CHAPTER 1: INFLUENZA

Highlights

- In Peel and Ontario, the incidence of influenza in the 2003/2004 season was the highest it has been in the last nine seasons. This is most likely due to increased use of newly available and convenient rapid tests for influenza and increased monitoring of respiratory infections in response to Severe Acute Respiratory Syndrome (SARS).
- In Peel, the reported incidence of influenza is highest in those aged less than five years and those 60 years and older. This may reflect the fact that these age groups are more likely to have a serious illness from influenza and be tested.
- The predominant strain of influenza that circulated in Ontario and Canada during the 2003/2004 influenza season was A/Fujian/411/02-like.
- During the 2003/2004 influenza season there were 21 outbreaks of influenza A in institutions reported by the Region of Peel Health Department to the Ontario Ministry of Health and Long-Term Care. The number of outbreaks for 2003/2004 was the highest since these data started to be collected in 1997/1998.

Introduction

Influenza (commonly known as the flu) is a serious respiratory infection that is caused by the influenza virus. Various strains of the virus circulate throughout the world year-round, causing local outbreaks. In Canada, influenza season usually runs any time from October to April. Most influenza activity occurs within a one or two month period during this time. It is estimated that between 10-25% of Canadians may become infected with influenza each year.[1] Although most of these people recover completely, many Canadians, mostly seniors, die every year from pneumonia and from other serious complications related to influenza. Health Canada estimates the number of deaths in Canada from influenza to be 700 to 2,500 per year.[2]

Vaccination, which is available before and during each influenza season, decreases the incidence and severity of disease.

History of Influenza

Historians can trace the past epidemics of influenza by examining reports for the signs, symptoms, extensiveness and explosive nature of previous outbreaks - widespread outbreaks of a rapidly spreading respiratory disease with fever that is accompanied by high rates of complications such as pneumonia and an excess of deaths is likely to have been influenza. Reports of influenza have changed

from the early Greek writings of 412 BC describing diseases which may have been influenza to the laboratory confirmed reporting done today. The term "influenza" resulted from an epidemic in 1357, to which Buonissequi referred as the "grande influenza." This Italian word for "influence" was used as a collective term for various causes of widespread epidemics.[3] After 1650, the term influenza is found regularly in scientific and lay publications. By 1700 onwards, the amount of information on influenza outbreaks increased and improved in quality so that people today can have an idea of the numbers of people infected, the severity of illness, the countries involved and the possible origins of some outbreaks.[3]

In Canada, influenza appeared in epidemic proportions on at least seven occasions during the 19th century. The effects of the epidemic of 1832 were masked by cholera and those of the epidemic of 1847/1848 by typhus, but the eradication of other diseases was not the only reason influenza grew in importance by the end of the 1800s. The epidemic of 1889/1890 was particularly widespread, affecting 40% of the world's population.[4]

Local historian William Perkins Bull noted the impact of influenza on communities here in Peel.[5] In 1874, there was a widespread outbreak of bronchitis which caused many deaths. Although the cause was unknown, in hindsight it may well have been influenza. Unfortunately, even after the Pandemic of 1918/1919, the cause of influenza was unknown. There were no laboratory tests to help physicians distinguish the flu from other less serious respiratory conditions. And it was unknown when a person with the flu ceased to be a danger to other people.[4]

Because of these uncertainties, during the Pandemic of 1918/1919 most schools in Peel were closed by local authorities and public gatherings were stopped.[5] The health care system at the time was stretched to its limit. Many people in Peel relied on hospitals in other cities such as Toronto and Hamilton. But these were so full that people from outside the city of a particular hospital could not be admitted. This made the situation very difficult in Peel (for example, in Brampton there were as many as 150 cases of influenza at one time). The founding of Peel Memorial Hospital and a local chapter of the Victorian Order of Nurses was in no small part a response to the events of the influenza pandemic.[5]

The pandemic of 1918/1919 (also known as the "Spanish Flu") demonstrated the devastation caused by influenza. Worldwide, an estimated 500 million persons were infected and over 20 million persons died.[3]

Since then, a number of scientific developments have improved our ability to track, prevent and treat influenza. In 1932, the influenza virus was first isolated allowing for the confirmation of a diagnosis as well as detailed information on strains causing illness in people. In the 1940s, influenza vaccines were developed providing a means to prevent influenza infection and its complications.[6] More recently, a number of drugs have been developed

providing not only a means to treat influenza infections, but also to enhance the preventive abilities of vaccines.

Biology of Influenza

Three types of influenza virus are known: A, B and C. Influenza A and B are the two types of influenza viruses that cause widespread human disease. Influenza A viruses are found in many different animals, including ducks, chickens, pigs, whales, horses, and seals. Influenza A viruses are divided into subtypes based on two proteins on the surface of the virus. These proteins are called hemagglutinin (H) and neuraminidase (N).[7] Influenza B viruses are found to circulate only among humans and are not categorized into subtypes. Influenza C is a minor cause of mild illness in people and not associated with epidemics like Influenza A or B. Receiving an influenza shot can prevent illness from Influenza types A and B.

The World Health Organization (WHO) system of naming A, B and C influenza viruses consists of a strain designation which includes the virus type, geographic origin, laboratory reference number, and year of occurrence.[3] For example "A/Fujian/411/02-like" would be type A, first found in the Fujian region of China, with laboratory number 411, first occurring in 2002. In addition, for influenza A viruses only, a description of the hemagglutinin ("H") and neuraminidase ("N") antigens is used.[3] So our previous example is more fully described as "A/Fujian/411/02(H3N2)-like".

The influenza virus is constantly changing. One type of change is called "antigenic drift."[7] These are small changes in the virus that happen continually over time. Antigenic drift produces new virus strains that may not be completely recognized by the body's immune system. Frequent development of new strains through antigenic drift is the reason why influenza comes back every year. The need for annual vaccination is to incorporate more of these new strains in each year's influenza vaccine.[7]

The other type of change is called "antigenic shift." Antigenic shift is an abrupt, major change in the influenza A virus, resulting in new hemagglutinin and/or new neuraminidase proteins in influenza viruses that infect humans. Shift results in a new influenza A subtype. When shift happens, most people have little or no protection against the new virus. While influenza viruses are changing by antigenic drift all the time, antigenic shift happens only occasionally. Type A viruses undergo both kinds of changes; influenza type B viruses change only by the more gradual process of antigenic drift and does so less rapidly than influenza A viruses.[7]

The main currently circulating subtypes of human influenza A viruses are A(H1N1) and A(H3N2). Influenza A(H1N1), A(H3N2), and influenza B strains are

included in the 2003/2004 influenza vaccine.[7] More on influenza vaccination will be discussed in the Influenza Vaccination and Treatment section of this report on page 22.

Mode of Transmission

The influenza virus spreads easily from person to person through droplets that have been coughed or sneezed into the air by someone who has influenza. A person can become infected with influenza by breathing in these droplets through their nose or mouth, or by the droplets landing directly on their eyes. The influenza virus is also found on the hands of people with influenza and on surfaces they have touched. A person can become infected if they touch contaminated surfaces and transfer the virus to their own eyes, nose or mouth. Influenza can be prevented by practising good hand-washing and getting the influenza vaccine every year.

The incubation period for influenza is an average of two days (range between one and four days). The period of communicability for influenza is probably three to five days from clinical onset in adults and up to seven days in young children.[8,9]

Signs and Symptoms of Influenza

Influenza typically starts abruptly with a headache, chills and cough, followed rapidly by fever, loss of appetite, muscle aches and fatigue, runny nose, sneezing, watery eyes and throat irritation. It can often come on so suddenly that people remember the exact time they first felt ill. Children may have nausea, vomiting and diarrhea, which are uncommon symptoms in adults. Many people use the terms "flu" or "stomach flu" to describe other illnesses such as a cold or a mild case of food poisoning. These illnesses are not caused by the influenza virus.

Complications and Health Outcomes

Although most people recover within a week or ten days, the risks of complications, hospitalizations and deaths from influenza are higher among persons aged 65 years and older, young children, and persons of any age with certain underlying conditions. These include chronic respiratory disease, heart or kidney disease, diabetes or a depressed immune system because of cancer, Human Immunodeficiency Virus (HIV) infection, or some other cause.[6] Influenza-related deaths can result from pneumonia as well as from exacerbations of cardiopulmonary conditions and other chronic conditions.[6]

Reye's syndrome can develop in children and teenagers who are given salicylates (aspirin) when they have high fever associated with illnesses such as influenza.[6] Reye's syndrome affects the central nervous system and the liver, and can be fatal. Aspirin should not be given to ill children or teenagers unless specifically directed by a doctor.[6]

Respiratory illness caused by influenza is difficult to distinguish from illness caused by other respiratory pathogens (such as colds) based on symptoms alone. Laboratory tests for influenza are crucial to making the diagnosis.

Laboratory Diagnosis of Influenza

The accuracy of clinical diagnosis of influenza on the basis of symptoms alone is limited because symptoms caused by other illnesses can overlap considerably with influenza. Fortunately, a large number of different diagnostic tests are available for detection of influenza. Rapid antigen testing and viral culture are the two main types of tests in use today.[10, 11]

Commercial rapid diagnostic tests are available that can detect influenza viruses within 30 minutes versus the three to ten days that viral culture can take. However, these tests are less accurate and provide less information than viral culture. [10, 11]

Despite the availability of rapid diagnostic tests, collecting clinical specimens for viral culture is critical, because only culture isolates can provide specific information regarding circulating influenza subtypes and strains. This information is needed to compare current circulating influenza strains with vaccine strains, to formulate vaccine for the coming year and to monitor the emergence of antiviral drug resistance and the emergence of new influenza A subtypes that might pose a pandemic threat. [10, 11]

Use of these tests on a population basis is helpful to determine the type and level of influenza activity in the community. Testing for influenza is also very helpful during a respiratory illness outbreak in an institution such as in a hospital or long-term care facility. This allows a number of specific control measures to be brought into place if influenza is found to be the cause. Use of rapid tests allows this to happen much more quickly (in addition to samples taken for viral culture). However, these tests do not need to be done on all patients. For most individual patients the knowledge that influenza is circulating widely in the community combined with their symptoms is enough to properly guide a doctor's care. [10, 11]

Influenza Surveillance

Influenza surveillance (monitoring) is a collaborative effort between local health departments, provincial and territorial ministries of health, participating laboratories, The College of Family Physicians of Canada, sentinel physicians, and Viral Respiratory Diseases Section, Division of Immunization and Respiratory Diseases, Centre for Infectious Disease Prevention and Control (CIDPC) at Health Canada.[12]

Influenza surveillance data collected by local health departments are part of an international system for monitoring this disease. Confirmed influenza cases reported to local health departments are transmitted to the Ontario Ministry of Health and Long-Term Care for provincial monitoring, which in turn is transmitted to Health Canada for national monitoring, and finally shared with the World Health Organization (WHO) to monitor global influenza trends. These data provide information regarding the presence of influenza viruses in the community, and identify the predominant circulating types, subtypes and strains of influenza.

The Viral Respiratory Diseases Section, Division of Immunization and Respiratory Diseases, Centre for Infectious Disease Prevention and Control (CIDPC) at Health Canada, produces *FluWatch* reports, summarizing influenza surveillance activities in Canada. Weekly reports are produced during the influenza season (October - May) and biweekly reports are produced during the off season (June - September).

The main components of the influenza surveillance system include:

1) Laboratory reports of positive influenza tests.

2) Influenza-like illness (ILI) reporting by sentinel physicians within Ontario and the country. ILI is a non-specific respiratory illness characterized by fever, fatigue, cough, and other symptoms. Although a large number of ILI cases are not caused by influenza but by other viruses (e.g. rhinovirus, respiratory syncytial virus (RSV), adenoviruses, and parainfluenza viruses) ILI monitoring does detect influenza activity when it is intense.[13]

3) Reporting of influenza activity by provincial and territorial epidemiologists. This assessment of influenza activity is based on various indicators, including laboratory surveillance, ILI, reporting school and work absenteeism, and outbreaks in long-term care facilities (LTCF) or other institutions.

4) World Health Organization and other international reports of influenza activity.[12]

This wide variety of information is collected to provide a timely and broad picture of influenza activity. Each type of information has its advantages and disadvantages. Laboratory tests for influenza, while accurate, tend to be done only on hospitalized patients and may not reflect what is happening in the community. Until the development of rapid tests, this system also was not timely. Physician reporting of influenza-like illness, while rapid and more reflective of transmission in the community, cannot distinguish between influenza and other respiratory viruses.

For further details on any of these components please consult Health Canada's FluWatch website at http://www.hc-sc.gc.ca/pphb-dgspsp/fluwatch/index.html.

Influenza in Canada and Ontario, 2003/2004

The Canadian 2003/2004 influenza season began earlier than usual and involved a new variant of the A(H3N2) strain (A/Fujian/411/2002) that was not included in the 2003/2004 year vaccine.[1] The vaccine was still felt by WHO to provide some reduced protection against this strain since it contained a closely related A(H3N2) strain (A/Panama/2007/99).[13] As with other H3N2 predominant seasons, the 2003/2004 influenza season was more severe than average, although surveillance indicators to date were still within the range of past seasons.[14]

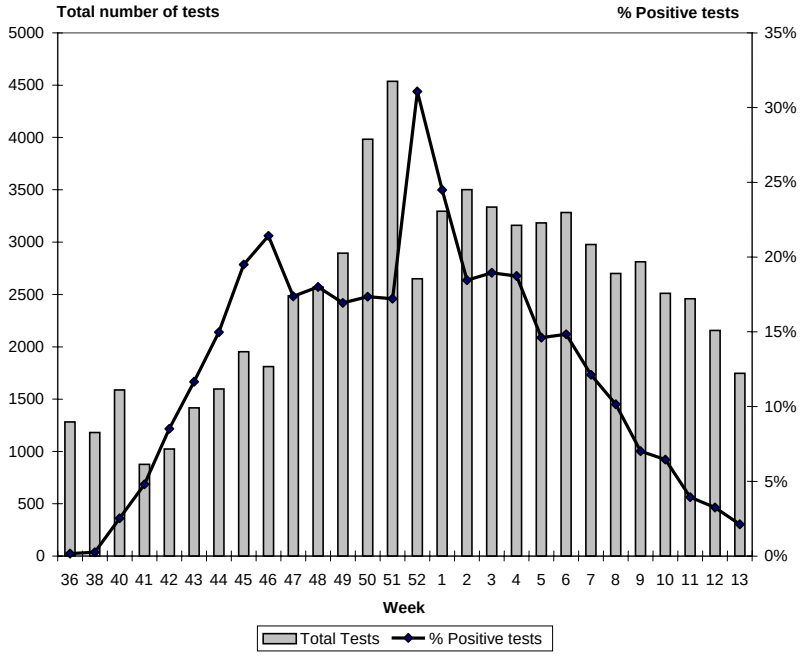
Positive Influenza Tests

Figures 1.1 and 1.2 show the percentage of positive tests in Canada and Ontario from August 24, 2003 (Week 36) to March 27, 2004 (Week 13). Up to March 27, 2004 Health Canada received 75,223 reports of laboratory tests for influenza, including 11,199 (14.9%) influenza A detections and 100 (0.1%) influenza B detections. In Ontario, there were 29,105 laboratory tests for influenza, of which 4,465 (15.3%) were positive for Influenza A and 31 (0.1%) were positive for Influenza B.

The highest percentage of positive influenza tests in both Canada and Ontario occurred during the week ending December 27, 2003 (Week 52), when nearly half (48.5%) of all influenza tests in Ontario were positive. The percentage of positive tests during week 52 was higher in Ontario (48.5%) than Canada (31.1%).

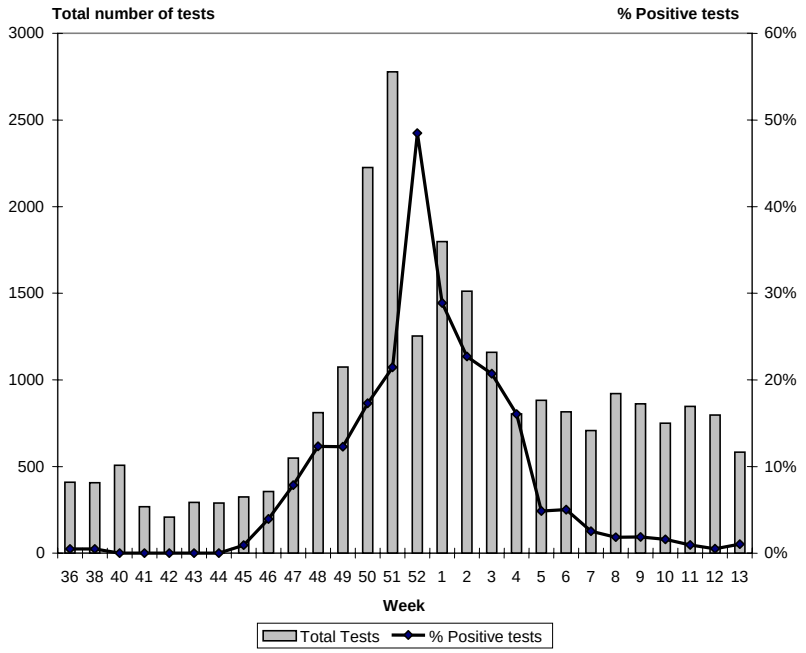
Compared to Ontario, (Figures 1.1 &1.2) influenza activity across Canada as a whole occurred over a wider time period but did not reach as high a peak. This reflects the fact that Canada-wide data are summed from differently timed regional influenza outbreaks across the country which tend to be more intense but of shorter duration. The peak of influenza activity in Ontario during week 52 can be seen in the national data but is not as intense. The earlier peak in the Canadian influenza graph (week 46) is due to the peak of influenza activity in the Prairie provinces (data not shown).[15]

Figure 1.1: Number and Percent of Positive Influenza Tests in Canada by Week of Report, August 24, 2003 (Week 36) to March 27, 2004 (Week 13)



Source: Health Canada, Population and Public Health Branch. *FluWatch Report: March 21 to 27, 2004.* 2004 April [cited 2004 May 12]: [7 screens].
Available from: URL: http://www.hc-sc.gc.ca/pphb-dgspsp/fluwatch/03-04/w13_04/index.html

Figure 1.2: Number and Percent of Positive Influenza Tests in Ontario by Week of Report, August 24, 2003 (Week 36) to March 27, 2004 (Week 13)

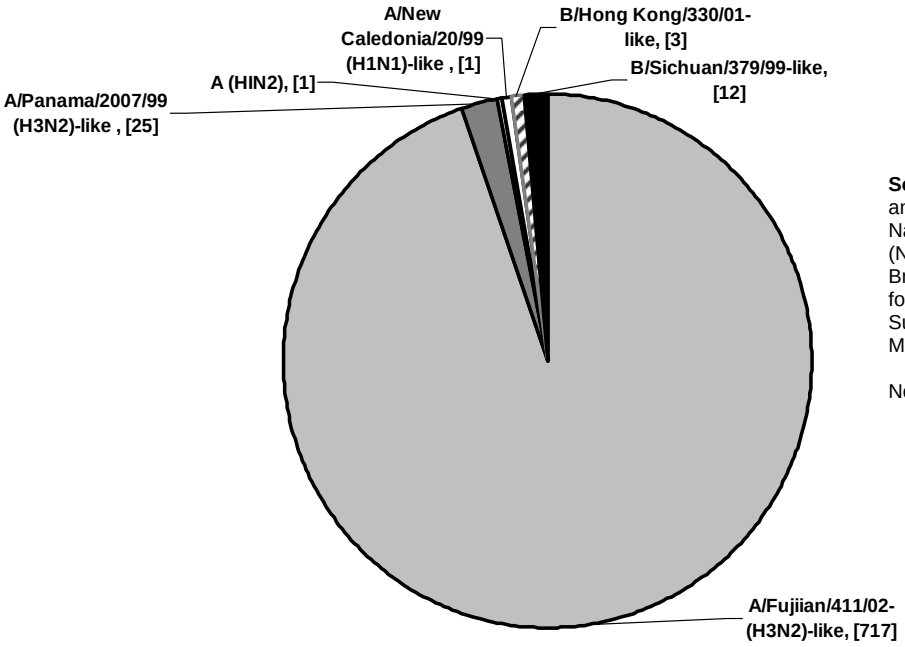


Source: Health Canada, Population and Public Health Branch. *FluWatch Report: March 21 to 27, 2004.* 2004 April [cited 2004 May 12]: [7 screens].
Available from: URL: http://www.hc-sc.gc.ca/pphb-dgspsp/fluwatch/03-04/w13_04/index.html

Strain Characterization

The predominant strain of influenza that circulated in Canada during the 2003/2004 influenza season was A/Fujian/411/02-like (717 out of 759 positive isolates or 94.5% - Figure 1.3).[12] A/Fujian is an H3N2 strain first isolated in 2002 and which appeared in Canada for the first time in 2003. It is closely related to A/Panama which has been circulating in Canada since the 2000/2001 influenza season. A/Panama was the predominant strain in 2001/2002.

Figure 1.3: Distribution of Influenza Strain Characterization, Canada, Cumulative Number, 2003/2004 influenza season [N=759]



Source: Health Canada. Influenza and Respiratory Viruses Section. National Microbiology Laboratory (NML), Population and Public Health Branch. Canadian Sciences Centre for Human and Animal Health. Submitted from October 1, 2003 to March 27, 2004.

Note: Pie chart is not to scale.

A/Fujian was also the predominant strain circulating in Ontario during the 2003/2004 influenza season (337 out of 349 positive isolates or 96.6%), followed by two influenza B strains - B/Sichuan (nine out of 349 positive isolates) and B/Hong Kong (three out of 349 positive isolates).[16]

The distribution of influenza strains in Canada for the five most recent influenza seasons is shown in Table 1. A particular strain may circulate for a number of years and is often only predominant during one influenza season. In any one year more than one strain can be circulating. The predominant strain in circulation for each of the past five influenza seasons has been type A, with the exception of 2000/2001 when type B was predominant.

Table 1: Distribution of Influenza Strains Characterized by the Respiratory Viruses Section of the National Microbiology Laboratory for the influenza Seasons 1999/2000 to 2003/2004, Canada

Influenza Season	1999/2000a	2000/2001b	2001/2002c	2002/2003d	2003/2004e
Strain					
A/New Caledonia/20/99-like	99	236	1	81	1
A/Fujian/411/02-like					717
A/Johannesburg/82/96-like		5			
A/H1N2			75	265	1
A/Panama/2007/99-like		2	347	78	25
A/Sydney/5/97-like	480				
B/Sichuan/379/99-like			5	2	12
B/Hong Kong/330/01-like			147	126	3
B/Yamanashi/166/98-like		253			
B/Beijing/243/97	43	1			
Total	**622**	**497**	**575**	**552**	**759**

predominant strain in a given year.

Sources:

a. Health Canada. *Influenza in Canada - 1999-2000 Season*. CCDR. 2001 January 1; 27(01): 1-12.

b. Health Canada. *Influenza in Canada - 2000-2001 Season*. CCDR. 2002 February 1; 28(03): 17-28.

c. Health Canada. *Influenza in Canada - 2001-2002 Season*. CCDR. 2003 March 15; 29(06): 45-60.

d. Health Canada, Population and Public Health Branch. *FluWatch Report: August 10 to August 23, 2003.* 2003 August [cited 2004 May 12]: [7 screens].
Available from: URL: http://www.hc-sc.gc.ca/pphb-dgspsp/fluwatch/02-03/w34_03/index.html

e. Health Canada, Population and Public Health Branch. *FluWatch Report: March 21 to 27, 2004.* 2004 April [cited 2004 May 12]: [7 screens].
Available from: URL: http://www.hc-sc.gc.ca/pphb-dgspsp/fluwatch/03-04/w13_04/index.html

Influenza Outbreaks in Canada

During the 2003/2004 influenza season in Canada (up to March 27, 2004), there were a total of 730 outbreaks reported, including 447 influenza confirmed outbreaks in long-term care facilities/retirement lodges (360) and hospitals (87), and 283 influenza-like illness outbreaks in schools (188) and other types of facilities (95).[12]

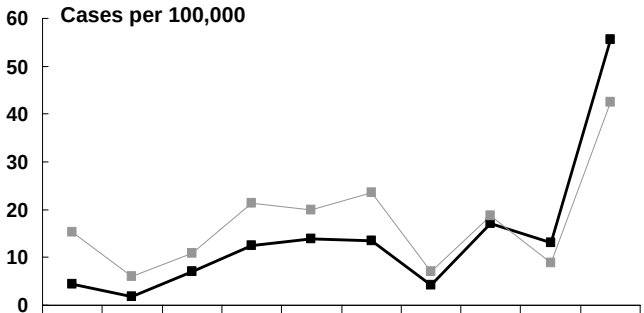
Influenza in the Region of Peel

The role of Peel Health in the prevention and control of influenza is to:

- Monitor influenza in the community and provide reports to stakeholders and the public
- Investigate cases and outbreaks of influenza
- Provide assistance to institutions experiencing outbreaks of influenza
- Promote the influenza vaccine
    - Distribute influenza vaccine to all sites where immunization will occur
    - Coordinate and offer influenza immunization clinics at community locations
    - Coordinate regional efforts to immunize in workplaces, hospitals, long-term care facilities, physician offices and schools.

The last influenza season in the Region of Peel (2003/2004) had the most cases (554) and highest incidence rate (55.5 per 100,000) compared to the previous 10 influenza seasons (Figure 1.4). This trend was similar for Ontario. In the Region of Peel, there were 550 cases of Influenza A and four cases of Influenza B for the 2003/2004 influenza season (up to March 20, 2004). Nine of the type A strains were characterized, and all were A/Fujian (H3N2). The increase in 2003/2004 compared to previous influenza seasons may be due to increased use of newly-developed rapid tests for influenza. In addition there was heightened awareness and testing of respiratory illnesses as a result of the outbreak of Severe Acute Respiratory Syndrome (SARS) which occurred in southern Ontario in the spring of 2003.

Figure 1.4: Incidence of Influenza by Seasonal* Year, Region of Peel and Ontario, 1994/1995-2003/2004



	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04
Peel	4.4	1.9	7.0	12.5	13.8	13.5	4.2	17.1	13.0	55.5
Ontario	15.3	6.1	10.9	21.3	19.9	23.5	7.1	18.8	8.9	42.5
Peel Cases	34	18	61	101	111	113	41	166	133	554

Year

*Seasonal year from July to June (e.g. 94/95 includes all cases from July 1, 1994 to June 30, 1995). 2003/2004 data up to March 20, 2004.

Note: Rates age-standardized using 1991 (adjusted) Canadian population.

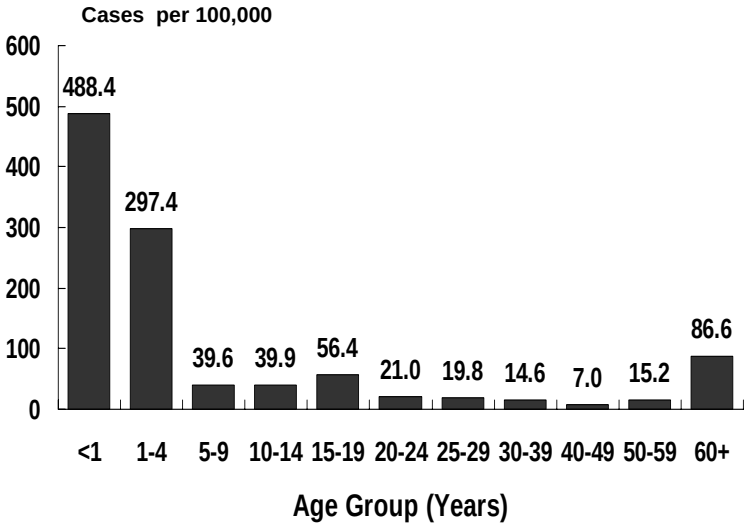
Sources: Ontario Data from RDIS, Ontario Ministry of Health and Long-Term Care, as of 05/18/2004.

Peel Data from RDIS, Region of Peel Health Department, as of 05/06/2004.

Statistics Canada, Population Estimates and Projections distributed by the Ontario Ministry of Health and Long-Term Care.

In Peel, the reported incidence of influenza is highest in those aged less than five years and those 60 years and older. This may reflect the fact that these age groups are more likely to have a serious illness from influenza and be tested. (Figure 1.5)

Figure 1.5: Incidence of Influenza by Age Group, Region of Peel, 2003/2004*



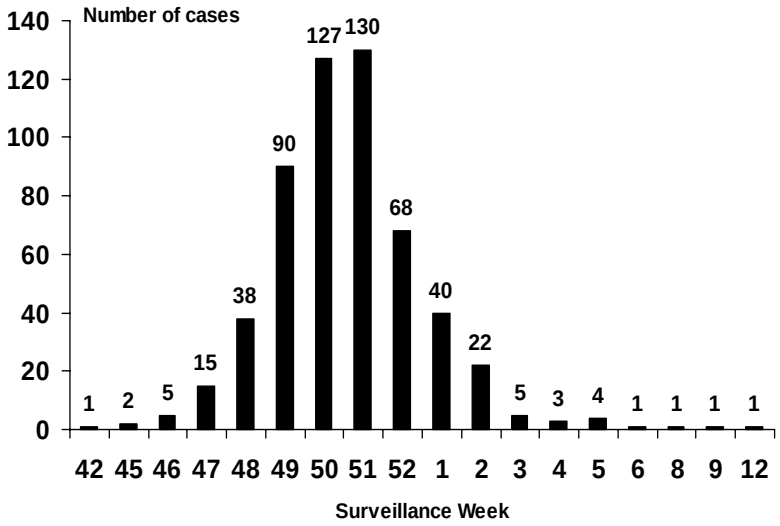
*Seasonal year 2003/2004 from October 12, 2003 to March 20, 2004.

Sources: Peel Data from RDIS, Region of Peel Health Department, as of 05/06/2004.

Statistics Canada, Population Estimates and Projections distributed by the Ontario Ministry of Health and Long-Term Care.

Influenza cases by week for the 2003/2004 influenza season show high activity for seven to eight weeks, with a peak of 130 cases during week 51 (week ending December 20, 2003) (Figure 1.6). This is similar to the pattern for Ontario (Figure 1.2). The small number of cases during week 52 compared to weeks 50 and 51 may be the result of the holiday season.

Figure 1.6: Influenza Cases By Week of Onset of Symptoms, Region of Peel, October 12, 2003 - March 20, 2004**



*Seasonal year 2003/2004 from October 12, 2003 to March 20, 2004.

**Note: Episode date was used when onset date was not available.

Source: Peel data from RDIS, Region of Peel Health Department, as of 05/06/2004.

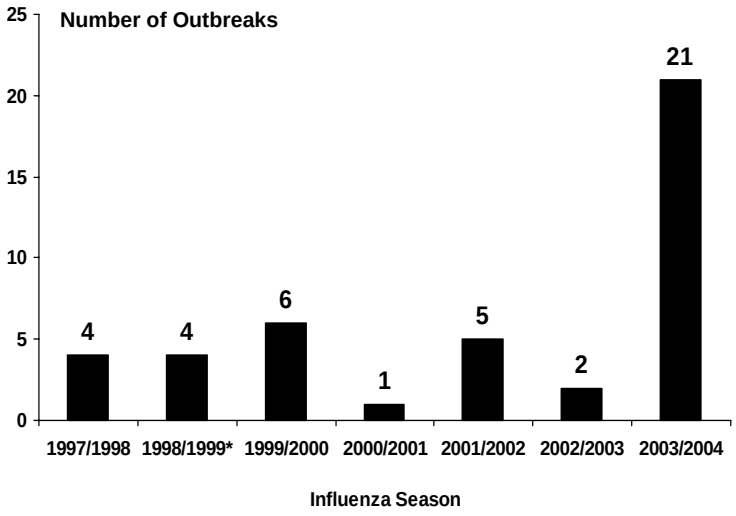
Influenza Outbreaks in the Region of Peel

During the 2003/2004 influenza season there were 21 outbreaks of influenza A in institutions reported by the Region of Peel Health Department to the Ontario Ministry of Health and Long-Term Care. The number of outbreaks for 2003/2004 was the highest since these data were collected, beginning in 1997/1998 (Figure 1.7).

There were four outbreaks of influenza in Peel Region hospitals during the 2003/2004 influenza season. There were two outbreaks in Peel Region hospitals in 2001/2002 and before this the last outbreak in a Peel Region hospital was during the 1999/2000 influenza season.

The above information needs to be interpreted with caution as the system of reporting outbreaks has improved and the number of institutions in Peel has increased substantially.

Figure 1.7: Influenza Outbreaks, by Influenza Season, Region of Peel, 1997/1998 - 2003/2004

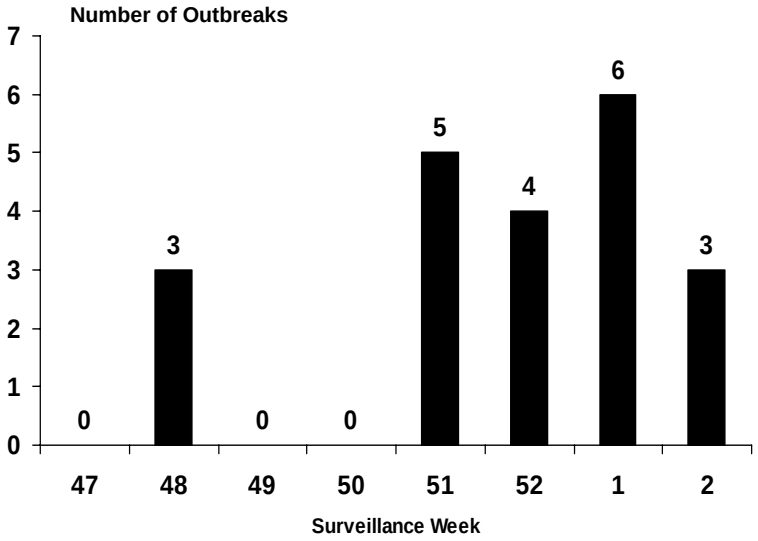


Source: Communicable Disease Division, Region of Peel Health Department, as of 05/06/2004.

Note: * outbreaks for 1998/1999 influenza season include one for Influenza B.

Influenza outbreaks during the 2003/2004 influenza season were clustered around week 51 to week 2, with a peak of six outbreaks during week 1 (Figure 1.8). This is similar to the time frame from other types of influenza reporting contained in this report.

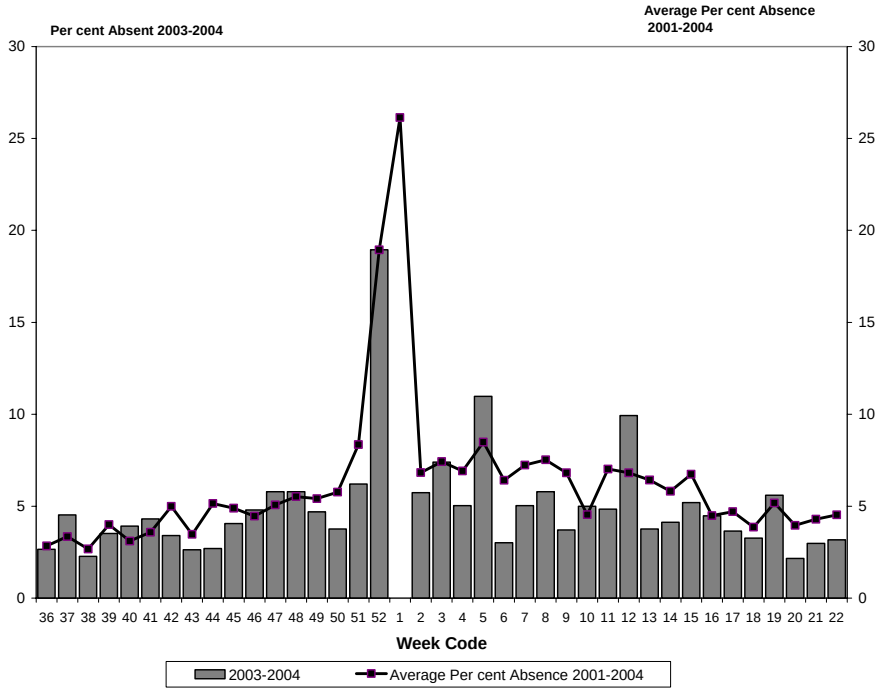
Figure 1.8: Influenza Outbreaks by Week, Region of Peel, 2003/2004 Influenza Season



Source: Communicable Disease Division, Region of Peel Health Department, as of 05/06/ 2004.

Another way that Peel Health monitors influenza in the community is by tracking absenteeism at local daycares and workplaces. This is one way to see if influenza is having an impact on the community. Results from the daycare surveillance data for the 2003/2004 influenza season are shown in Figure 1.9. The peak absences during week 52 and week 1 are most likely due to the holiday season and corresponding vacations occurring during this time of year. This is a well known problem with absenteeism monitoring – many people are away for reasons other than illness often as a function of holiday schedules.

Figure 1.9: Per Cent Absenteeism in Daycares: Pandemic Influenza Watch, Region of Peel, 2003-2004



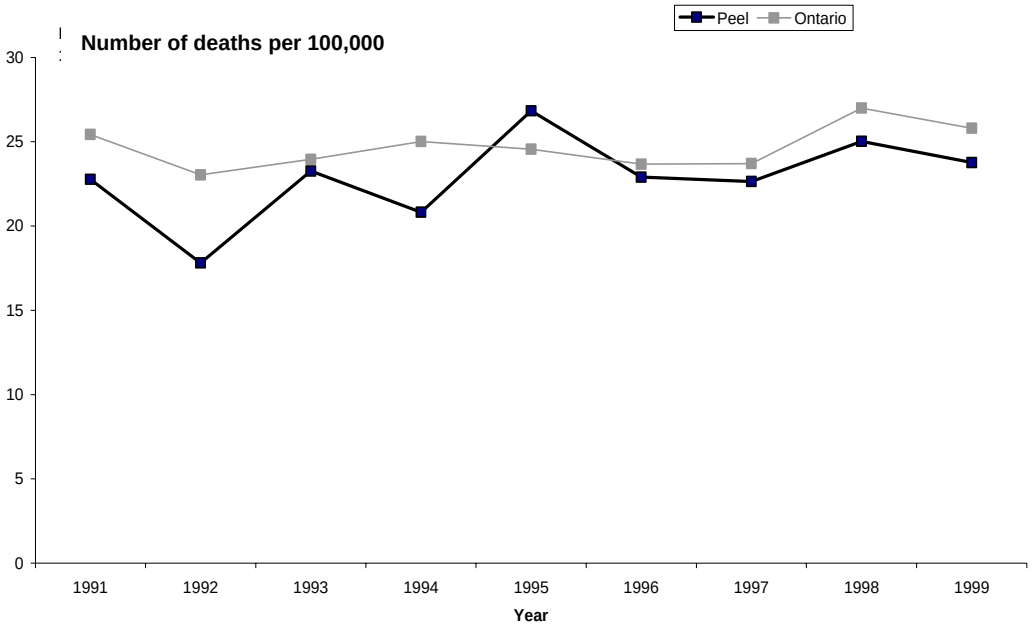
Source: Communicable Disease Division, Region of Peel Health Department, as of 06/07/2004.

Pneumonia and Influenza Mortality and Morbidity

Approximately 700 to 2,500 deaths per year are reported in Canada due to influenza or pneumonia as a complication of influenza. However, this number may be an underestimate since there are many more deaths where the immediate cause of death is another underlying medical condition but where influenza may have started the chain of events leading to death.

Information on deaths from influenza in Peel is available for the years 1991-1999. From 1991 to 1998 in the Region of Peel there were less than five deaths per year where the cause of death was reported as influenza. In 1999 this increased to seven deaths. Most of these deaths occurred in adults aged 65 and older. When influenza deaths were combined with pneumonia (one of the complications of influenza which can also be due to other causes), the death rate in the Region of Peel fluctuated between 17 and 27 deaths per 100,000 from 1991 to 1999 (Figure 1.10). The death rates in Peel were similar to the rates in Ontario.

Figure 1.10: Influenza and Pneumonia-Related Deaths, Region of Peel and Ontario, 1991-1999

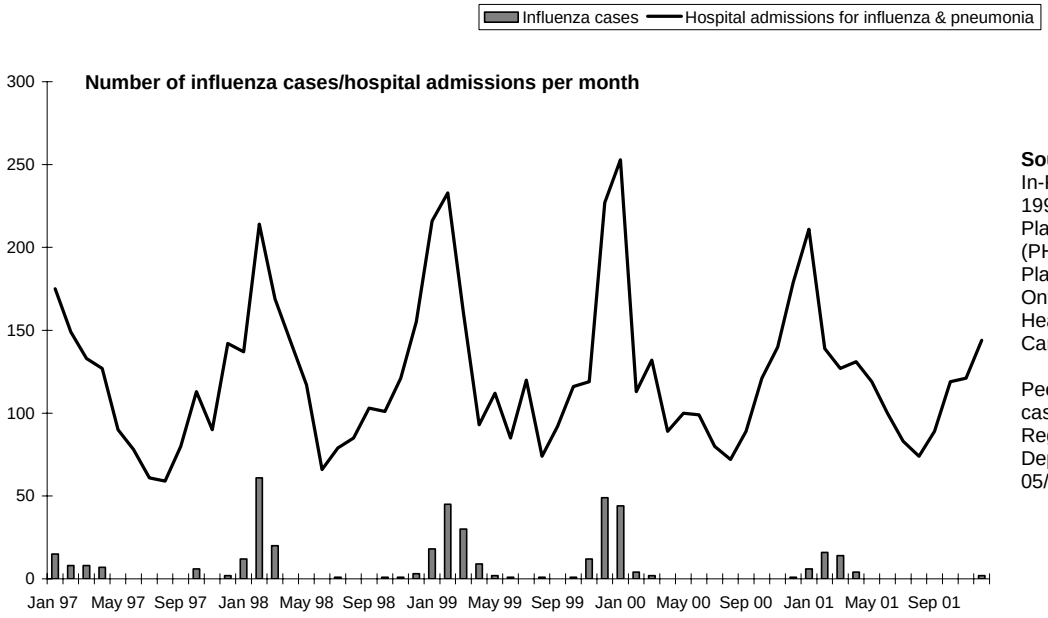


Sources: Ontario Mortality Database 1991-1999, HELPS (Health Planning System), Public Health Branch, Ontario Ministry of Health and Long-Term Care.

Statistics Canada, Population Estimates and Projections distributed by the Ontario Ministry of Health and Long-Term Care.

Hospitalizations due to pneumonia and influenza in the Region of Peel typically peak in January and February each year (Figure 1.11). This coincides with peak activity of influenza and other respiratory viruses. The majority of these hospitalizations occur in those aged 65 years or more followed by those aged four years of age and less.

Figure 1.11: Influenza Cases and Hospital Admissions due to Influenza/Pneumonia, by Month, Region of Peel, January 1997 - December 2001



Sources: Hospital In-Patient Data 1997-2001, Provincial Planning Database (PHPDB), Health Planning Branch, Ontario Ministry of Health and Long-Term Care.

Peel data on Influenza cases from RDIS, Region of Peel Health Department, as of 05/06/2004.

Influenza Vaccination and Treatment

Vaccination is recognized as the single most effective way of preventing or lessening the impact of influenza for those at high risk of serious illness or death from influenza infection and related complications. With a good match between the vaccine and the circulating virus, influenza vaccination has been shown to prevent laboratory-confirmed influenza illness in approximately 70% to 90% of healthy children and adults. Under these circumstances, studies have also shown influenza vaccination to be approximately 70% effective in preventing hospitalization for pneumonia and influenza among elderly people living in the community. Studies of elderly people residing in nursing homes have shown influenza vaccination to be 50% to 60% effective in preventing hospitalization and pneumonia and up to 85% effective in preventing death, even though the efficacy in preventing influenza illness may often be in the range of 30% to 40% among the frail elderly.[17]

The effectiveness of influenza vaccine in any particular person varies depending on the immune system of the vaccine recipient and the degree of similarity between the virus strain included in the vaccine to the strain of circulating virus during the influenza season.[18] Because circulating influenza strains change from year to year, a new vaccine, updated yearly with the most current circulating strains, is needed to protect against new infections every year. Which influenza strains go into a particular year's vaccine are determined by the World Health Organization (WHO) Global Influenza Surveillance Network. The WHO recommends the content of the influenza vaccine for the subsequent influenza season based on currently circulating strains, February for the northern hemisphere and September for the southern hemisphere.[18] This allows people in the northern hemisphere to be vaccinated from October to mid-November just before influenza season usually starts.[18]

Universal voluntary influenza immunization began in Ontario in 2000 with free influenza vaccine being made available to all Ontario residents aged six months and older. Currently, Ontario is the only province in Canada to provide a universal influenza "flu shot" campaign.

Influenza vaccine programs should aim to vaccinate at least 90% of eligible recipients. Nevertheless, only 70% to 91% of long-term care facility (LTCF) residents and 20% to 40% of adults and children with medical conditions listed previously receive vaccine annually. Studies of health care workers (HCW) in hospitals and LTCFs have shown vaccination rates of 26% to 61%.[17]

The National Advisory Committee on Immunization recommended that the trivalent influenza vaccine for the 2004/2005 influenza season contain A/New Caledonia/20/99 (N1H1)-like, A/Fujian411/2002 (H3N2)-like, and B/Shanghai/361/2002-like virus antigens.[19]

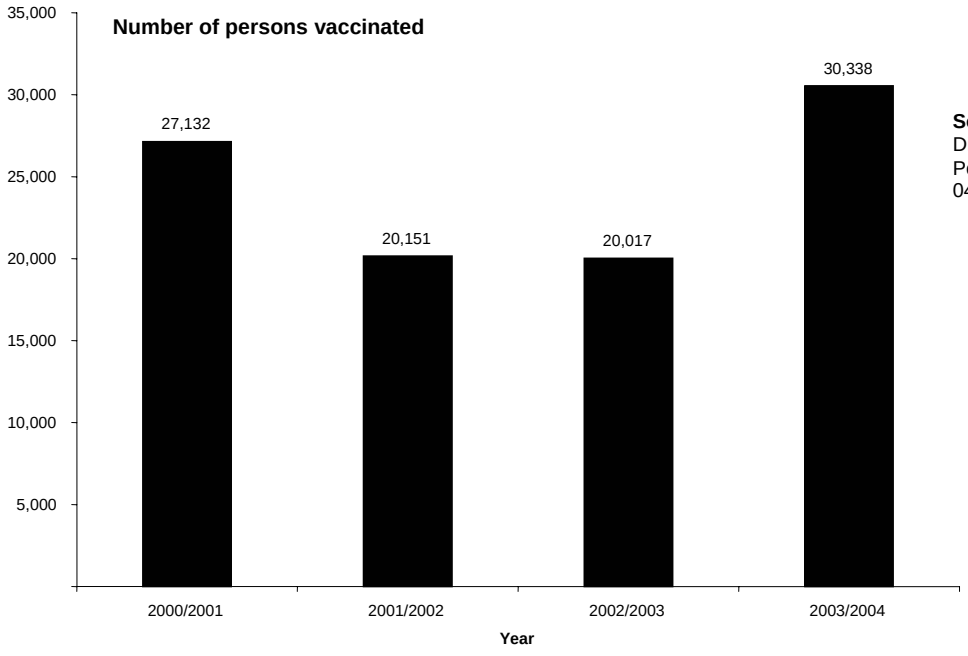
Vaccination in the Region of Peel

The Peel Health Department distributes vaccine to local physicians, hospitals, long-term care facilities, nursing agencies and workplaces, and also holds various community clinics for local residents before and during each influenza season.

According to Rapid Risk Factor Surveillance System (RRFSS) data for the Region of Peel, about 39% of Region of Peel residents aged 18 and older reported having an influenza shot during the 2003/2004 influenza season. This figure was slightly higher than the 32% of residents who reported having an influenza shot during the 2002/2003 influenza season.

There were 162 influenza clinics held at various community sites and secondary schools in the Region of Peel from October 15, 2003 through to January 19, 2004. The number of influenza vaccinations given by Peel Health Department staff during the 2003/2004 influenza season was the highest it had been since the influenza immunization campaign became universal in 2000 (Figure 1.12).

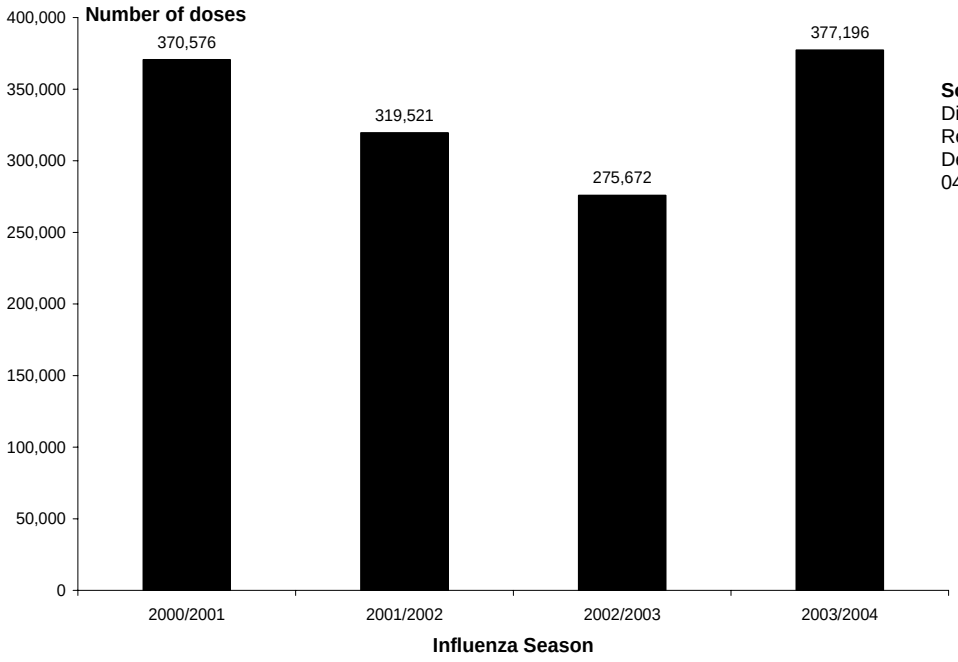
Figure 1.12: Influenza Vaccinations Given by Peel Health Staff, by Influenza Season, 2000/2001 to 2003/2004



Source: Communicable Disease Division, Region of Peel Health Department, as of 04/26/2004.

During the 2003/2004 influenza season, approximately 377,196 doses of the influenza vaccine were distributed by the Region of Peel Health Department, which represents a 37% increase over those distributed during the 2002/2003 influenza season (Figure 1.13). It is apparent that most people in Peel receive their influenza vaccine outside of a Peel Health clinic.

Figure 1.13: Influenza Vaccine Doses Distributed by Peel Health, by Influenza Season, 2000/2001 to 2003/2004



Source: Communicable Disease Division, Region of Peel Health Department, as of 04/26/2004.

People who are residents of long-term care facilities (LTCF) are among the most vulnerable to influenza. The Region of Peel data in Table 2 indicate that at least 94% of LTCF residents have been vaccinated for influenza each year since the 1998/1999 influenza season. The immunization rates among LTCF staff are lower than among residents, yet higher than what is shown among different studies of the general population. Immunization rates in LTCF staff jumped from 34% in 1998/1999 to 81% in 1999/2000 largely as a result of a province-wide effort to increase influenza vaccination in this group of health care workers. This was in response to a January 1999 outbreak of influenza in a Kitchener LCTF that killed 17 of 238 residents.[20] These rates of coverage are all the more remarkable given that only about 5% of LTCF staff in Ontario were immunized in 1993/1994.[21]

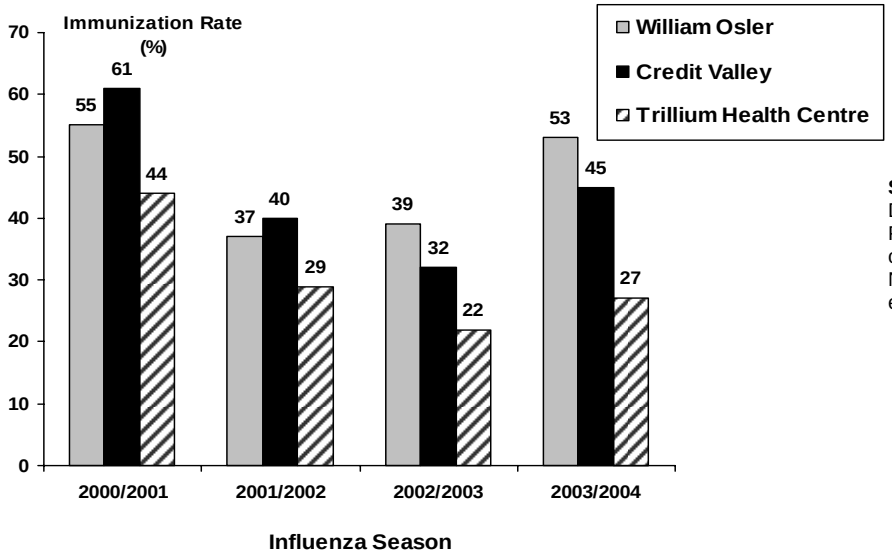
Table 2: Immunization Rates in Long-Term Care Facilities, Region of Peel, 1998/1999 to 2003/2004

Year	Residents	Staff
1998/1999	96%	34%
1999/2000	96%	81%
2000/2001	95%	81%
2001/2002	96%	82%
2002/2003	95%	79%
2003/2004	93%	73%

Note: Rates are for nursing homes and retirement homes combined in the Region of Peel.
Source: Communicable Disease Division, Region of Peel Health Department, as of 03/31/2004.

Hospital workers in the Region of Peel have shown a much lower rate of influenza vaccination compared to long term care facility staff, as shown in Figure 1.14. In general, the immunization rates for staff from each hospital in the Region of Peel declined from 2000/2001 to 2002/2003, only to increase in 2003/2004. Unfortunately, immunization rates of hospital staff are not much above those of the general population despite the fact that immunization in this group is strongly recommended and encouraged due to their contact with highly vulnerable individuals. During the 2003/2004 influenza season, only one Peel hospital out of three reported that more staff were immunized than not. This is an improvement over the previous two seasons when none of the three hospitals reached this target.

Figure 1.14: Influenza Immunization Rates among Hospital Staff, Region of Peel, 2000/2001 - 2003/2004



Source: Communicable Disease Division, Region of Peel Health Department, as of 03/31/2004.
Note: Data as of December 1 each year.

Adverse Vaccine Reactions

Adverse reactions may follow the use of vaccines, with most occurring shortly after immunization and others appearing only later. Mild vaccine-associated adverse events such as fever or swelling at the injection site are common, predictable and disappear quickly, while more serious and unexpected adverse reactions such as seizures or anaphylaxis (a severe allergic reaction) rarely develop.[22] Influenza vaccination cannot cause influenza because the vaccine does not contain live virus.

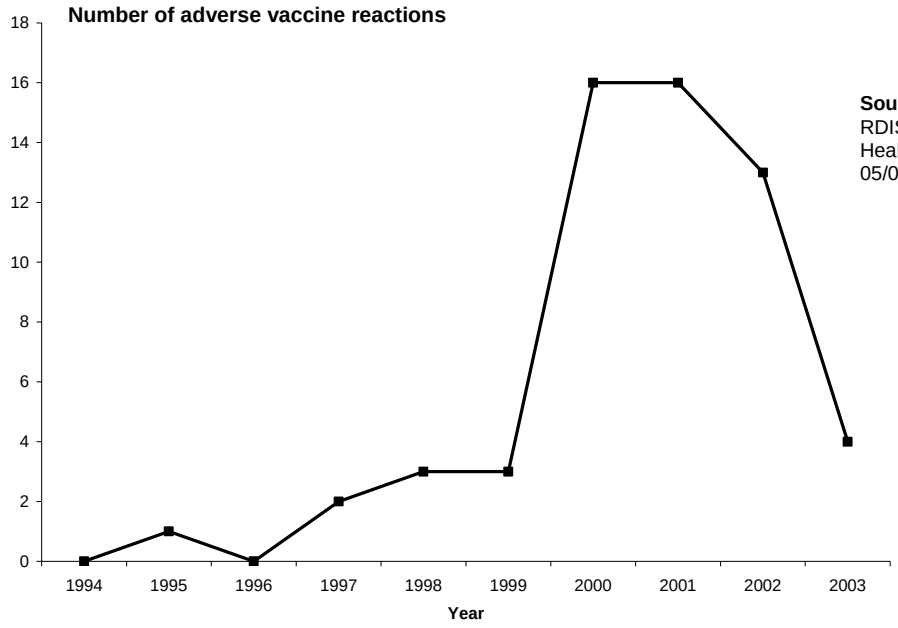
The benefits of influenza shots far outweigh the risks. Soreness at the injection site lasting up to two days is common but rarely interferes with normal activities. Fever, fatigue, and muscle soreness may occur within six to 12 hours after vaccination and last one to two days. Occasionally people develop a condition called "oculo-respiratory syndrome" (ORS) after an influenza shot. The symptoms include red eyes and respiratory effects such as cough, wheezing, chest tightness, difficulty breathing, or sore throat. In most cases, the symptoms are mild and disappear within 48 hours. During the 2000-2001 season, Health Canada received a large number of reports of red eyes, respiratory symptoms (cough, sore throat, difficulty breathing, chest tightness, and wheezing), and facial edema following influenza immunization.[23] Since then, reports of oculo-respiratory syndrome have been fewer.

Allergic responses to influenza vaccine are rare and are probably a consequence of hypersensitivity to some vaccine component, most likely residual egg protein, which is present in very small quantities. Severe allergic reactions to influenza shots are rare.

A rare possible side effect of influenza vaccination is Guillain-Barré syndrome (GBS). This is an autoimmune disease that attacks the nervous system and results in weakness and abnormal sensations. Most patients recover fully. The chance of developing GBS as a result of an influenza shot is literally one in a million.[6]

Numbers of adverse reactions attributable to influenza vaccine in the Region of Peel are shown in Figure 1.15. The increase in the number of adverse reactions from 2000 to 2002 is most likely the result of an increase in the number of vaccinations given due to the universal influenza immunization campaign which was initiated in Ontario in 2000.

Figure 1.15: Adverse Influenza Vaccine Reactions, Region of Peel, 1997-2003



Source: Peel data from RDIS, Region of Peel Health Department, as of 05/06/2004.

As a precaution, influenza vaccine should not be given to people who have had an allergic reaction to a previous dose or who have known allergy to eggs manifested as hives, swelling of the mouth and throat, difficulty in breathing, low blood pressure and shock.

In comparison to these adverse reactions, the prospect of disease and death caused by influenza are much more serious.

Drug Treatment for Influenza

While the main strategy to limit influenza's impact is vaccination, there are three drugs available in Canada that can be used to treat and prevent influenza: amantadine, oseltamivir and zanamivir. These drugs are often referred to as antivirals. Amantadine works by interfering with the ability of the virus to reproduce once it has infected a cell. Oseltamivir and zanamivir are chemically related drugs called neuraminidase inhibitors (NAIs). They both work by interfering with the ability of new virus particles to be properly released from an infected cell. Amantadine has been in use since the 1960's. It is relatively inexpensive but has more side effects and the influenza virus can rapidly develop resistance, rendering the drug ineffective.[24]

When used to treat a person ill with influenza, all three drugs have been shown to shorten the length of illness by about one to two days. There is some limited information that shows neuraminidase inhibitors can reduce complications such as pneumonia and hospitalizations. However, in order to be effective, these drugs need to be given within two days of the start of symptoms. The sooner they are given, the better their effectiveness. People who are at high risk of complications from influenza infection are most likely to benefit from antiviral treatment (i.e. those over 65 years and those with chronic diseases of the lungs, heart, kidneys, liver or immune system). The need to start treatment so soon after the start of symptoms and the lack of a readily available diagnostic test has limited the use of antiviral drugs for treatment of influenza.[24]

These same drugs can also be used to prevent people from acquiring an influenza infection (this prevention is called "chemoprophylaxis"). The drugs are commonly used in situations when there is an influenza outbreak within institutions or other semi-enclosed settings that house many high-risk individuals. Examples of such settings include long-term care facilities, residential communities of high-risk persons and hospitals. In these situations, and along with other outbreak control measures (such as cohorting of patients or residents, institution of droplet precautions, limiting of visitors), the antiviral drugs are given to all uninfected patients or residents for the duration of the institutional outbreak regardless of their vaccination status. Many vaccinated elderly still become infected with influenza despite vaccination and can transmit the virus; however, the vaccine is highly effective in preventing complications in this group. In addition, chemoprophylaxis is used for unvaccinated employees who have contact with patients or residents for the duration of the institutional outbreak. It is common to see an outbreak of influenza quickly stop within a day or two of starting chemoprophylaxis and other control measures.[24]

Pandemic Influenza

Influenza A and B usually occur in epidemic outbreaks every winter. Pandemic influenza occurs when a new, highly infectious and dangerous strain of the influenza virus appears that results in worldwide outbreaks. The pandemic influenza virus causes severe complications, such as pneumonia and death in previously healthy individuals, much more often than a non-pandemic strain. The last three pandemics occurred in 1918/1919, 1957/1958 and 1968/1969. Pandemics are unpredictable, but most experts agree that another is likely to occur in the next five to 10 years.[25]

Scientists from the World Health Organization (WHO) are continually monitoring the influenza situation. When the next pandemic happens, it will likely begin outside of North America, but with today's growing volume of international travel, the virus can spread rapidly throughout the world.

Even with the best science available, it would take at least four to six months for manufacturers to produce the first batch of vaccine once the new virus is obtained. Health Canada has taken steps to be able to ramp up production once the virus is available. In this event, production of influenza vaccine by a domestic manufacturer, Shire Biologics of Saint-Foy, Quebec, can start immediately and production capacity can be increased. The goal is to produce enough vaccine to protect all Canadians as quickly as possible. Canada is the first country worldwide to plan for a secure vaccine supply through the contracting of a domestic supplier. The contract ensures that everything required for vaccine production, including the eggs required to grow the vaccine virus and storage facilities, is in place.[25]

The WHO is urgently working together with laboratories in the WHO Global Influenza Surveillance Network to develop a prototype pandemic vaccine for use by leading vaccine manufacturers based on the H5N1 virus that has caused the recent Avian Flu outbreaks in Asia.[26]

Contingency plans for Pandemic Influenza have been developed by Health Canada,[27] the Ontario Ministry of Health and Long-Term Care[28] and the Region of Peel outlining how each level of government will respond to a pandemic. Peel Health has developed a community plan to deal with pandemic influenza at the local level and has been educating and assisting municipalities, health organizations including hospitals, police, emergency workers and local industry to do their own planning. The local plan will be regularly reviewed and updated as needed.

Implications of a Pandemic in the Region of Peel

The following implications of a pandemic in the Region of Peel are based on data from the Ontario Ministry of Health and Long-Term Care:

- as many as 750,000 people in the Region of Peel will be affected with pandemic influenza
- almost 380,000 people will become sick enough to stay in bed for several days
- up to 170,000 people would need medical treatment
- 1,100 residents could die
- hospitals, doctors and emergency rooms will be severely overburdened.

Emergency workers including police, fire, ambulance and nursing staff will be in high demand, but many of them will also be sick. One of the biggest challenges will be to provide medical attention to all the people who need it.

Once the pandemic influenza virus is identified, a special vaccine will have to be made. It can take several months to make a new vaccine and then a longer period to distribute it. Because of worldwide demand, the pandemic influenza vaccine may be in short supply at first.

Avian Influenza

Avian influenza, or "bird flu", is a contagious disease of animals caused by viruses that normally infect only birds and, less commonly, pigs. It is of concern because of its potential to develop into the source of the next pandemic. The large numbers of birds in close-quarters helps the disease to spread quickly.[26, 29]

Avian influenza viruses do not normally infect species other than birds and pigs. The first documented infection of humans with an avian influenza virus occurred in Hong Kong in 1997, when a highly pathogenic strain, known as “H5N1”, caused severe respiratory disease in 18 humans, of whom six died. The infection of humans coincided with an epidemic of avian influenza, caused by the same strain, in Hong Kong’s poultry population.[26] In 2003 this same strain made two members of the same Hong Kong family ill after they traveled to China, one of whom died. In this last year H5N1 jumped the species barrier again, causing disease in 34 individuals in Viet Nam and Thailand, 23 of whom died.[30] Recent outbreaks of avian influenza A (H5N1) in poultry throughout Asia have had major economic and health repercussions.

An outbreak of another highly pathogenic avian influenza A subtype H7N7 started at the end of February 2003 in commercial poultry farms in the Netherlands.[31] Although the risk of transmission of these viruses to humans was initially thought to be low, an outbreak investigation noted an unexpectedly high number of transmissions of avian influenza A virus subtype H7N7 from chickens to humans directly involved in handling infected poultry. There was also evidence for person-to-person transmission.[31] In all, 89 people were confirmed to have been infected.

In the spring of 2004, Avian Influenza infected two poultry workers in the Fraser Valley area of southern British Columbia[32] who had mild illness. More significant was the impact on agriculture in the area. All poultry in the area (estimated to be 17 million birds) was depopulated starting in March. It was not until July 9th that farms there were allowed to restock. It is important to note that the H7 strain found in British Columbia is not the same strain that has caused serious illness and some deaths in Asia.[33]

The greatest concern is the possibility that an outbreak of avian influenza could give rise to another influenza pandemic in humans. Scientists know that avian and human influenza viruses can exchange genes when a person or animal is simultaneously infected with viruses from both species. This process of gene swapping could give rise to a completely new subtype of the influenza virus. It would have the ability to cause high rates of death and severe illness like the recent avian flu in Vietnam and Thailand, and the ability to spread easily from person to person like current human influenza viruses. Because it would be a previously unknown type of virus, people would have little if any immunity to it.

Moreover, existing vaccines, which are developed each year to match presently circulating strains and protect humans during seasonal epidemics, would not be effective against a completely new influenza virus.[26]

This was the situation during the great influenza pandemic of 1918/1919, when a completely new influenza virus subtype emerged and spread around the globe in around four to six months. Several waves of infection occurred over two years, killing over an estimated 20 million persons.[26] The present day global system of influenza monitoring, testing and rapid vaccine development is designed to prevent this from happening again. By quickly detecting new influenza viruses and implementing control measures, it may be possible to prevent these viruses from developing into the next pandemic strain. If despite these efforts a new deadly and highly transmissible strain of influenza arises, the rapid development of a new vaccine and implementation of pandemic plans could minimize its impact on human health.