Influenza and Respiratory Infection Surveillance Summary Report:
2012–13 Season
Public Health Ontario

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Abbreviations

ACH    Acute care hospital
HPPA   Health Protection and Promotion Act
ILI    Influenza-like illness
iPHIS  Integrated Public Health Information System
LTCH   Long-term care home
MOHLTC Ministry of Health and Long-Term Care
NAAT   Nucleic acid amplification testing
NML    National Microbiology Laboratory
PCR    Polymerase chain reaction
PHA    Public Hospitals Act
PHAC   Public Health Agency of Canada
PHO    Public Health Ontario
PHOL   Public Health Ontario Laboratories
PIV    Parainfluenza virus
RH     Retirement home
RNA    Ribonucleic Acid
RSV    Respiratory syncytial virus
WHO    World Health Organization
Glossary

**Antigen:** A foreign substance which results in an immune response.

**Influenza antiviral resistance:** The influenza virus has changed such that the antiviral drug is less effective in treating or preventing illnesses as a result of influenza infection.

**Influenza types /subtypes/strains:** There are three types of influenza: influenzas A, B and C. Only influenza A viruses are further broken down into subtypes on the basis of the two main surface glycoproteins hemagglutinin (HA) and neuraminidase (NA), e.g., the subtypes of influenza A that currently circulate throughout the world, influenza A(H3N2) and influenza A(H1N1). Influenza A subtypes and influenza B viruses are further classified into strains.¹

**iPHIS (integrated Public Health Information System):** iPHIS is the electronic information system used for reporting and managing client, case, contact and outbreak information for all reportable diseases in Ontario, as described in O. Reg. 569 of the Health Protection and Promotion Act.² The Ministry of Health and Long-Term Care launched iPHIS in 2005.

**ILI (Influenza-like illness):** Acute onset of respiratory illness with fever and cough and with one or more of the following: sore throat, arthralgia, myalgia, or prostration which is likely due to influenza. It is important to note that many respiratory viruses and bacteria can present with “influenza-like” symptoms. Therefore, infections caused by other respiratory pathogens may be difficult to distinguish from influenza on the basis of clinical features alone.

**Isolate:** Live virus derived from a positive specimen grown in cell culture.

**Sentinel ILI consultation rates:** The number of individuals presenting to a community sentinel health care provider for a given day of the week with influenza-like illness (ILI) out of all individuals presenting to the sentinel health care provider on that day. This rate is reported per 1,000 patient visits.

**NAAT (Nucleic acid amplification testing) – for influenza:** Includes any test that amplifies and detects the genetic material of the influenza virus. PCR is an example of a NAAT test.

**Percent positivity:** The proportion of specimens testing positive for a given pathogen out of all specimens tested for that pathogen over a specific period of time.

**PCR (Polymerase chain reaction):** A NAAT testing method to analyze a short sequence of DNA or RNA (possible even in samples containing only small amounts quantities of DNA or RNA). PCR is used to reproduce identical copies of selected sections of DNA or RNA for analysis.

**Rapid antigenic testing:** Diagnostic tests for detection of influenza virus antigen. Such tests can only detect the type of influenza (i.e., influenza A, B); results are usually available within 30 minutes.

**Virus culture:** Use of a cell culture in order to replicate (grow) the influenza virus. Results may take up to 10 days to be finalized.
Executive Summary

For many years in Ontario, influenza was the focus of provincial surveillance for respiratory infections. This is still the case, but to a lesser degree as it is evident that many other viruses can cause respiratory infections that result in influenza-like illness (ILI). It is therefore important to know which virus(es) may be the cause of an outbreak or which is most responsible for increased rates of ILI in the community: this information informs clinical management and the implementation of public health prevention and protection measures.

Surveillance for respiratory viruses occurs year-round in Ontario. Based on laboratory test data, different respiratory viruses have their periods of extended and peak activity at different times of the year. The 2012–13 respiratory virus surveillance season started with an increase in rhinovirus activity in September which was reflected in the percentage of respiratory samples that tested positive for rhinovirus and the number of outbreaks in institutions attributed to rhinovirus. Influenza and coronavirus activity peaked next, in late December to early January, followed by respiratory syncytial virus and metapneumovirus in March, and then parainfluenza virus in June.

The 2012–13 season had extensive influenza activity, mainly associated with influenza A in the winter, but with a distinctive influenza B peak in the spring. This can be seen in the percentage of samples testing positive for influenza at the Public Health Ontario Laboratories (PHOL), the overall number of laboratory-confirmed influenza cases reported, and the timing of influenza outbreaks. In addition, the increase in influenza A was well reflected in the sentinel physician ILI consultation rate data. The circulating influenza A subtype was predominantly influenza A(H3N2) with some influenza A(H1N1)pdm09 co-circulating. Peak influenza A activity took place at the end of December 2012 and the beginning of January 2013. Data from the National Microbiology Laboratory showed that the circulating H3N2 strain was a match with the H3N2 strain included in the influenza vaccine for 2012–13: influenza A/Victoria/361/2011-like. However, results from the influenza vaccine effectiveness study conducted across five Canadian provinces showed low vaccine effectiveness, attributed to mutations in the virus included in the vaccine during vaccine production. Influenza B activity began later in the season after influenza A activity had subsided, with peak influenza B activity taking place in April 2014. Most influenza B activity was caused by the B/Wisconsin/01/2010-like strain with the B/Brisbane/60/2008-like strain co-circulating. The B/Wisconsin/01/2010-like strain was included in the vaccine for the 2012–13 season.

1. Introduction

1.1 Purpose

The purpose of the 2012–13 Influenza and Respiratory Infection Surveillance Summary report is to describe the epidemiology of influenza and other respiratory viruses that are routinely monitored in Ontario. This report will focus on summarizing the overall patterns in terms of timing and progression, geographic trends, severity, virus characteristics (e.g., influenza types/subtypes, percent positivity by respiratory virus, etc.), and at-risk populations with respect to seasonal influenza and respiratory infection activity for the 2012–13 surveillance season. The surveillance season described in this report occurred between September 1, 2012, to August 31, 2013.

1.2 Background of the Influenza and Respiratory Virus Surveillance Program

Ontario’s influenza and respiratory infection surveillance program collects data on individual cases of laboratory-confirmed influenza as well as respiratory infection outbreaks in institutions. Influenza has been a reportable disease in Ontario since 1923 and respiratory infection outbreaks in institutions have been reportable since 2001. For reporting purposes in Ontario, institutions include long-term care homes (LTCHs), retirement homes (RHs) with more than 10 residents, and hospitals operating under the Public Hospitals Act. Under the Health Protection and Promotion Act (HPPA), clinicians, laboratories and others are legally required to report cases of influenza to their local medical officer of health as per Ontario Regulation 559/91. In turn, Ontario public health units report this information provincially through the integrated Public Health Information System (iPHIS).

In alignment with the main objectives of the Ontario Influenza and Respiratory Infection Surveillance Program, Public Health Ontario (PHO) releases routine surveillance reports and monitors an array of data sources for respiratory viruses and influenza-like illness activity to inform public health, clinical and government partners at the local, provincial and federal levels, as well as support federal and global surveillance efforts. Some examples of the surveillance reports currently available include the Ontario Respiratory Virus Bulletin (ORVB), the Laboratory-Based Respiratory Pathogen Surveillance Report and this annual summary report. The ORVB summarizes the latest trends in respiratory infection and influenza activity for the current period as well as for the season to-date. The Laboratory-Based Respiratory Pathogen Surveillance Report reports on respiratory viruses and specific respiratory bacteria testing conducted at Public Health Ontario Laboratories (PHOL). Both of these reports are produced on a weekly basis starting in November and biweekly during the “off season” starting in May. PHO’s surveillance reports are available online.

The main data sources used for this report include:

- PHOL respiratory virus data, such as percent positivity for various respiratory viruses including influenza
- Circulating influenza strains and antiviral resistance testing conducted by the National Microbiology Laboratory (NML)
- Reports of laboratory-confirmed influenza cases and confirmed institutional respiratory infection outbreaks reported by public health units through iPHIS
- Hospitalizations and deaths among laboratory-confirmed cases of influenza reported by public health units through iPHIS
• Sentinel reporting of influenza-like illness (ILI) consultation rates as coordinated by the national influenza surveillance program, FluWatch
• Median provincial influenza immunization rates for staff of LTCHs and hospitals as collected by public health units from these institutions

1.3 Goal and Objectives of the Influenza and Respiratory Virus Surveillance Program for the 2012–13 season

Goal:
To monitor, analyze and communicate in a timely fashion the onset, duration, conclusion, geographic patterns, severity and progression of seasonal influenza activity, in order to anticipate heightened influenza activity.

Objectives:
1. To monitor influenza-like illness (ILI) activity to provide accurate and timely information for the:
   a) Detection of unusual events (new influenza strains including epizootic strains, antigenic drift/shift, unusual outcomes or syndromes, unusual severity or distribution)
   b) Identification of influenza types and subtypes to enable comparisons between circulating influenza strains and vaccine composition and recommendations
   c) Comparison with national and international respiratory virus activity
   d) Estimation of ILI indicators such as attack rates, hospitalization rates, emergency room visits and case fatality rates.

2. To describe the epidemiology (e.g., incidence and prevalence) of influenza and other viral respiratory illnesses (endemic, emerging and re-emerging), including the identification of high-risk groups for the implementation of appropriate prevention and control measures.

3. To share accurate and timely surveillance information with public health partners at the local, provincial, national and international levels in order to:
   a) Anticipate and guide prevention, response and control efforts
   b) Guide and inform timely research
   c) Evaluate treatment, prophylaxis and control measures in the management and termination of outbreaks.
2. Laboratory Surveillance of Influenza and Other Respiratory Viruses

2.1 Respiratory Virus Detections at the Public Health Ontario Laboratories (PHOL)

2.1.1 Influenza viruses

Influenza A

During the 2012–13 surveillance season, influenza A percent positivity had exceeded 5% for two consecutive weeks by week 46 (November 11–17, 2012) (Figure 1). Influenza A percent positivity continued to increase from that point onward, peaking during week 52 (December 23–29, 2012) at 40.5%, followed by a gradual decline until week 11 (March 10–16, 2013) when percent positivity decreased to less than 5%. Influenza A(H3N2) was the predominant circulating subtype in Ontario, representing 90.6% (3,737/4,124) of all subtyped influenza A viruses. The highest number of specimens (2,537) for influenza and other respiratory virus testing were submitted during week 1 (December 30, 2012–January 5, 2013).

Influenza B

Influenza B percent positivity rose above 5% for the second consecutive week during week 12 (March 17–22, 2013) and reached a peak of 8.3% during week 15 (April 7–13, 2013) (Figure 1). Influenza B percent positivity did not decline below 5% until week 20 (May 12–18, 2013).

2.1.2 Other respiratory viruses

Other respiratory viruses circulated at various times during the course of the 2012–13 surveillance season (Figures 1 and 2). During the times when they reached their peak activity, rhinovirus and respiratory syncytial virus (RSV) were the dominant circulating respiratory virus, as measured by percent positivity.

Overall, entero/rhinovirus was the second most common respiratory virus detected at PHOL after influenza A (Figure 1). There were two distinct periods of elevated entero/rhinovirus activity in the fall and summer, with lower levels of activity observed during the spring and winter months. The highest percent positivity in the fall period was reported in Week 40 (September 30–October 6, 2012) at 20.7% and the highest percent positivity in the summer period was 23.4%, reported during Week 28 (July 7–13, 2013). Fluctuations in entero/rhinovirus percent positivity apparent in Figure 1 are in part due to changes in testing methods. Fewer specimens were being tested for entero/rhinovirus by viral culture due to implementation of a new rapid respiratory viral culture method (R-MIX) in 2012, which does not target entero/rhinovirus.

Respiratory syncytial virus was the third most common respiratory virus identified at PHOL (Figure 1) in the 2012–2013 season. The percent positivity of RSV peaked at 20.1% in March (Week 10: March 3–9, 2013). Coronavirus percent positivity peaked at 20.2% in early January (Week 1: December 30, 2012–January 5, 2013) (Figure 2). Parainfluenza viruses circulated at low levels for most of the surveillance period, reaching a peak of 12.4% in June (Week 25: June 16–22, 2013) (Figure 1). Human metapneumovirus had a brief period of activity, with a peak of 10.8% in March (Week 13; March 24–30,
Adenovirus circulated at low levels for most of the surveillance season with percent positivity never exceeding 3% (Figure 2).

**Figure 1.** Percentage of specimens testing positive, by all methods, for influenza A and B, parainfluenza, respiratory syncytial virus, and entero/rhinovirus: PHOLs, September 1, 2012, to August 31, 2013

Source: Public Health Ontario Laboratory, extracted from the Laboratory Information Management System, 2013/09/03.

**Figure 2.** Percentage of specimens testing positive, by all methods, for coronavirus, metapneumovirus, and adenovirus: PHOLs, September 1, 2012, to August 31, 2013

Source: Public Health Ontario Laboratory, extracted from the Laboratory Information Management System, 2013/09/03.
2.2 Comparison of Influenza Strains Circulating in Canada/Ontario

2.2.1 NML Data Summary and Comparison against Vaccine Components

The National Microbiology Laboratory (NML) is Canada’s reference laboratory and performs influenza strain characterization. NML receives a proportion of influenza isolates from provincial laboratories for strain characterization and antiviral resistance testing. During the 2012–13 influenza season, the NML antigenically characterized 918 influenza A viruses from across Canada: 663 A(H3N2) and 255 A(H1N1)pdm09. In addition, NML antigenically characterized 602 influenza B viruses: 138 B/Brisbane/60/2008-like strains and 464 B/Wisconsin/01/2010-like strains (Table 1).

For Canada, the influenza A (H3N2)A/Victoria/361/2011-like strain was the most commonly identified influenza A strain, found in 72.2% (663/918) of influenza A strain typed isolates during the surveillance season. In Ontario, the influenza A(H3N2)/Victoria/361/2011-like and the influenza A(H1N1)pdm09/California/7/2009-like strains were identified in 51.7% (205/396) and 48.3% (191/396) of influenza A strain-typed isolates, respectively (Table 1). Both strains were the influenza A strains recommended by the WHO for the Northern Hemisphere’s 2012–13 trivalent influenza vaccine.4

B/Wisconsin/01/2010-like was the most common influenza B strain in Canada and Ontario, identified in 77.1% (464/602) and 84.6% (219/259) influenza B strain-typed isolates tested from Canada and Ontario, respectively. Co-circulation of both influenza B strains, B/Wisconsin/01/2010-like and B/Brisbane/60/2008-like, was observed throughout the year. B/Wisconsin/01/2010-like was the influenza B strain recommended by WHO for the Northern Hemisphere’s 2012–13 trivalent influenza vaccine.4

Table 1. NML strain characterization, influenza isolates in Ontario and Canada, September 1, 2012, to August 29, 2013

<table>
<thead>
<tr>
<th>Influenza strains</th>
<th>Ontario</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza A(H3N2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/Victoria/361/2011-like</td>
<td>205</td>
<td>663</td>
</tr>
<tr>
<td>Influenza A(H1N1)pdm09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/California/7/2009-like</td>
<td>191</td>
<td>255</td>
</tr>
<tr>
<td>Influenza B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/Brisbane/60/2008-like*</td>
<td>40</td>
<td>138</td>
</tr>
<tr>
<td>B/Wisconsin/01/2010-like*</td>
<td>219</td>
<td>464</td>
</tr>
</tbody>
</table>

Source: Influenza and Respiratory Viruses Section, National Microbiology Laboratory (NML). Published on September 2, 2013.

*Influenza B strains are generally associated with two distinct lineages: Victoria and Yamagata. B/Brisbane/60/2008-like is a strain belonging to the Victoria lineage and B/Wisconsin/01/2010-like is a strain associated with the Yamagata lineage.
2.2.2 Summary of the Canadian Multiprovincial Influenza Vaccine Effectiveness Study Results, 2012–13

The Influenza Vaccine Effectiveness (VE) Study started as a pilot program in BC in 2004 to monitor annual influenza circulation and VE against laboratory-confirmed influenza. Ontario joined this initiative in 2008 and the study is now being conducted in five provinces: British Columbia, Alberta, Manitoba, Ontario and Quebec. The study utilizes a province-wide network of sentinel sites to collect samples from patients presenting to community health care providers with influenza-like illness, and tests them for influenza and other viral respiratory pathogens. In Ontario, sentinel health care providers submit specimens and accompanying laboratory requisitions to the PHOL in Toronto. Combined VE analysis is conducted at British Columbia’s Centre for Disease Control using anonymized aggregated data from participating provinces.

As illustrated elsewhere in this report, the 2012–13 influenza season started early in Ontario with a high number of laboratory-confirmed cases and institutional influenza outbreaks. During the 2012–13 study, influenza was detected in 43% (652/1,537) of VE study participants, of which 60% were influenza A(H3N2) (394/652) and the rest were divided between influenza A(H1N1)pdm09 (12%; 79/652), B/Yamagata (15%; 98/652) and B/Victoria (8%; 54/652). Eleven influenza A positive samples were not subtyped and 15 influenza B positive samples were of unknown lineage; one sample was both influenza A(H1N1)pdm09 and influenza A(H3N2) positive. The overall VE of 50% (95%CI:33–63%) was driven by predominant H3N2 activity, for which VE was 42% (95% CI:19–59%). The low VE for influenza A(H3N2) was related to virus mutations that arose during vaccine production and was not related to mutations in circulating influenza viruses.3 This emphasizes the need to monitor vaccine viruses as well as circulating influenza viruses to better understand vaccine performance. The full results are available online.
3. Integrated Public Health Information System (iPHIS)

In Ontario, public health units are required to report data on laboratory-confirmed cases of influenza to the Ministry of Health and Long-Term Care through iPHIS. The case definition for a laboratory-confirmed case of influenza reported in iPHIS is stipulated in the latest Infectious Diseases Protocol; the case definition in place for the 2012–13 season is included in Appendix B.5

3.1 Laboratory-Confirmed Cases of Influenza

3.1.1 Influenza type and Seasonality

The number of individual laboratory-confirmed cases of influenza reported in iPHIS is an underestimate of the true burden of illness from influenza, as only a portion of individuals infected with the influenza virus seek medical attention, with few individuals seeking medical attention receiving laboratory testing.6 The sensitivity of laboratory testing for influenza can be affected by the limitations of the particular laboratory testing methods as well as the timing and adequacy of the specimens sent for testing, meaning not all true positive cases will be positive based on laboratory test results. Additionally, some individuals are asymptotically infected. Therefore, the reported number of cases represents only a portion of the true number of individuals infected with the influenza virus.

The number of cases of influenza A in the 2012–13 influenza season began to increase in late October to early November 2012 (Week 44) and continued to increase until the first week of January (Week 1). The highest number of cases was reported from the middle of December 2012 to early January 2013 (Week 51 to Week 2). More influenza A cases were reported in the 2012–13 season than any of the previous four seasons, not including the influenza A(H1N1)pdm09 pandemic in the 2009–10 season. Peak influenza A activity also occurred earlier than in the previous non-pandemic seasons with the exception of the 2010–11 season (Figure 3).

While influenza A was dominant in the the early portion of the 2012–13 surveillance season, the weekly number of influenza B cases reported slowly increased from early December 2012 (Week 49) to the middle of March 2013 (Week 11). The number of influenza B cases plateaued from the middle of March through April 2013 (Week 11 to Week 16) and was higher than the weekly number of influenza A cases reported during that time (Figure 4).

Among laboratory-confirmed cases of influenza, influenza A accounted for 89.4% (8,739/9,778) of cases and influenza B represented 10.6% (1,037/9,778) of cases; there were also two cases that were co-infected with influenza A and influenza B (Figure 5). Subtype information was available for 42.0% (3,671/8,739) of laboratory-confirmed influenza A cases. Among those 3,671 cases, H3N2 was the dominant subtype, representing 90.8% (3,334/3,671) of subtyped influenza A cases. Influenza A was the dominant influenza type in all public health units with the majority of laboratory-confirmed subtyped influenza A cases being H3N2 (Table 2).
Figure 3. Laboratory-confirmed cases of influenza A: Ontario, September 1, 2007, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public health Ontario [2014/04/03].

Cases with an episode date after Week 15 in the 2008–09 season, as well as all cases from the 2009–10 influenza season, were excluded from this graph based on the assumption that the influenza burden during the pandemic period is not comparable to a regular influenza season. To allow for four comparable historical seasons, the 2007-08 season was included in the figure. Week 53 of the 2008–09 season has been removed for continuity in displaying trends.

Figure 4. Laboratory-confirmed cases of influenza B: Ontario, September 1, 2008, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public health Ontario [2014/04/03]. Week 53 of the 2008–09 season has been removed for continuity in displaying trends.
**Figure 5. Number of laboratory-confirmed cases of influenza by type and episode date: Ontario, September 1, 2012, to August 31, 2013**

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/04/03].

*Excludes two laboratory confirmed cases of influenza A and B.*
### Table 2. Cumulative number of laboratory-confirmed cases of influenza by type and subtype and by public health unit and health region: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Region</th>
<th>Public Health Unit</th>
<th>Influenza A (H1N1) pdm09</th>
<th>Influenza A No Subtype/Not Subtyped</th>
<th>H3N2</th>
<th>Influenza A and B</th>
<th>Influenza B</th>
<th>TOTAL</th>
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<tr>
<td>North West</td>
<td>Northwestern</td>
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<td>TOTAL EASTERN</td>
<td>16</td>
<td>357</td>
<td>789</td>
<td>0</td>
<td>116</td>
<td>1,278</td>
</tr>
<tr>
<td>Central East</td>
<td>Durham Region</td>
<td>26</td>
<td>81</td>
<td>93</td>
<td>0</td>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Haliburton, Kawartha, Pine Ridge</td>
<td>5</td>
<td>39</td>
<td>89</td>
<td>0</td>
<td>19</td>
<td>152</td>
</tr>
<tr>
<td></td>
<td>Peel Region</td>
<td>48</td>
<td>307</td>
<td>432</td>
<td>0</td>
<td>127</td>
<td>914</td>
</tr>
<tr>
<td></td>
<td>Peterborough County-City</td>
<td>3</td>
<td>76</td>
<td>99</td>
<td>1</td>
<td>15</td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>Simcoe Muskoka District</td>
<td>8</td>
<td>132</td>
<td>277</td>
<td>0</td>
<td>23</td>
<td>440</td>
</tr>
<tr>
<td></td>
<td>York Region</td>
<td>20</td>
<td>130</td>
<td>144</td>
<td>0</td>
<td>44</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>TOTAL CENTRAL EAST</td>
<td>110</td>
<td>765</td>
<td>1,134</td>
<td>1</td>
<td>278</td>
<td>2,288</td>
</tr>
<tr>
<td>Toronto</td>
<td>Toronto</td>
<td>136</td>
<td>1,047</td>
<td>651</td>
<td>1</td>
<td>261</td>
<td>2,096</td>
</tr>
<tr>
<td></td>
<td>TOTAL TORONTO</td>
<td>136</td>
<td>1,047</td>
<td>651</td>
<td>1</td>
<td>261</td>
<td>2,096</td>
</tr>
<tr>
<td>South West</td>
<td>Chatham-Kent</td>
<td>2</td>
<td>27</td>
<td>31</td>
<td>0</td>
<td>12</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Elgin-St. Thomas</td>
<td>1</td>
<td>22</td>
<td>41</td>
<td>0</td>
<td>4</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Grey Bruce</td>
<td>0</td>
<td>43</td>
<td>80</td>
<td>0</td>
<td>8</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>Huron County</td>
<td>1</td>
<td>20</td>
<td>45</td>
<td>0</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Lambton County</td>
<td>2</td>
<td>24</td>
<td>39</td>
<td>0</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Middlesex-London</td>
<td>6</td>
<td>71</td>
<td>377</td>
<td>0</td>
<td>29</td>
<td>483</td>
</tr>
<tr>
<td></td>
<td>Oxford County</td>
<td>1</td>
<td>30</td>
<td>35</td>
<td>0</td>
<td>4</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Perth District</td>
<td>3</td>
<td>36</td>
<td>22</td>
<td>0</td>
<td>4</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Windsor-Essex County</td>
<td>6</td>
<td>52</td>
<td>65</td>
<td>0</td>
<td>64</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>TOTAL SOUTH WEST</td>
<td>22</td>
<td>325</td>
<td>735</td>
<td>0</td>
<td>136</td>
<td>1,218</td>
</tr>
<tr>
<td>Central West</td>
<td>Brant County</td>
<td>6</td>
<td>95</td>
<td>67</td>
<td>0</td>
<td>3</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>City Of Hamilton</td>
<td>4</td>
<td>41</td>
<td>546</td>
<td>0</td>
<td>45</td>
<td>636</td>
</tr>
<tr>
<td></td>
<td>Haldimand-Norfolk</td>
<td>1</td>
<td>14</td>
<td>42</td>
<td>0</td>
<td>15</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Halton Region</td>
<td>4</td>
<td>52</td>
<td>209</td>
<td>0</td>
<td>25</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td>Niagara Region</td>
<td>7</td>
<td>72</td>
<td>168</td>
<td>0</td>
<td>18</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td>Waterloo Region</td>
<td>8</td>
<td>137</td>
<td>222</td>
<td>0</td>
<td>28</td>
<td>395</td>
</tr>
<tr>
<td></td>
<td>Wellington-Dufferin-Guelph</td>
<td>9</td>
<td>105</td>
<td>120</td>
<td>0</td>
<td>24</td>
<td>258</td>
</tr>
<tr>
<td></td>
<td>TOTAL CENTRAL WEST</td>
<td>39</td>
<td>516</td>
<td>1,374</td>
<td>0</td>
<td>158</td>
<td>2,087</td>
</tr>
<tr>
<td></td>
<td>TOTAL ONTARIO</td>
<td>337</td>
<td>3,334</td>
<td>5,068</td>
<td>2</td>
<td>1,037</td>
<td>9,778</td>
</tr>
</tbody>
</table>

**Source:** Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/04/22].

**No subtype available** includes influenza A isolates classified as not subtyped, untypeable, or indeterminate.
### 3.1.2 Geographic Distribution

The incidence rate in Ontario for laboratory-confirmed cases for the 2012–13 season was 72.4 cases per 100,000 population. Geographically, the highest number of influenza cases per 100,000 population was observed in the North East region at 110.7 cases per 100,000 population, whereas the Central East region demonstrated the lowest regional rate in the province, at 57.7 cases per 100,000 population (Table 3). Among public health units, North Bay Parry Sound District had the highest incidence rate of influenza (224.5 cases per 100,000 population), and York Region had the lowest rate (31.1 cases per 100,000 population) (Figure 6). Some of the regional differences may be explained by health-seeking behaviours, access to laboratory testing and variations in testing practices resulting in geographic variation in submission of specimens for testing.

#### Table 3. Rate and counts of influenza per 100,000 population, by health region: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Region</th>
<th>Cases</th>
<th>Rate</th>
<th>Proportion of cases</th>
<th>Proportion of Ontario’s population</th>
</tr>
</thead>
<tbody>
<tr>
<td>North West</td>
<td>188</td>
<td>78.58</td>
<td>1.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>North East</td>
<td>623</td>
<td>110.74</td>
<td>6.4%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Eastern</td>
<td>1,278</td>
<td>72.88</td>
<td>13.1%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Central East</td>
<td>2,288</td>
<td>57.72</td>
<td>23.4%</td>
<td>29.3%</td>
</tr>
<tr>
<td>Toronto</td>
<td>2,096</td>
<td>75.09</td>
<td>21.4%</td>
<td>20.7%</td>
</tr>
<tr>
<td>South West</td>
<td>1,218</td>
<td>75.71</td>
<td>12.5%</td>
<td>11.9%</td>
</tr>
<tr>
<td>Central West</td>
<td>2,087</td>
<td>80.68</td>
<td>21.3%</td>
<td>19.2%</td>
</tr>
<tr>
<td>Ontario</td>
<td>9,778</td>
<td>72.40</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care (MOHLTC), integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/04/03]. Population data obtained from IntelliHEALTH Ontario, retrieved by Public Health Ontario [2013/09/16].
Figure 6. Rate of influenza per 100,000 population (and counts, in parentheses), by public health unit: Ontario, September 1, 2012, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care (MOHLTC), integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/04/03]. Population data obtained from IntelliHEALTH Ontario, retrieved by Public Health Ontario [2013/09/16].

3.1.3 Age Distribution

The highest rates of laboratory-confirmed influenza were observed among adults over 90 years of age and children less than one year of age. The rates per 100,000 population show sharp increases among adults 75 years of age and older, as well as elevated rates in infants less than one year of age and children 1-4 years old. These age groupings, under 5 and 75 and older, accounted for 52.4% (5,128/9,778) of laboratory-confirmed cases reported in the 2012–13 season (Figure 7).
Figure 7. Rate of laboratory-confirmed cases of influenza per 100,000 population, by age group and type: Ontario, September 1, 2012, to August 31, 2013

3.1.4 Hospitalizations and Deaths

Public health units are required to report hospitalizations and deaths occurring in laboratory-confirmed cases of influenza.\(^7\) Deaths are included where reported in any laboratory-confirmed case, whether or not the death is attributed to influenza. In addition, the numbers of hospitalizations and deaths reported in iPHIS are an underestimate of the true experience in the Ontario population due to underreporting and thus need to be interpreted with caution.

During the 2012–13 influenza season, a total of 3,698 hospitalizations and 292 deaths were reported among laboratory-confirmed cases of influenza. Adults 65 years of age and older accounted for the majority of laboratory-confirmed cases with severe outcomes, including more than 50% of hospitalizations and over 80% of deaths (Table 4). Children less than one year of age had the highest rate of hospitalizations (Table 4). Older adults (aged 65 years and older) had the highest mortality rate (Table 4).
Table 4. Hospitalizations and deaths among laboratory-confirmed influenza cases by age group: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Hospitalizations</th>
<th>Rate per 100,000</th>
<th>Deaths</th>
<th>Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>&lt;1</td>
<td>213</td>
<td>5.8</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>1-4</td>
<td>327</td>
<td>8.8</td>
<td>5</td>
<td>1.7</td>
</tr>
<tr>
<td>5-19</td>
<td>194</td>
<td>5.2</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>20-44</td>
<td>296</td>
<td>8.0</td>
<td>11</td>
<td>3.8</td>
</tr>
<tr>
<td>45-64</td>
<td>592</td>
<td>16.0</td>
<td>32</td>
<td>11.0</td>
</tr>
<tr>
<td>65+</td>
<td>2,073</td>
<td>56.1</td>
<td>239</td>
<td>81.8</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>0.1</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,698</td>
<td>100.0</td>
<td>292</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care (MOHLTC), integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/03/25]. Population data obtained from IntelliHEALTH Ontario, retrieved by Public Health Ontario [2013/09/16].

The majority of laboratory-confirmed influenza cases who had a severe outcome during the 2012–13 season were infected with influenza A, which accounted for 90.1% (3,332/3,698) of hospitalizations and 93.1% (272/292) of deaths (Table 5). The proportion of severe outcomes by influenza type and subtype is similar to the relative frequency with which the strains circulated during the season.

Table 5. Hospitalizations and deaths among laboratory-confirmed influenza cases by influenza type and subtype: Ontario, September 1, 2012 to August 31, 2013

<table>
<thead>
<tr>
<th>Subtypes</th>
<th>Hospitalizations</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Influenza A (H1N1)pdm09</td>
<td>153</td>
<td>4.1</td>
</tr>
<tr>
<td>Influenza A (H3N2)</td>
<td>1,363</td>
<td>36.9</td>
</tr>
<tr>
<td>Influenza A unsubtyped*</td>
<td>1,816</td>
<td>49.1</td>
</tr>
<tr>
<td>Influenza B</td>
<td>365</td>
<td>9.9</td>
</tr>
<tr>
<td>Influenza A and B</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,698</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care (MOHLTC), integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/03/26]

*Influenza A cases may not have had subtyping performed or the information may not have been entered into iPHIS. It is assumed based on the breakdown of the subtyped cases that the majority of the unsubtyped cases are influenza A (H3N2).
The highest numbers of hospitalizations occurred in laboratory-confirmed cases of influenza with episode dates in Weeks 52 and 1, with 562 and 563 hospitalizations, respectively (Figure 8).

Figure 8. Number of hospitalizations among laboratory-confirmed cases of influenza, by episode date: Ontario, September 1, 2012, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care (MOHLTC), integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/03/26]

A total of 292 deaths were reported among laboratory-confirmed influenza cases for the 2012–13 influenza season (Figure 9). Based on the date of death, the most deaths occurred in Week 2, with 57 reported deaths that week.
3.2 Respiratory Infection Outbreaks in Institutions: Ontario, 2012–13

Since 2001, public health units in Ontario have been required to report all confirmed respiratory infection outbreaks in institutions to the Ministry of Health and Long-Term Care.\(^8\) Data were collected and analyzed for outbreaks that occurred in long-term care homes (LTCHs), retirement homes (RHs) with more than 10 residents, acute care hospitals (ACHs), chronic care hospitals, and other hospitals under the Public Hospitals Act (PHA).\(^9\)

3.2.1 Geographic Location

There were 1,437 confirmed institutional respiratory infection outbreaks reported in iPHIS from September 1, 2012, to August 31, 2013. The number of institutional respiratory infection outbreaks reported by health region ranged from 19 in the North West region to 347 reported by the Central West region. The highest percentage of outbreaks reported was among the Central West and Central East health regions, which represent a higher proportion of the Ontario population overall (Table 6). Relative to their proportion of the Ontario population, a higher proportion of outbreaks were reported in the South West and Central West regions. The number of outbreaks reported by public health units ranged from five reported from Northwestern Health Unit to 212 reported from Toronto Public Health.
Table 6. Number of institutional respiratory infection outbreaks by health region: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Health Region</th>
<th>Count (n)</th>
<th>Percentage of Outbreaks (%)</th>
<th>Proportion of Population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North West</td>
<td>19</td>
<td>1.3</td>
<td>1.8</td>
</tr>
<tr>
<td>North East</td>
<td>92</td>
<td>6.4</td>
<td>4.2</td>
</tr>
<tr>
<td>Toronto</td>
<td>212</td>
<td>14.8</td>
<td>20.7</td>
</tr>
<tr>
<td>Eastern</td>
<td>235</td>
<td>16.4</td>
<td>13.0</td>
</tr>
<tr>
<td>South West</td>
<td>265</td>
<td>18.4</td>
<td>11.9</td>
</tr>
<tr>
<td>Central East</td>
<td>267</td>
<td>18.6</td>
<td>29.3</td>
</tr>
<tr>
<td>Central West</td>
<td>347</td>
<td>24.1</td>
<td>19.2</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>1,437</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/05/06]. Population data obtained from IntelliHEALTH Ontario, retrieved by Public Health Ontario [2013/09/16].

### 3.2.2 Identified Organisms

Of the 1,437 reported respiratory infection outbreaks in institutions, 646 (45.0%) were laboratory-confirmed influenza outbreaks. Influenza A was identified in 592 (41.2%) outbreaks, influenza B in 46 (3.2%) outbreaks, and both influenza A and B were identified in eight outbreaks (0.6%). Among institutional outbreaks of influenza, influenza A was identified in 91.6% of outbreaks, influenza B was identified in 7.1%, and both influenza A and B were identified in 1.2% of outbreaks. Other respiratory viruses were identified as the causative organism in 634 (44.0%) of all respiratory infection outbreaks. There were 157 (11.0%) institutional respiratory infection outbreaks for which no organism was identified in iPHIS (Table 7).
Table 7. Number of respiratory infection outbreaks, by causative organism: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Causative Organism</th>
<th>Number of Outbreaks</th>
<th>Percentage of Total Outbreaks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Influenza A</em></td>
<td>592</td>
<td>41.2</td>
</tr>
<tr>
<td><em>Influenza B</em></td>
<td>46</td>
<td>3.2</td>
</tr>
<tr>
<td><em>Influenza A and B</em></td>
<td>8</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Influenza Total</strong></td>
<td>646</td>
<td>45.0</td>
</tr>
<tr>
<td><em>Entero/rhinovirus</em></td>
<td>248</td>
<td>17.3</td>
</tr>
<tr>
<td><em>Other organisms</em></td>
<td>135</td>
<td>9.4</td>
</tr>
<tr>
<td><em>Combined Outbreaks</em>†</td>
<td>104</td>
<td>7.2</td>
</tr>
<tr>
<td><em>RSV</em></td>
<td>80</td>
<td>5.6</td>
</tr>
<tr>
<td><em>Parainfluenza (All types)</em></td>
<td>67</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Other Respiratory Viruses Total</strong></td>
<td>634</td>
<td>44.0</td>
</tr>
<tr>
<td><strong>No Organism Identified</strong></td>
<td>157</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,437</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/05/06].

*Other organisms include institutional respiratory infection outbreaks involving other aetiological agents, such as human metapneumovirus, adenovirus, or coronavirus.

†Combined outbreaks include institutional respiratory infection outbreaks in which more than one non-influenza organism has been identified (e.g., RSV, parainfluenza, rhinovirus, etc.).

**No organism identified includes those institutional respiratory infection outbreaks for which no aetiological agents were reported, including unknown, no organism identified, and missing values.

3.2.3 Institution Types

Of the 1,437 reported respiratory infection outbreaks in institutions, 62.4% (897/1,437) occurred in LTCHs. A smaller percentage of outbreaks occurred in RHs and hospitals which accounted for 15.3% (220/1,437) and 6.3% (91/1,437) of all outbreaks respectively (Figure 10). The institution type for 15.2% (219/1,437) of the respiratory infection outbreaks was not specified in iPHIS (Figure 10).

Of all the institutional influenza outbreaks reported, 55.6% (359/646) were in LTCHs, 20.4% (132/646) were in RHs, and 8.7% (56/646) occurred in hospitals. Influenza outbreaks represented 61.5% (56/91) of all respiratory infection outbreaks reported in hospitals, and 40.0% (359/897) of all respiratory infection outbreaks reported in LTCHs. The institution type for 14.4% (93/646) of the institutional influenza outbreaks was not specified in iPHIS (Figure 10).

Of all the institutional outbreaks with respiratory viruses other than influenza detected, 70.3% (446/634) were in LTCHs, 10.9% (69/634) were in RHs, 4.4% (28/634) occurred in hospitals, and the institution type for 13.7% (87/634) was not specified in iPHIS (Figure 10).
A higher percentage of outbreaks in LTCHs, 9.2% (92/897), had no organism identified than in other institution types. The proportion of outbreaks with no organism identified in hospitals was 0.7% (7/91) and 1.9% (19/220) in RHs.

**Figure 10.** Respiratory infection outbreaks by causative organism and institution type: Ontario, September 1, 2012, to August 31, 2013

Of the 91 respiratory infection outbreaks that occurred in hospitals, 27.5% (25/91) occurred in ACHs, 57.1% (52/91) were in chronic care hospitals, 14.3% (13/91) were in psychiatric hospitals, and one was in a hospital not regulated under the PHA (Figure 11). Of the 56 influenza outbreaks that occurred in hospitals, 48.2% (27/56) were reported in chronic care hospitals, 32.1% (18/56) were in chronic care hospitals and 19.6% (11/56) were in psychiatric hospitals (Figure 11).
**3.2.4 Outbreak Duration**

Outbreak duration was defined as the number of days from the onset date of illness in the first case until the date the outbreak was declared over. Due to the wide range of data reported in iPHIS, median results are summarized below.

The median duration for all respiratory infection outbreaks for which data were available (95.0% of all outbreaks; 1,365/1,437) was 16.4 days (range: 3 to 94 days). For the 2012–13 season, the median outbreak duration for influenza A outbreaks and influenza B outbreaks at 15.6 days (range: 4 to 71 days) and 16.0 days (range: 7 to 94 days), respectively, were both lower than the median duration of outbreaks caused by other respiratory viruses (Table 8). The median duration of the eight outbreaks where both influenza A and B were identified was 19.3 days (range: 11 to 37 days) (Table 8).

The median duration of respiratory infection outbreaks caused by RSV was 19.2 days (range: 7 to 65 days), the highest median duration compared to all other respiratory viruses. The median duration for respiratory infection outbreaks in which an organism was not identified was 15.4 days (range: 6 to 50 days) (Table 8).
### Table 8. Median duration of institutional respiratory infection outbreaks by causative organism: Ontario, September 1, 2012, to August 31, 2013

<table>
<thead>
<tr>
<th>Causative Organism</th>
<th>Number of outbreaks*</th>
<th>Median Outbreak Duration (Days)</th>
<th>Range (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined **</td>
<td>98</td>
<td>18.5</td>
<td>6 to 51</td>
</tr>
<tr>
<td>Influenza A</td>
<td>562</td>
<td>15.6</td>
<td>4 to 71</td>
</tr>
<tr>
<td>Influenza B</td>
<td>45</td>
<td>16.0</td>
<td>7 to 94</td>
</tr>
<tr>
<td>Influenza A and B</td>
<td>8</td>
<td>19.3</td>
<td>11 to 37</td>
</tr>
<tr>
<td>Entero/rhinovirus</td>
<td>242</td>
<td>16.0</td>
<td>3 to 69</td>
</tr>
<tr>
<td>Parainfluenza virus (PIV)</td>
<td>64</td>
<td>18.3</td>
<td>5 to 57</td>
</tr>
<tr>
<td>Respiratory Syncytial Virus (RSV)</td>
<td>76</td>
<td>19.2</td>
<td>7 to 65</td>
</tr>
<tr>
<td>Other organisms ***</td>
<td>128</td>
<td>18.4</td>
<td>7 to 45</td>
</tr>
<tr>
<td>No organism identified</td>
<td>142</td>
<td>15.4</td>
<td>6 to 50</td>
</tr>
<tr>
<td><strong>All organisms</strong></td>
<td><strong>1,365</strong></td>
<td><strong>16.4</strong></td>
<td><strong>3 to 94</strong></td>
</tr>
</tbody>
</table>

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/05/06].

*The median outbreak duration could not be calculated for 72 institutional respiratory infection outbreaks due to missing outbreak onset date and/or declared over date.

**Combined outbreaks include outbreaks in which more than one non-influenza organism has been identified (e.g., RSV, parainfluenza, rhinovirus, etc.).

***Other organisms include outbreaks involving other aetiological agents, such as human metapneumovirus, adenovirus, and coronavirus.

### 3.2.5 Seasonal Trends

The number of institutional respiratory infection outbreaks peaked from December 2012 to January 2013 with 389 and 270 outbreaks reported, respectively in each month. Peak activity for institutional respiratory infection outbreaks during the 2012–13 season was driven by influenza outbreaks (Figures 12 and 13). In December 2012, 78.1% (304/389) of the outbreaks were due to influenza. The proportion of outbreaks caused by influenza decreased to 67.4% (182/270) in January 2013. Most of the influenza outbreaks occurring in these months were influenza A outbreaks (Figure 12). Unlike influenza outbreaks which were concentrated in December and January, entero/rhinovirus outbreaks occurred throughout the surveillance season. While more entero/rhinovirus outbreaks were reported in September and October, there were only a few weeks during the whole season where an entero/rhinovirus outbreak did not occur (Figure 13). Outbreaks caused by respiratory syncytial virus mostly occurred from the end of December until the end of April (Week 51 to Week 17) (Figure 13).
Figure 12. Number of institutional respiratory infection outbreaks by causative agent and month: Ontario, September 1, 2012, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/05/06].

*No organism identified includes those institutional respiratory infection outbreaks for which no aetiological agents were reported, including unknown, no organism identified, and missing values.

**A total of 23 institutional respiratory infection outbreaks were missing the date of onset of illness for the first case and were excluded from this figure.
**Figure 13.** Number of institutional respiratory infection outbreaks by causative agent and reporting week: Ontario, September 1, 2012, to August 31, 2013

Source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/05/06]

*Other organisms include institutional respiratory infection outbreaks involving other aetiological agents, such as entero/rhinovirus, parainfluenza, respiratory syncytial virus, human metapneumovirus, adenovirus, and coronavirus

**No organism identified includes those institutional respiratory infection outbreaks for which no aetiological agents were reported, including unknown, no organism identified, and missing values.

***A total of 23 institutional respiratory infection outbreaks were missing the date of onset of illness for the first case and were excluded from this figure.
4. Public Health Agency of Canada / College of Family Physicians of Canada FluWatch Program

4.1 Summary of ILI Consultation Rates

The Public Health Agency of Canada coordinates with the College of Family Physicians of Canada to recruit physicians who volunteer to act as sentinels and report weekly on the total number of patients they have seen and how many of those patients had influenza-like-illness (ILI). The median number of sentinels reporting each week from September 1, 2012, to August 31, 2013 was 55.5 (range: 32 to 88). The ILI rates increased and remained above the five-year average from Week 44 to Week 5 (October 28, 2012 to February 2, 2013) (Figure 14); this corresponds to the most intense influenza A activity based on percent positivity and the number of laboratory-confirmed cases reported, with the highest ILI rates reported from Week 52 to Week 2 (Figure 14). While the ILI rate was highest in Week 52, these data need to be interpreted with caution due to the low number (32) of sentinels reporting in that week.

Figure 14. Influenza-like-illness (ILI) consultation rate (per 1,000 patient visits) reported by sentinel sites, by surveillance week: Ontario, September 1, 2012, to August 31, 2013

Source: Public Health Agency of Canada (PHAC), FluWatch ILI sentinel surveillance reporting

Sentinel information is reported to Public Health Agency of Canada. Due to small numbers of sentinels reporting (particularly for Week 52, of 2012 due to reduced reporting over the holidays), readers are advised to review overall trends and place less emphasis on week to week fluctuations.

Ontario average ILI rates include data from the 2006–07 to the 2011–12 seasons, excluding ILI rates during the time period of the influenza pandemic in Ontario (April 2009 to January 2010) due to the incomparability of those rates to a regular influenza season.
5. Influenza Immunization Coverage in Long-Term Care Homes and Hospitals

As per the Ontario Influenza Prevention and Surveillance Protocol for Long-Term Care Facilities (Appendix 9 of *A Guide to the Control of Respiratory Infection Outbreaks in Long-Term Care Homes*, 2014) and the Influenza Surveillance Protocol for Ontario Hospitals (2014), seasonal influenza immunization coverage for staff of LTCHs and public hospitals are reportable to the local Medical Officer of Health. For the 2012–13 season, institutions were asked to report their institutional influenza immunization coverage as of December 15, 2012 to the local Medical Officer of Health. This information was then reported to the Ministry of Health and Long-Term Care by January 15, 2013. Immunization data were available for 93.1% (584/627) of LTCHs and for 91.3% (209/229) of hospitals in Ontario.

In 2009–10, seasonal influenza immunization coverage was low as health care workers received the pandemic influenza A (H1N1)pdm09 influenza vaccine, not the seasonal influenza vaccine. The median influenza immunization coverage seen in the 2011–12 and 2012–13 seasons, was higher than 2010–11. These increases reflect a continued rebound in influenza immunization coverage which began after the 2009–10 season. Influenza immunization coverage had approached pre-pandemic coverage rates for the 2012–13 season (Figure 15).

**Figure 15.** Median influenza immunization coverage among LTCH and hospital staff, by influenza season: Ontario, 2003–04 to 2012–13 seasons

Source: Ontario Ministry of Health and Long-Term Care, Ontario Influenza Immunization Database [as of 2013/01/31]; analyzed by Public Health Ontario [2013/03/06].

Notes: For the 2012–13 influenza season, immunization coverage was reported as of December 15. In prior seasons, immunization coverage as of November 15 was reported.

*Not Collected: LTCH resident immunization coverage was not collected for the 2012–13 surveillance season.
6. Summary

The 2012–13 season was one in which there was extensive influenza activity consisting of an initial wave of influenza A infections and outbreaks in the winter with a distinctive influenza B peak in the spring. Influenza activity was observed across the province with laboratory-confirmed cases and outbreaks reported from all public health units, which is typical for each influenza season. The reported rates of influenza were high in various public health units around the province and were particularly high among some public health units in Northern Ontario. As expected, the highest rates for laboratory-confirmed influenza were observed in people under the age of five and over the age of 65, with the highest rates being seen in people over the age of 90.

Influenza activity in the 2012–13 season resulted in numerous institutional outbreaks as well as hospitalizations and deaths among laboratory-confirmed cases of influenza. The number of hospitalizations and deaths among these cases, albeit underestimated, highlight the potentially severe nature of influenza infection. Influenza outbreaks constituted the majority of respiratory infection outbreaks reported in hospitals as well as many of the respiratory infection outbreaks reported in LTCHs. The presence of these influenza outbreaks, in addition to hospitalizations and deaths among laboratory-confirmed cases of influenza underscores the importance of seasonal influenza immunization. With respect to health care worker influenza immunization, the median coverage among staff at LTCHs was almost 75% for the 2012–13 season while the median for hospital staff was approximately 50%.

Throughout the 2012–13 surveillance season, Public Health Ontario (PHO) provided regular updates on the epidemiology of influenza and other respiratory viruses via the Ontario Respiratory Virus Bulletin and the Laboratory-Based Respiratory Pathogen Surveillance report. PHO remains committed to the ongoing provision of regular and timely surveillance reports.
References


Appendix A: Technical notes

Data Sources

Ontario reportable disease data

In Ontario, influenza is specified as reportable under Regulation 559/91 pursuant to the Health Protection and Promotion Act (HPPA), R.S.O 1990. Public Health Ontario (PHO) is aware of cases and related data elements reported by the local public health units in accordance with the HPPA, Ontario Regulation 569, the Ontario Public Health Standards, and the Infectious Diseases Protocol.

The Public Health Ontario Laboratories (PHOL) were the main source for laboratory test data used in this report. The PHOL perform the majority of testing for influenza and other respiratory viruses however this is also done by a number of hospital laboratories. Therefore, the number of positive specimens contained in this report does not represent the total number of positive results in Ontario.

The main source for influenza case (laboratory-confirmed case counts and calculated incidence rates) and respiratory infection outbreak data in this report is the integrated Public Health Information System (iPHIS), the electronic reporting system for reportable diseases in Ontario. iPHIS replaced the Reportable Diseases Information System (RDIS) and was implemented in phases throughout 2005 starting on April 1, with full implementation by all 36 local public health units by the end of that year.

- Laboratory data from the PHOL were extracted from the Laboratory Information Management System on September 3, 2013.
- The iPHIS data used in this report were extracted between March 3 and May 6, 2014.

Additional data sources were used to supplement PHOL and iPHIS data:

Population data

IntelliHEALTH Ontario is a repository of health-related data that describes the population and delivery of health care services in Ontario. Population counts for Ontario, originally sourced from Statistics Canada, were obtained from IntelliHEALTH for this report. Unless otherwise specified, population and live birth data for Ontario were extracted by PHO from IntelliHEALTH on September 16, 2013. The data, stratified by age and public health unit, were used as denominators to calculate overall, age-, and geographic-specific crude incidence rates, where applicable.

National Microbiology Laboratory data

The National Microbiology Laboratory (NML) is Canada’s reference laboratory and performs influenza strain characterization. NML receives a proportion of influenza isolates from provincial laboratories for strain characterization and antiviral resistance testing. The data used in this report were for Ontario and Canada and were published on September 2, 2013. The data include counts of influenza cases by strain.

Sentinel physician influenza-like illness (ILI) consultation rates

The Public Health Agency of Canada coordinates with the College of Family Physicians of Canada to recruit physicians who volunteer to act as sentinels and report weekly on the total number of patients they have seen and how many of those patients had ILI. These data are obtained on a weekly basis throughout the respiratory infection surveillance season. Data from 2006 to 2013 were compiled for use
in this report. The sentinel physicians reporting may be different from week to week and may not have participated in every year of data used in this report.

**Reports of influenza immunization rates for residents/staff of LTCHs / Hospitals**

As per the Ontario Influenza Prevention and Surveillance Protocol for Long-Term Care Facilities (Appendix 9 of *A Guide to the Control of Respiratory Infection Outbreaks in Long-Term Care Homes*, 2014) and the *Influenza Surveillance Protocol for Ontario Hospitals* (2014), seasonal influenza immunization coverage rates for staff of long term care homes and public hospitals are reportable to the local Medical Officer of Health. The Ministry of Health and Long-Term Care (MOHLTC) maintains the Ontario Influenza Immunization Database where these data are reported and stored. Data for the current season were extracted as of January 31, 2013.

**Laboratory data**

Laboratory detection of respiratory viruses at PHOL includes testing through viral culture, nucleic acid amplification testing (NAAT), including polymerase chain reaction (PCR) and rapid antigenic testing. Results from rapid testing are not included in this report because more sensitive testing is done to confirm positive results.

Laboratory data represent the number of specimens tested, which may not necessarily correspond with the number of patients because more than one specimen may have been submitted per patient.

Percent positivity is defined as the number of specimens positive for a particular virus divided by the number of specimens tested for that virus over a specified time period, multiplied by 100.

For the purposes of this report, increased activity for a particular virus is defined as percent positivity greater than 5% for two consecutive weeks.

Several changes in testing algorithms were performed in the laboratory during the 2012–13 season to streamline the process during periods of high volume testing. These changes can result in fewer or different tests being performed and need to be considered when interpreting these data. In accordance with the laboratory testing algorithm, not all specimens were tested by the same method and therefore not all specimens are tested for the same viral pathogens. For example, community-based specimens (not including VE study samples) were tested by viral culture, which is less sensitive than molecular methods and is not able to detect coronavirus and human metapneumovirus.

Decreased testing is noted during weekends and holidays, which is likely related to decreased specimen collection/submission during this time and therefore may artificially impact percent positivity.

The specimen collection date was used for most of the analysis; however, if it was missing, the date the specimen was received at the laboratory was used.

**Case Definitions**

Appendix B lists the case classifications for influenza in Ontario for the 2012–13 season. The most recent provincial case definitions are available online in Appendix B of the Infectious Diseases Protocol.

Changes to provincial surveillance case definitions and disease classifications have occurred over the years to reflect the changing epidemiology of infectious diseases and the use of more current laboratory diagnostic practices and technology. Cases are classified in iPHIS according to MOHLTC’s surveillance case definitions used at the time the case was identified, and public health units are responsible for
ensuring that cases reported to the province meet the relevant case definition. Consideration of changes to provincial case definitions and associated case classifications over time are important when interpreting any disease trends presented in this report.

**Case Classifications**

Unless otherwise stated, case counts include only the confirmed case classification.

**Descriptive Measures**

The descriptive measures used throughout the report to characterize the epidemiology of reportable infectious diseases in Ontario are listed below.

**Case counts**

This measure refers to the total number of reported cases of laboratory-confirmed influenza in a given respiratory infection surveillance season and within a select group or subgroup that were reported as confirmed.

Influenza cases are counted in the respiratory infection surveillance season within which they occurred. Respiratory infection surveillance seasons run from September 1 of one year to August 31 of the following year. For example, the 2012–13 influenza season started on September 1, 2012, and ended on August 31, 2013.

**Respiratory infection outbreaks in institutions**

Respiratory infection outbreaks in institutions have been reportable since 2001 in Ontario in accordance with the HPPA. Based on information provided by hospitals and long-term care homes, the data presented on respiratory infection outbreaks in institutions in this report was obtained from iPHIS and analyzed as follows:

- Outbreaks are allocated to month based on the onset date of illness for the first (earliest) case.
- Duration was calculated based on the time between the date the outbreak was declared over and the onset date of illness for the first (earliest) case.

**Crude incidence rates (reported as rates per 100,000 population per year)**

Crude incidence rates are calculated by dividing the total case count in a year by the total number of people at risk of acquiring the disease in that year. As specified in the “Case counts” section above, the total case count consists of confirmed cases. In this report, rates are presented per 100,000 population. The formulas for calculating overall and population-specific rates used throughout the report are noted below (using the example of rates presented per 100,000 population).

\[
\text{Number of cases in specified time period and population} \quad \frac{\text{Total number of people in that population}}{} \times 100,000
\]

*Overall:* Number of all new cases over a specified time period divided by the Ontario population for that time period, multiplied by 100,000.

*Group-specific:* Number of new cases in a subgroup (e.g., age group, sex, or public health unit) over a specified time period divided by the Ontario population for that subgroup for that time period, multiplied by 100,000.
In general, incidence rate is defined as the number of new cases of disease occurring within a defined period. Throughout the report, the term “incidence rate” refers to an annual rate (e.g., the number of cases observed for every 100,000 Ontarians per respiratory infection surveillance season), unless otherwise specified. Cases are attributed to a particular year based on their “episode date” as outlined in the section “Data Management: Reference Period” below.

**Public health unit distribution**

Unless otherwise specified, this measure refers to the number of new cases reported by each public health unit in the 2012–13 season. Crude incidence rates are also provided for each public health unit, and are calculated as per the group-specific incidence rate formula described above. In some instances, public health unit counts have been aggregated based on geographic location, e.g., North West region.

Orientation of case counts by public health unit is based on the diagnosing health unit (DHU), which refers to the case's public health unit of residence at the time of illness onset, and does not necessarily reflect the location of exposure or diagnosis. iPHIS Bulletin 13 provides additional detail on scenarios in which a public health unit is considered the DHU. Cases for which the DHU was reported as MOHLTC (to signify a case that is not a resident of Ontario) or Muskoka Parry Sound (a public health unit that no longer exists) have been excluded.

To compare relative distributions, incidence rates by public health unit were presented in a maps using quartiles to group rates into categories for mapping.

**Age distribution**

Age groups for cases were based on standard five year age groupings. When looking at hospitalizations and deaths, aggregation of those five year age groupings were used.

**Hospitalization**

This measure refers to the proportion of laboratory-confirmed cases that were reported as hospitalized. In this report, a case is considered hospitalized if at least one hospital admission date was recorded for the case of interest. It should be noted that under-reporting of hospitalizations may occur in iPHIS, as hospitalizations and admission dates may not always be reported to public health units.

**Deaths**

This measure refers to laboratory-confirmed cases of influenza that died while ill. It does not take into account cause of death ascertainment.

**Subtype/Strain**

The number and proportion of cases that represent distinct subtypes or strains of influenza are provided.

**Analysis Software**

Data analysis and presentation for this report were completed using SAS version 9.3, and Microsoft Excel 2010 with the PowerPivot add-in.
**iPHIS Data Management**

*Reference period*

The majority of information in this report reflects the number of incident cases reported in Ontario through iPHIS with episode dates from September 1, 2012, to August 31, 2013. Passive surveillance systems such as iPHIS generally accommodate the entry of several dates to estimate the symptom onset date when it is not available. In Ontario, cases of influenza are classified by time using the episode date, which is an estimate of the symptom onset date of disease. In order to determine the episode date, the following hierarchy is in place in iPHIS:

1. Symptom onset date
2. Specimen collection date
3. Lab test date (date laboratory testing was performed)
4. Reported date (date the case was reported to the public health unit).

During data extraction, the earliest date available at each stage in the hierarchy was selected as the episode date for each case. For example, if an onset date had been entered, it was selected as the episode date instead of the specimen collection date and so on. In some situations, the episode dates captured can be much later than the date of symptom onset (e.g., when the only date available is the reported date).

*Case ascertainment criteria*

This report includes all confirmed reports of influenza made through iPHIS with an episode date in the 2012–13 respiratory infection surveillance season, with the following exclusions:

1. Cases who were not residents of Ontario at the time of diagnosis
2. Cases reported with a Disposition Status of “ENTERED IN ERROR,” “DOES NOT MEET DEFINITION,” “DUPLICATE-DO NOT USE”, or any variation on these values.

*Respiratory infection outbreaks in institutions ascertainment criteria*

Respiratory outbreaks that did not meet the provincial case definition for respiratory infection outbreak in an institution were removed from the analysis (see Appendix B for the definition).

Therefore, the report includes all respiratory infection outbreaks with an Outbreak Classification entered as “Confirmed” or “Suspict” reported through iPHIS meeting provincial case definition for a confirmed respiratory infection outbreak with an onset of illness in the first case during the 2012–13 season. If the onset of illness in the first case was missing, the date the outbreak was created was used to ascertain whether the outbreak belonged in the 2012–13 season. In the instance that more than one aetiological agent including influenza was identified in an outbreak, the outbreak was classified as an influenza outbreak. Where more than one non-influenza organism was identified in an outbreak, the outbreak was classified as a combined outbreak.

*Data Limitations*

*Accuracy of data*

PHO provides public health units with preliminary case counts for the previous year in February or March for review and cleaning. This data is subsequently re-extracted in June and reported to Public
Health Agency of Canada as Ontario’s case counts for the previous year. However, iPHIS is a dynamic disease reporting system that allows ongoing updates to data previously entered. As a result, any data extracted from iPHIS, including the data used in this report, represent a snapshot at the time of extraction and may differ from previous or subsequent reports. Discrepancies in disease counts and rates provided in this report and other published data may exist due to:

- late reporting
- local and/or provincial-led data cleaning initiatives
- differences in data extraction dates.

Where such variability exists, data provided in other versions of this report, other PHO surveillance products (e.g., Monthly Infectious Diseases Surveillance Report), or published research may be a more appropriate source depending on how the methodology, data caveats, and/or extraction dates align with the intended use of the data.

**Under-reporting**

Passive surveillance systems such as iPHIS that primarily rely on mandatory physician and laboratory reports of illness can be characterized by under-reporting the true burden of illness. Case counts only represent known cases reported to public health units and recorded in iPHIS. The resulting degree of under-reporting is influenced by a variety of factors such as disease awareness, medical care-seeking behaviours, availability of health care, methods of laboratory testing, reporting behaviours, testing practice, and severity of illness. The degree to which under-reporting occurs has not been fully assessed but may be significant for influenza and/or respiratory infection outbreaks in institutions in Ontario.

**Duplicates**

The possibility of duplicates exists because duplicate sets are not identified and excluded unless they were resolved prior to data extraction either at the local or provincial level.

**Missing data (data not reported to/by public health units)**

Data quality (completeness) for some fields is lower than others. Hospitalization and death are under-reported in iPHIS, with the degree of under-reporting influenced by the severity of illness and associated outcomes (e.g., less under-reporting if illness or outcomes are more severe) and the timing of the event (i.e., there is likely less under-reporting if hospitalization or deaths occur shortly after symptom onset, or before case investigations are complete). In general, the degree of under-reporting is influenced by a combination of factors including incomplete follow-up of cases (e.g., case is not reachable), incomplete or late entry of data in iPHIS, and the occurrence of deaths after follow-up has been completed.

Cases may also not be diagnosed or reported to public health units, or may be reported but not entered into iPHIS. While these processes result in under-reporting, they are not accounted for in the analyses completed for this report.
Appendix B: Case Definitions

iPHIS reports of institutional respiratory infection outbreaks and laboratory-confirmed cases of influenza from public health units across Ontario

The criteria for an institutional respiratory outbreak and for confirmed cases of influenza were the following as indicated in the latest Infectious Diseases Protocol (2009)\textsuperscript{15}

**Confirmed respiratory infection outbreak in a Long-Term Care Home**

Two cases of acute respiratory tract illness within 48 hours, at least one of which must be laboratory-confirmed

OR

Three cases of acute respiratory illness (laboratory confirmation not necessary) occurring within 48 hours in a geographic area (e.g., unit, floor)

OR

More than two units having a case of acute respiratory tract illness within 48 hours

**Confirmed influenza outbreak in a hospital**

Two or more cases of nosocomially acquired influenza-like illness occurring within 48 hours on a specific hospital unit, with at least one case laboratory-confirmed as influenza

**Confirmed case of influenza**

Clinically compatible signs and symptoms with:

- Laboratory confirmation by detection or isolation of influenza virus from appropriate clinical specimen/s (e.g., nasopharyngeal/ throat swabs)
- Demonstration of a significant (i.e., fourfold or greater) rise in complement fixation antibody titres to influenza between acute and convalescent sera
- An epidemiologic link to a laboratory-confirmed case\textsuperscript{1}
- Detection of influenza-specific ribonucleic acid (RNA)

\textsuperscript{1} An epidemiologic link to a laboratory-confirmed case applies to institutional outbreaks only