. Nearly one in five hospital admissions for influenza A resulted in admission to the ICU and/or use of a ventilator. This was similar to what was reported for the rest of the province[13].

Figure 8: Influenza A Hospitalization and ICU/Ventilation Rates

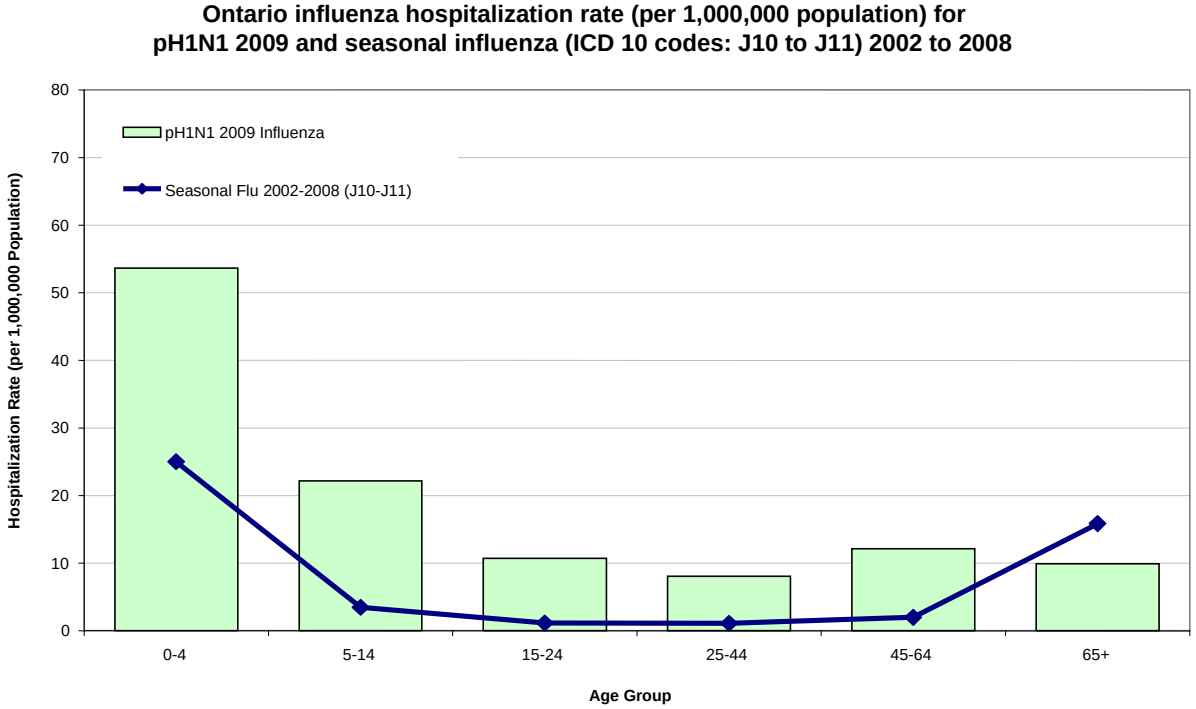


	Wave 1 (Apr 11 - Aug 31)	Wave 2 (Sept 1 - Dec 5)	Cumulative (Apr 11 to Dec 5)
SMDHU Hospital Admits	1.0	18.2	19.1
SMDHU ICU/Vent	0.4	2.9	3.3

Source : iPHIS & intelliHealth Ontario, MOHLTC.

- The influenza A hospitalization rate among young children (less than five years of age) was four times higher than for all other age groups. While complications from influenza are usually greatest in the very young and very old[11], it appears that those 65 years of age and older were relatively spared with this pandemic. The median age of our hospitalized cases over the course of the pandemic was substantially younger than for seasonal influenza, 26 years compared with 58 years[14]. This reduction in hospitalizations among older population was also observed in the US[5] and Australia[8].
- Figure 9 compares the age specific pandemic influenza hospitalization rate (the green bars) with the seasonal influenza hospitalization rate from 2002 to 2008 (the blue line) per 100,000 population for Ontario. This chart shows an increase in the hospitalization rates during the pandemic for all age groups less than 65 years when compared to the seasonal influenza rates. The true number of influenza-related hospitalizations during the pandemic may be found to be further elevated once the final data becomes available. It is possible that not all admitted cases with confirmed pH1N1 subtype have been reported to health units, despite the heightened surveillance efforts. In addition, not all hospitalizations related to influenza will be identified through testing either because of false negative test results or because testing was never conducted.

Figure 9: Age-Specific pH1N1 Hospitalization Rates, Simcoe Muskoka & Ontario



Source: MOHLTC intellihealth deaths data and population estimates and projections;
Data from Ontario Influenza Bulletin Weeks 51-52, MOHLTC,
site:http://www.health.gov.on.ca/english/providers/program/pubhealth/flu/flu_09/bulletins/flu_bul_01_20100108.pdf

- Nearly three-quarters (73%) of all the influenza A hospitalized cases in Simcoe Muskoka during the pandemic had at least one medical risk factor that would put them at high-risk for complications from influenza. Table 1 lists the most commonly reported risk factors among hospitalized cases in Simcoe Muskoka. Asthma (20%), smoking (14%) and COPD (11%) were the most frequently reported risk factors.

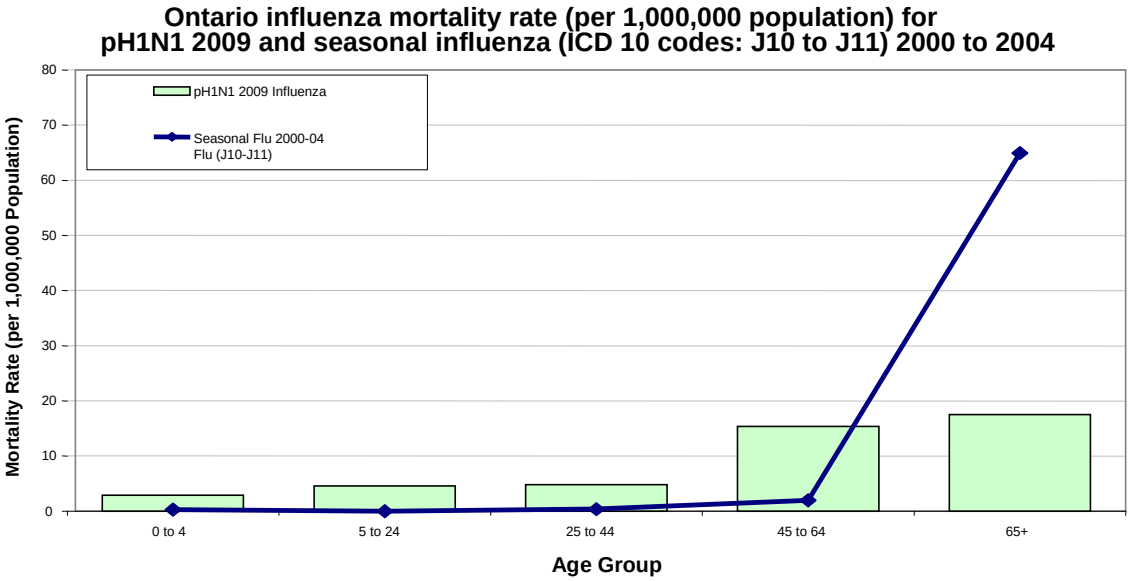
Table 1: Reported Risk Factors Among Hospitalized Influenza A Patients

Risk Factor	Cases	%
Asthma	20	20.4%
Smoker	13	13.3%
COPD	10	10.2%
Diabetes	8	8.2%
Cancer	7	7.1%
Obese	7	7.1%
Pregnant	4	4.1%
Any Risk Factor	*72*	*73.4%*
Total	**98**	**100.0%**

- pH1N1 vaccination status was obtained for 70 (78%) of the 90 influenza hospitalized cases admitted after the pH1N1 vaccine became available. Among those for which vaccination status was known, eight (11%) reported having received the pH1N1 vaccine; however, all of these cases had received their immunization within 10 days of onset of illness or were immunocompromised at the time of vaccination. Antiviral drug treatment was initiated with three-quarters of hospitalized cases in Simcoe Muskoka. Of these, about half were treated within 48 hours of symptom onset. Among those admitted to the ICU, approximately two-thirds were treated with antiviral drugs, but less than half were treated within 48 hours. This included one case in our area that was infected with an oseltamivir-resistant strain of pH1N1 virus.

- There were four deaths in Simcoe Muskoka where the individuals had a laboratory-confirmed pH1N1 diagnosis. In all cases the individuals had pre-existing medical conditions that put them at higher risk for complications from influenza. One of these fatal cases did receive the pH1N1 vaccine; however, this individual was immunocompromised at the time of vaccination and was likely unable to develop a sufficient immune response to be protected against infection from the virus. The annual number of deaths attributable to seasonal influenza A in Simcoe Muskoka is between five and 10[12]. The impact estimates included in the health unit pandemic plan called for between 100 and 300 influenza-related deaths[3].
- Once again, it appears that those 65 years of age and over were relatively spared during the pandemic with deaths compared to past influenza seasons. However, it is important to note that despite this, adults aged 65 and above still had the highest mortality rates of any age group. In Ontario, the median age of fatal pH1N1 cases was 55 years of age, much younger than the median age of 86 years for influenza deaths in Ontario between 2000 and 2005[18].
- Figure 10 compares the age-specific morality rates for pH1N1 (the green bars) and seasonal influenza (the blue line) for Ontario. This figure clearly illustrates the elevated mortality in all age groups under 65 years and a substantial reduction in mortality among those 65 years of age and older.

Figure 10: Ontario Age-Specific Influenza Mortality Rate for pH1N1 (2009) and seasonal influenza (2000 to 2004)

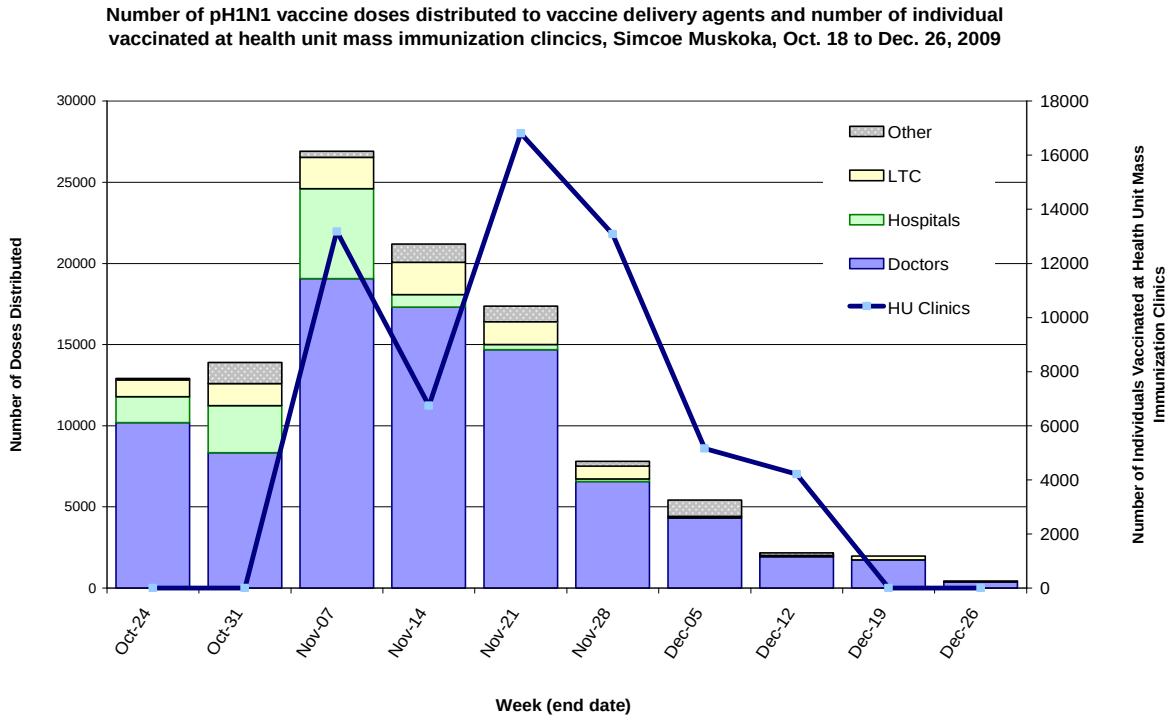


Source: MOHLTC intellihealth deaths data and population estimates and projections;
Data from Ontario Influenza Bulletin Weeks 51-52, MOHLTC,
site:http://www.health.gov.on.ca/english/providers/program/pubhealth/flu/flu_09/bulletins/flu_bul_01_20100108.pdf

pH1N1 Immunization

- The health unit began receiving pH1N1 vaccine from the province in late October, at which time doses were distributed to participating vaccine delivery agents (i.e. hospitals, physicians, long-term care institutions and other key health care partners). The health unit began immunizing the public through mass immunization in the first week of November. Initial efforts were focused on immunizing those in the first priority sequence, which included those less than five years of age, pregnant women, those under 65 years of age with chronic conditions, those living in remote communities and health care providers[15].
- Figure 11 shows the amount of vaccine distributed by the health unit to vaccine delivery agents (the bars) and the number of individuals immunized at health unit mass immunization clinics (the line) by week, from late October to mid December. Enough vaccine was made available through either vaccine-delivery agents or health unit mass immunization clinics to have immunized more than three-quarters of those in priority sequence one by November 14 (after which time vaccine was made available to the general population). By the end of December enough vaccine was made available to have immunized more than one-third of the entire Simcoe Muskoka population.

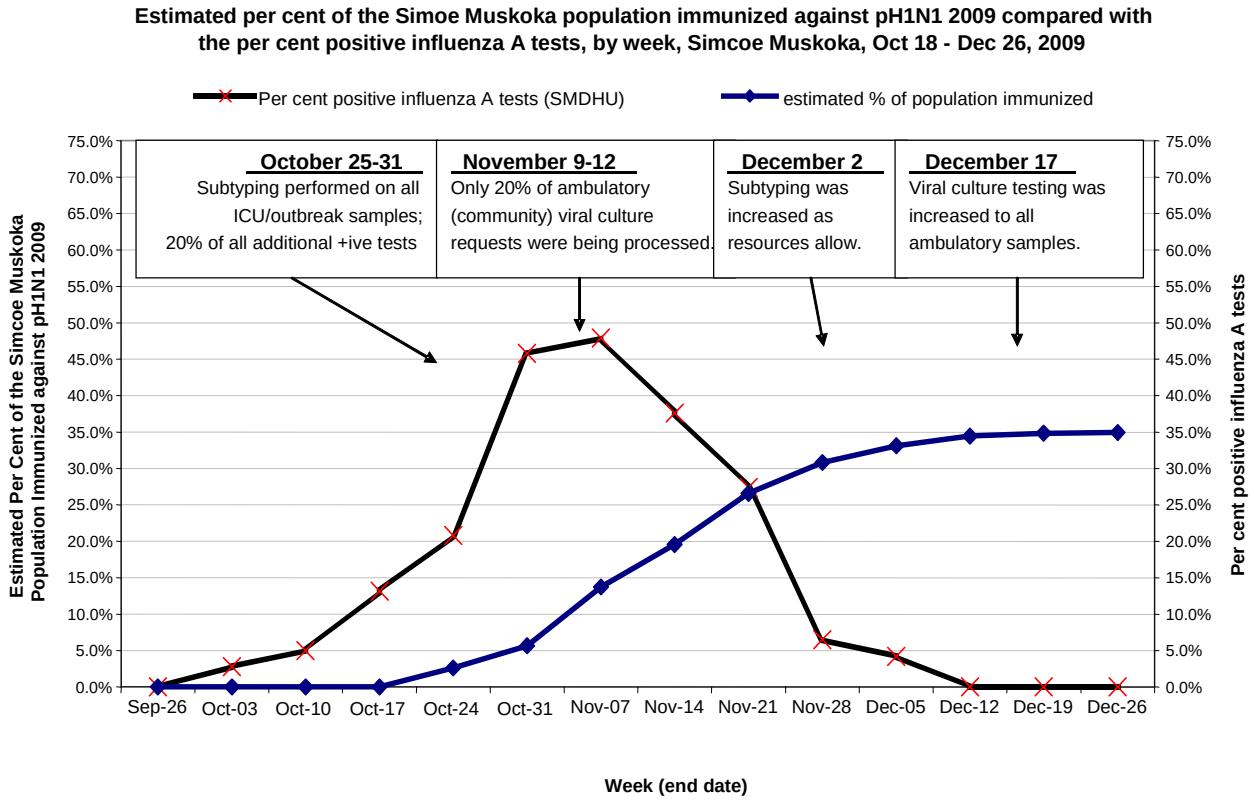
Figure 11: pH1N1 Vaccine Distributed to Vaccine-Delivery Agents and Individuals Immunized at Health Unit Mass Immunization Clinics



Sources: Bioinventory System (BIOS) & Clinic Event Manager Database SMDHU.

❖ Figure 12 compares the estimated per cent of the Simcoe Muskoka population immunized against the pH1N1 virus (the blue line) with the per cent positive influenza A tests in Simcoe Muskoka by week from late October to the end of December. While it is difficult to quantify the exact impact of the vaccination campaign on influenza activity in the community, the pattern does suggest that the vaccination efforts may have contributed to a more rapid decrease in influenza activity than would have been seen otherwise.

Figure 12: pH1N1 Vaccine Distributed to Vaccine Delivery Agents and Individuals Immunized at Health Unit Mass Immunization Clinics



Sources: Bioinventory System (BIOS), Clinic Event Manager Database SMDHU &
Ontario Agency fro Health Protection and Promotion (OAHPP) Laboratory Pandemic H1N1 Surveillance Report.

SUMMARY

- Table 2 summarizes a number of key influenza surveillance indicators for Simcoe Muskoka for the duration of the pandemic and provides comparators (where available) to what our experience has been with seasonal influenza and what we were expecting based on our pandemic plan. All indicators suggest that this pandemic was much more moderate than what was planned for. The data also suggests that our experience during the pandemic was not entirely out of scope with what is normally experienced with seasonal influenza other than the atypical timing of activity.

Table 2: Comparison of Key Surveillance Indicators

Outcome	1st Wave	2nd Wave	Total	Seasonal Influenza A		SMDHU Pandemic Plan[1]
Lab-Confirmed Cases of Influenza A	64 – confirmed pH1N1 37 – suspect but not sub-typed	162 – confirmed pH1N1 172 – suspect but not sub-typed	227 – confirmed pH1N1 209 – suspect but not sub-typed	173[2] Flu A Cases		Not Available (n/a)
Hospitalizations (Rate per 100,000)	5 (1.0)	93 (18.4)	98 (19.4)	Flu[3] 37 (7.6)	P&I[3] 927 (190.0)	301 – 1,094 (63.1 – 229.3)
ICU Admissions (Rate per 100,000)	2 (0.4)	15 (3.0)	17 (3.4)	Not Available (n/a)		Not Available (n/a)
Deaths (Rate per 100,000)	0 (0.0)	4 (0.8)	4 (0.8)	Flu[4] 1 (0.2)	P&I[4] 18 (3.6)	118 – 331 (24.7 – 69.4)
Outbreaks	5* *summer camps	3* *institutional	8	5 – 10		Not Available (n/a)

[1] Based on a 15% Clinical Attack Rate
[2] 2007/08 – iPHIS; MOHLTC
[3] 2002-2008 – Inpatient Discharge; MOHLTC
[4] 2002-2008 – Inpatient Discharge; MOHLTC
Flu = Influenza (ICD10 Codes J09-J11); P&I = Pneumonia & Influenza (ICD10 Codes J09-J18)

DISCUSSION

The 2009 influenza A (pH1N1) pandemic was not the pandemic for which we planned. This pandemic was much more moderate in terms of severe outcomes and societal disruption than was anticipated in our pandemic plan. Contingencies related to excess mortality during the pandemic, like enhancing capacity for death registration and burial permits were included in our agency's pandemic plan[3]. There was no evidence of any increase in mortality during the 2009 pandemic. Overall influenza-related mortality was much less than what is typically observed with seasonal influenza. This is most likely attributable to an apparent sparing of those 65 years of age and over, which usually account for approximately 95per cent of influenza-related deaths[16]. Mortality rates in those less than 65 years were higher during the pandemic when compared to typical influenza seasons. However, the total number of deaths remained relatively small (less than 1 per 100,000).

The pandemic did put a strain on local ambulatory and acute health care providers, particularly during the second wave. However, most health care service providers were able to adapt to the situation and manage the increase in the level of service required to meet the demand. There was not a comprehensive surveillance system for influenza-like illness (ILI) during the pandemic in Simcoe Muskoka; however, several providers did successfully implement in-house surveillance systems to monitor ILI in order to plan for appropriate staff and resource allocation. A syndromic surveillance system that allows for real-time monitoring of ILI, like ones that have been implemented in Grey-Bruce, Kingston, Ottawa and much of Eastern Ontario[17], may have facilitated a more timely targeted response to the increase in health care demands during the second wave (e.g. opening of assessment centres). Progress has been made in this area with three hospital corporations, covering Muskoka and Northern Simcoe County, signing on to the QUESST[7] system in 2010. The retrospective analysis of the data from these hospitals during the second wave demonstrated the sensitivity of the system to detect increased influenza activity in the community. However, full participation from all hospitals in our jurisdiction is needed for this system to be maximally effective.

As with all sources of data, the indicators used in this report are subject to a number of limitations that should be taken into consideration when interpreting the findings. During the 2009 influenza pandemic, issues such as timeliness of reporting, specificity to influenza and coverage are important in interpreting the various indicators. Testing policy changed significantly over the pandemic period. Initially, health units wanted to confirm the presence of the pandemic strain in their community. Laboratories quickly reached capacity and testing became increasingly restricted. During the fall wave, testing was primarily limited to hospitalized patients with clinical symptoms of influenza. The per cent of tests that are positive for influenza A is often used to adjust for differences in testing policies. However, the per cent positive is not directly comparable over longer periods of time, as the proportion of tests that are positive for influenza will depend on various factors, such as who is being tested, swabbing methods and the sensitivity of the laboratory tests that

are used. The ILI consultation rates obtained from sentinel physicians provide a reliable trend of influenza-activity over time. However, since these are not laboratory-confirmed influenza cases, but only those presenting with ILI, which could be caused by other viruses, these rates do not represent true rates of influenza infections in the community.

Another key limitation is the comparability of the seasonal influenza mortality and hospitalization rates from previous years to those derived from the surveillance data available during the pandemic. In Ontario, there is usually at least a year delay in having the complete coded record of hospitalizations and the interval for coded mortality data can be more than three years[18].

An attempt was made to assess the impact of antiviral drug treatment and pH1N1 immunization on reducing severe outcomes in Simcoe Muskoka. The timing of the introduction of the vaccine made it difficult to assess the true impact it had on reducing severe outcomes during the second wave. Locally, we did not have any reported cases of vaccine failure among our fatal or hospitalized cases, which suggests that the vaccine was effective. However, given the availability of the vaccine after the onset of the second wave, the impact of the program in preventing cases was almost certainly significantly reduced. Without a comparable control group it is difficult to assess the effectiveness of early treatment of antiviral drugs during the pandemic. The fact that only half were treated with antiviral drugs within 48 hours of symptom onset may be consistent with limited access to treatment. Moreover, given that half of those admitted to ICU were treated with antiviral drugs within 48 hours of symptom onset also suggests that the benefit of early treatment is not great. This finding is consistent with a recently published study that has raised questions around the effectiveness of neuraminidase inhibitors in preventing complications from influenza[19]. However, early treatment with antiviral therapy was associated with a reduction in ICU admissions in a cumulative case-control study of laboratory-confirmed pH1N1 influenza cases in Manitoba during the first wave of the outbreak[20]. This mixed evidence concerning the effectiveness of antiviral therapy for hospitalized influenza-infected patients underscores the need for randomized controlled trials.

CONCLUSION

The 2009 influenza A (pH1N1) pandemic was mild to moderate in terms of severity of outcomes and societal disruption. Overall, our experience in Simcoe Muskoka with pH1N1 was consistent with that of the province and with the international experience, which included a dramatic increase in ambulatory cases at periods of time atypical for seasonal influenza, a dramatic reduction in mortality in seniors compared with past influenza seasons, with a resultant decrease in overall mortality and an increase in severity in younger populations, particularly those with pre-existing medical conditions. The fact that vaccine was not available prior to the peak of the second wave likely limited the impact of this measure on mitigating severe outcomes. Early treatment with antiviral therapy was initiated with only half of all hospitalized cases, which may suggest limited access to care in the early stages of illness. The full implementation of a local surveillance system for ILI like QUESST[7] may facilitate a more targeted and timely response in the event a future pandemic or other infectious disease related emergency.

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APPENDICES

Appendix 1: List of Data Sources

1. **Sentinel Physicians Influenza-Like Illness (ILI) Consultation Reporting**
   This is a component of the Public Health Agency of Canada (PHAC) FluWatch program. FluWatch is Canada's national surveillance system that monitors the spread of influenza and flu-like illnesses. Influenza-like illness (ILI) is defined as the acute onset of respiratory illness with fever and cough and with one or more of the following: sore throat, arthralgia, myalgia, or prostration that could be due to influenza virus. Each sentinel physician reports the weekly number of patient visits that were due to ILI and the total number of patients seen, by age group. The FluWatch program compiles the information from each sentinel physician and calculates an overall rate of ILI activity for the province (i.e. number of patient visits due to ILI per 1000 patient visits). The Ontario Ministry of Health and Long-Term Care (MOHLTC) posts the weekly ILI data from the Ontario sentinel physicians to the secure area of their public health portal.

2. **Simcoe Muskoka District Health Unit Electronic School Absenteeism Reporting**
   The health unit receives weekly electronic reports from the three largest school boards in the area, Trillium Lakelands District School Board, Simcoe County District School Board and Simcoe Muskoka Catholic School Board. These reports include the daily student enrolment and daily number of students absent for any reason for all elementary schools and high schools in Simcoe Muskoka. This data was used to calculate the per cent of elementary schools and high schools that report a weekly all-cause student absenteeism rate of greater than 10 per cent.

3. **Integrated Public Health Information System (iPHIS)**
   This is the database used by public health units to report information on cases of reportable diseases to the MOHLTC. The numbers of cases of reportable diseases included in iPHIS is an underestimate of the actual numbers since not all people with a reportable disease seek medical treatment and therefore the disease goes unreported.

4. **Communicable Disease (CD) Program Intake Database**
   The CD intake database tracks which reportable disease cases are investigated annually as well as monitors the workload of case investigators. The information in this database was used to supplement the information that is recorded in iPHIS.

5. **Hospital Inpatient Discharges**
   Data are collected from each patient's chart at the time of discharge from hospital and are recorded on an abstract provided by Canadian Institute for Health Information (CIHI). The abstract collects information on the patient and the nature of their stay. The main diagnostic code gives the primary reason for the hospital stay or "most responsible diagnosis" (MRD). The data source contains discharge records, not admissions. The data is reported for completed cases only. Hospitals do not report on cases that are still being treated. The data presented in this report includes discharges

from January 1, 2002 to December 31, 2008. The data represents the number of discharges, not the number of people.

6. **Deaths**
   Death or mortality data are derived from death certificates completed by physicians, which are collected by the Office of the Registrar General (ORG). The cause of death reported is that which initiates the sequence of events leading to death. Consequently, there may be some uncertainty in classifying when there are multiple causes of death. Determining true cause of death may be influenced by the social or legal conditions surrounding the death and by the level of medical investigation, e.g. AIDS, suicide. Data is analyzed by the residence of the deceased not where the death occurred. Records for Ontario residents who die outside of the province are not available and are therefore excluded. Otherwise, due to legal reporting requirements, registration of deaths is considered to be virtually complete. The data presented in this report includes discharges from January 1, 2000 to December 31, 2004.

7. **Population Estimates**
   The source data used are population estimates by single year of age (up to 90+) and sex for Ontario's Census Subdivisions (CSD) updated November 13, 2009. Years covered by these estimates are from 1986 to 2008. The population estimates are produced by the Demography Division, Statistics Canada. Estimates are final intercensal from 1986 to 2005, final postcensal for 2006, updated postcensal for 2007 and 2008.

Appendix 2: Summary of Changes to the Ontario Public Health Laboratory Testing Algorithm During the Pandemic Influenza A (H1N1) Outbreak

December 17, 2009	Viral culture testing was increased to all ambulatory samples and a minimum of 20% of influenza A negative RT-PCR tests. Viral culture testing increases as resources allowed.
December 2, 2009	Subtyping was increased as resources allow.
November 9-12, 2009	Only 20% of ambulatory (community) viral culture requests were being processed.
October 25-31, 2009	Subtyping was performed on all intensive care samples, outbreak samples and on 20% of all additional influenza A positive tests.
August 18, 2009	The Ontario Ministry of Health and Long-Term Care requested that laboratory testing be performed on all Severe Respiratory Illness (SRI) patients admitted to hospitals.
June 4, 2009	Laboratory testing was limited to cases where lab results are required for clinical management of hospitalized cases of influenza-like illness (ILI) or where patients were at high-risk for complications from influenza (e.g. immunocompromised, pregnant, persons under the age of two years and over 65 years of age).