Influenza in New Zealand 2007

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

Summary

During the 2007 winter season, 2695 consultations for influenza-like illness (ILI) were reported from a national sentinel network of 87 general practices. It is estimated that ILI resulting in a visit to a general practitioner affected over 32 771 New Zealanders (1.0% of total population) during the season, compared with an estimated 40 068 in 2006. The influenza activity peaked in July and the overall level of ILI in 2007 was low compared with the 1997-2006 period. The ILI consultation rates varied greatly among health districts with the highest rates being reported from the South Canterbury and Eastern Bay of Plenty Health Districts. In 2007, the majority of the viruses were influenza A (78.1%) surpassing the influenza B viruses (21.9%). Among all typed and subtyped viruses, influenza A(H3N2)-like viruses (44%) and A(H1N1) (31%) viruses were co-predominant strains with A(H1N1) viruses predominating in the early winter season followed by A(H3N2) viruses in the late season. Significant antigenic drift was observed among the A(H1N1), A(H3N2) and B viruses, resulting in three vaccine components being updated for 2008.

Recommendations

1. That the sentinel influenza surveillance system be enhanced using standard surveillance system criteria and benchmarked against international best practice. This should include the review of:
   - The case definition for ILI
   - The methods of specimen collection from cases
   - Being able to extend the system beyond the period of May to September in order to monitor influenza activity beyond this period
   - Greater use of electronic approaches to data collection and dissemination in order to ease workload on PHS and GPs and improve timeliness of ILI reporting
   - Improvement of recording of swabs sent and received so isolation rates can be calculated with greater accuracy
   - Collect the information on antiviral medication in the specimen request form in the surveillance program
   - Obtain the demographic information for the total patient population from each sentinel GP in order to calculate accurate ILI rates among different age groups.
   - Explore other complimentary surveillance approaches for detecting early cases of ILI.

2. That the sentinel influenza surveillance system be reviewed in terms of its potential during early, peak and late pandemic periods

3. That the sentinel influenza surveillance system be reviewed in terms of its potential for surveillance of other diseases and syndromes of public health importance

1. Introduction

Surveillance of influenza in New Zealand is based on sentinel general practice (GP) and laboratory-based reporting. This surveillance monitors the incidence and distribution of the disease and virus strains. Influenza is not a notifiable disease in New Zealand.

The purpose of influenza surveillance is:

- to understand incidence and distribution of influenza in the community
- to assist with early detection of influenza epidemics within the community and to guide the development and implementation of public health measures
- to identify the predominant circulating strains in the community and guide influenza vaccine composition for the subsequent year[1].

This report summarises results obtained from influenza surveillance in New Zealand for 2007, including some comparisons with previous years. It also includes information on hospital admissions for influenza (obtained from NZHIS) and influenza immunisation coverage data (obtained from Health Benefits Limited).

2. Methods

2.1. General Practice Sentinel Surveillance – Consultation and Isolate Data

The sentinel surveillance system, in its current form, commenced in 1991 as part of the WHO Global Programme for Influenza Surveillance. It is operated nationally by ESR and locally by influenza surveillance co-ordinators in the public health services (PHSs). Normally sentinel surveillance operates from May to September.

In 2007, national influenza sentinel surveillance was undertaken from May to September (week 18 to week 39 inclusive). Local surveillance co-ordinators recruited general practices within their region to participate on a voluntary basis. Where possible, the number of practices recruited was proportional to the size of the population in each health district covered by the Public Health Service (PHS) (approximately 1:50 000 population).

General practitioners (GPs) were required to record the number of consultations for influenza-like illness each week and the age group (current categories as per Figure 8) of each of these suspected cases on a standardised form.

Influenza-like illness (ILI) was defined by a standardised case definition, which was:
"Acute upper respiratory tract infection characterised by abrupt onset and two of the following: fever, chills, headache, and myalgia."

Each practice was also asked to collect respiratory samples (nasopharyngeal or throat swab) from one patient (preferably the first) seen with an ILI on Monday, Tuesday and Wednesday of each week. The swabs were sent to a regional virus diagnostic laboratory and/or the WHO National Influenza Centre (NIC) at ESR for viral isolation and strain identification.

Information on the number of ILI consultations and swabs sent from each health district was forwarded to ESR by local co-ordinators each week (Monday to Sunday). ILI consultation

data was received by the following Monday to Wednesday. Likewise virology laboratories reported to ESR the total number of swabs received from each health district, the influenza viruses identified, together with updated details on type and strain. This data was collated, analysed and reported on a weekly, monthly and annual basis.

Consultation rates were calculated using the sum of the patient populations, reported by the participating practices, as the denominator. Because the age-specific patient population data were not provided by the participating practices, the denominator for the age-specific ILI rate calculation was based on the New Zealand census data with the assumption that age distribution of the GP patient population was the same as the New Zealand population. The national level of ILI activity is described using a set of threshold values.[2, 3] A weekly rate below 50 consultations per 100 000 patient population is described as baseline activity. A weekly consultation rate of 50-249 is considered indicative of normal seasonal influenza activity. Within the normal seasonal activity, 50 to 99 is low activity, 100-149 moderate, and 150 to 249 high. A rate of 250-399 indicates higher than expected influenza activity and ≥400 indicates an epidemic level of disease.

2.2. Laboratory-based Surveillance – Year-round Isolate Data

In addition to influenza viruses (isolates) identified from sentinel surveillance, year-round laboratory surveillance of influenza (and other viruses) is carried out by the three regional virus diagnostic laboratories at Auckland, Waikato, and Christchurch Hospitals, and by the WHO National Influenza Centre at ESR. Each week, all viral identifications, including influenza, largely from hospital inpatients and outpatients are reported to ESR. ESR in turn collates and reports virology surveillance data nationally.

The criteria for laboratory identification of influenza include the direct detection of viral antigen or isolation of the virus by culture or detection of viral nucleic acid. Virus isolation is the gold standard for influenza diagnosis and surveillance specificity. All influenza isolates are typed and most influenza A isolates subtyped.

2.3. Hospitalisations

Hospital admission data for influenza (ICD-10 J10-J18) were extracted from the New Zealand Health Information Service's National Minimum Dataset (NMDS) for the year 2007 (by admission date). Influenza-related hospitalisations were conservatively taken to include only those where influenza was the principal diagnosis. Repeat admissions were included, as repeat infections with another influenza A subtype or B virus are possible.

2.4. New Zealand Population

Population data for each age group obtained from the Statistics New Zealand 2007 estimated Census of Population and Dwellings were used.

2.5. Immunisation Coverage

In 1997 influenza vaccination was made available free to those ≥65 years of age, and in 1999 free vaccination was extended to risk groups <65 years.[4, 5] The data that medical

practitioners provide to Health Benefits Limited to claim reimbursement were used to estimate coverage in 2007 among persons ≥65 years of age.

3. Results

3.1. Sentinel Practices

In 2007, 87 sentinel practices were recruited from 23 of the 24 health districts (one health district did not participate in 2007). All PHSs began reporting by the beginning of May 2007. Some practices did not report every week. The average number of practices participating per week was 79, with an average patient population roll of 347 723, about 8.6% of the New Zealand total population.

3.2. Disease Burden

From May to September 2007, a total of 2695 sentinel consultations for influenza-like illness were reported. The cumulative incidence rate of ILI consultation for 2007 during the influenza season was 775.0 per 100 000. The average national weekly consultation rate in 2007 was 37.2 per 100 000 patient population. This rate is lower than the average weekly rates for 2006 (48.6 per 100 000) and 2005 (52.5 per 100 000).

Extrapolating ILI consultations obtained from the GP patient population to the New Zealand population, it is estimated that ILI resulting in a visit to a general practitioner affected 37 771 New Zealanders during the influenza season (1.0% of total population). This is lower than the estimated 41 626 affected in 2006.

Figure 1 compares the weekly consultation rates for influenza-like illness in 2007 with 2006 and 2005. Influenza consultation activity remained at the baseline level from week 18 to 28, and then increased to a peak at week 31 (28 July – 3 August) with a consultation rate 69.9 per 100 000 patient population. This is four weeks later than the peak in 2006 (week 27) and six weeks later than 2005 (week 25) with rates of 99.4 per 100 000 and 174.4 per 100 000 respectively. Consultation activity then gradually declined, remaining at a moderate level until week 35, and dropping below the baseline in week 36.

Figure 1. Weekly consultation rates for influenza-like illness in New Zealand, 2005, 2006 and 2007

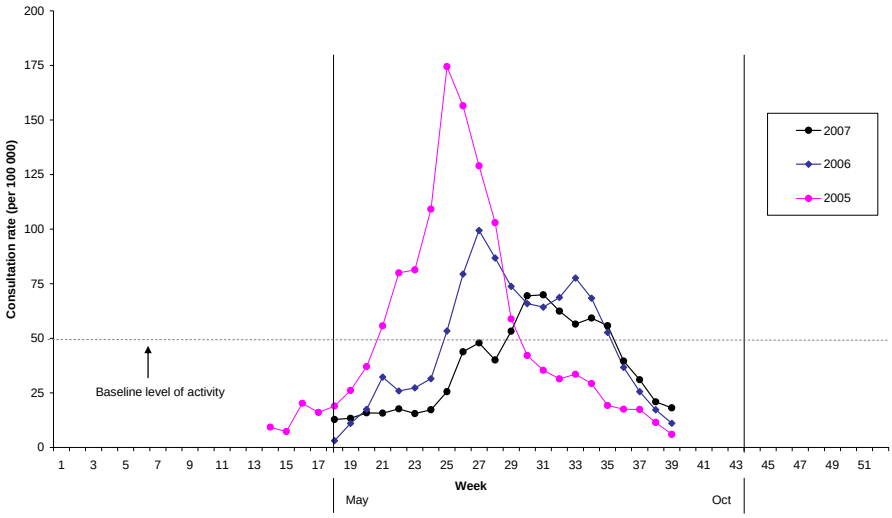


Figure 2. Total influenza isolates by surveillance type and week specimen taken, 2007

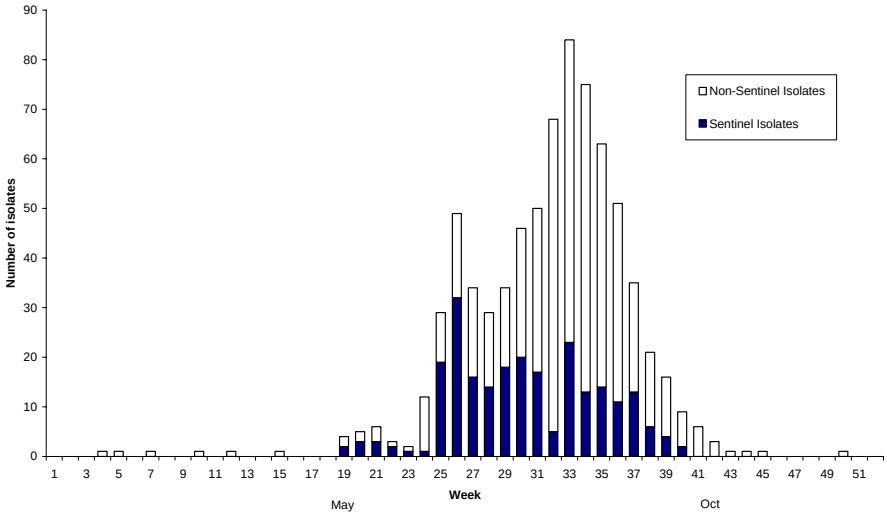
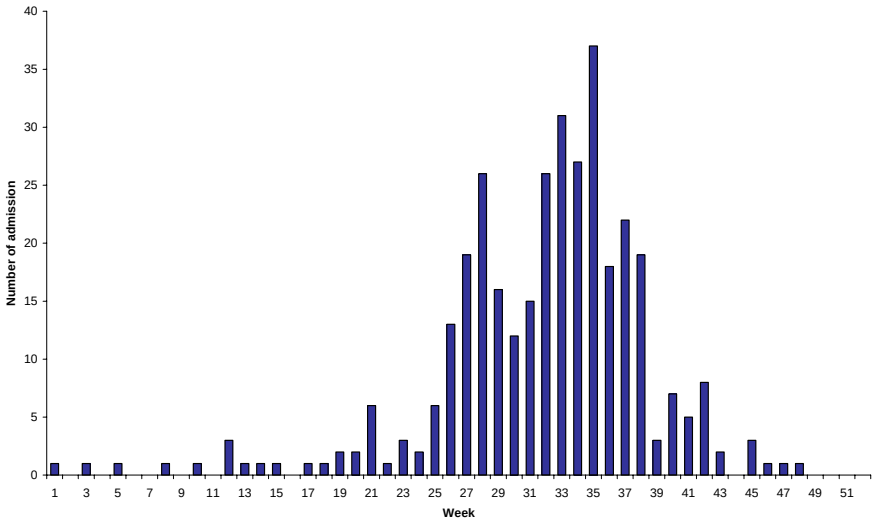


Figure 3. Influenza hospitalisation by week admitted, 2007



A total of 744 influenza isolates were identified in 2007, lower than the 768 and 845 isolates in 2006 and 2005 respectively. Of the 744 isolates, 239 came from sentinel practice surveillance during May to September. This is lower compared to the 315 sentinel isolates identified in 2006 and 273 isolates in 2005. There were 505 non-sentinel isolates identified in 2007 compared to 453 in 2006 and 572 in 2005.

Figure 2 shows influenza virus isolations each week throughout 2007. There were two peaks of the sentinel isolates, one (32) came from specimens taken in week 26 and another (23) from specimens taken in week 33. The broad peak period of the sentinel isolates correlated with the peak period in consultation rates (week 31). Sporadic influenza isolates were identified as early as January during the summer season, however the vast majority (736, 99%) were from specimens taken during May to October. Non-sentinel isolates also peaked in week 32. Overall influenza isolates in 2007 were detected later than that of 2006 but similar to 2005. Most sentinel and non-sentinel isolates (94%) came from the late sentinel period (weeks 24 to 39).

In 2007, there were a total of 347 hospital admissions for influenza and this was lower than the 2006 and 2005 hospitalisations of 464 and 390 respectively. Figure 3 shows these admissions by week, 85% (296) of which occurred during June to September. The highest number of admissions (123) occurred in August. Hospital admissions peaked in week 35, four weeks later than the peak in consultation rates (week 31) and three weeks later than the peak of the non sentinel influenza isolates (week 32).

3.3. Geographic Distribution

In addition to national activity, sentinel surveillance is able to provide an indication of the distribution of influenza-like illness and viral strains within New Zealand.

Figure 4 shows the sentinel average weekly consultation rates for each health district during May to September 2007 (square brackets denotes a health district that did not participate in sentinel surveillance). The health district reporting the highest rate was South Canterbury (101.4 per 100 000 patient population), followed by Eastern Bay of Plenty (76.3 per 100 000), Hawke's Bay (69.6 per 100 000), Otago (66.5 per 100 000), Wairarapa (65.6 per 100 000), Hutt (53.6 per 100 000), Taupo (53.6 per 100 000), Tauranga (42.9 per 100 000), Canterbury (40.4 per 100 000), and Nelson Marlborough (39.2 per 100 000). Table 1 shows health districts codes and description.

Figure 5 shows the distribution of sentinel influenza isolates based on the health district from which the specimen (swab) was taken. Most isolates came from Canterbury, the greater Auckland area, Wellington, Waikato, and Hawke's Bay regions. Isolates were not identified in two health districts (Rotorua and West Coast no swabs received), and swabs for sentinel surveillance were not taken in one health district. The national isolation rate for 2007, illustrated in Figure 6 was 30.7% (239 isolates from 778 swabs received), which is lower than the 2006 rate of 34.1% (924 swabs) and higher than the 2005 rate of 27.8% (981 swabs).

With regards to the geographical distribution of received influenza isolates, it is important to take into account that for some health districts there is a discrepancy in the reported number

of swabs sent by sentinel GPs in that district, and the number of swabs recorded as received by virology labs.

Figure 4. Sentinel average weekly consultation rate for influenza-like illness by health district, 2007

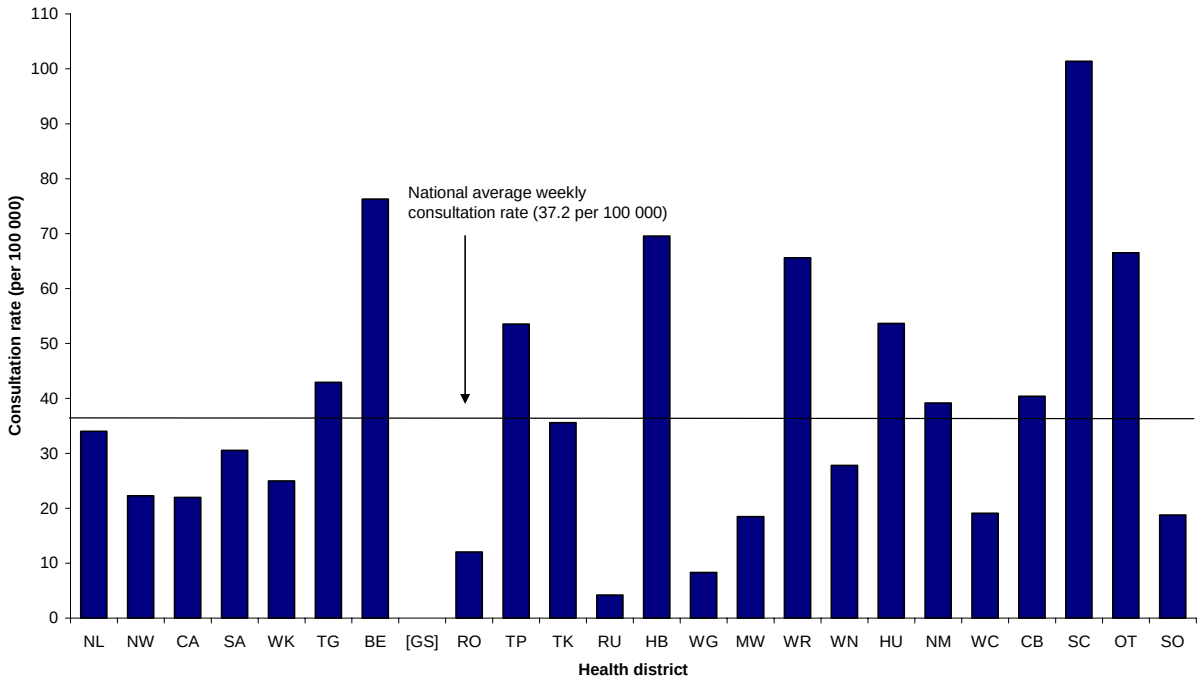


Figure 5. Cumulative laboratory confirmed influenza isolates from sentinel surveillance by health district, May-September 2007

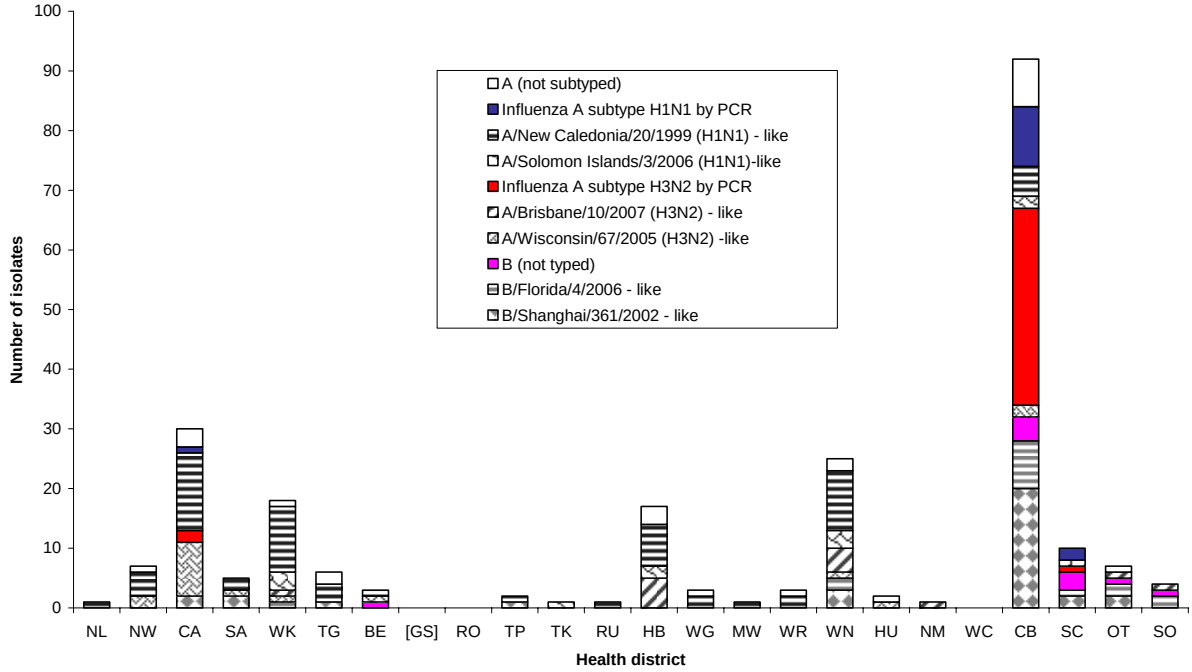
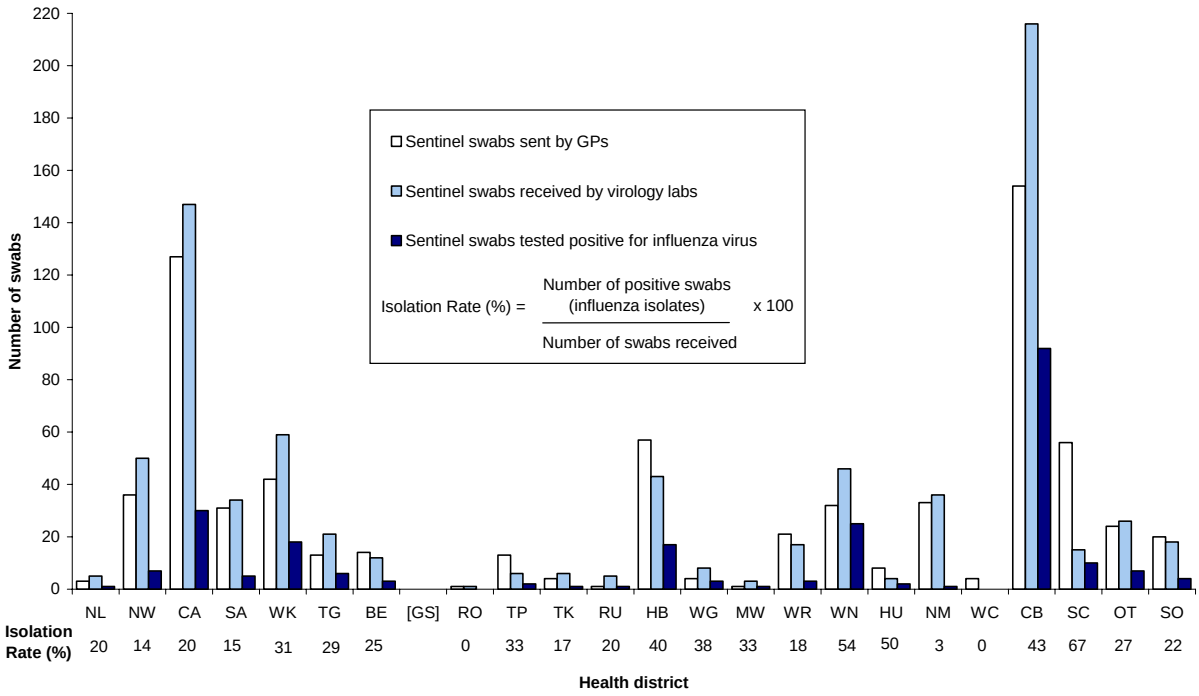


Table 1. Health District Codes and Description

Code	Description	Code	Description
NL	Northland	HB	Hawke's Bay
NW	North West Auckland	WG	Wanganui
CA	Central Auckland	MW	Manawatu
SA	South Auckland	WR	Wairarapa
WK	Waikato	WN	Wellington
TG	Tauranga	HU	Hutt
BE	Eastern Bay of Plenty	NM	Nelson Marlborough
GS	Gisborne	WC	West Coast
RO	Rotorua	CB	Canterbury
TP	Taupo	SC	South Canterbury
TK	Taranaki	OT	Otago
RU	Ruapehu	SO	Southland

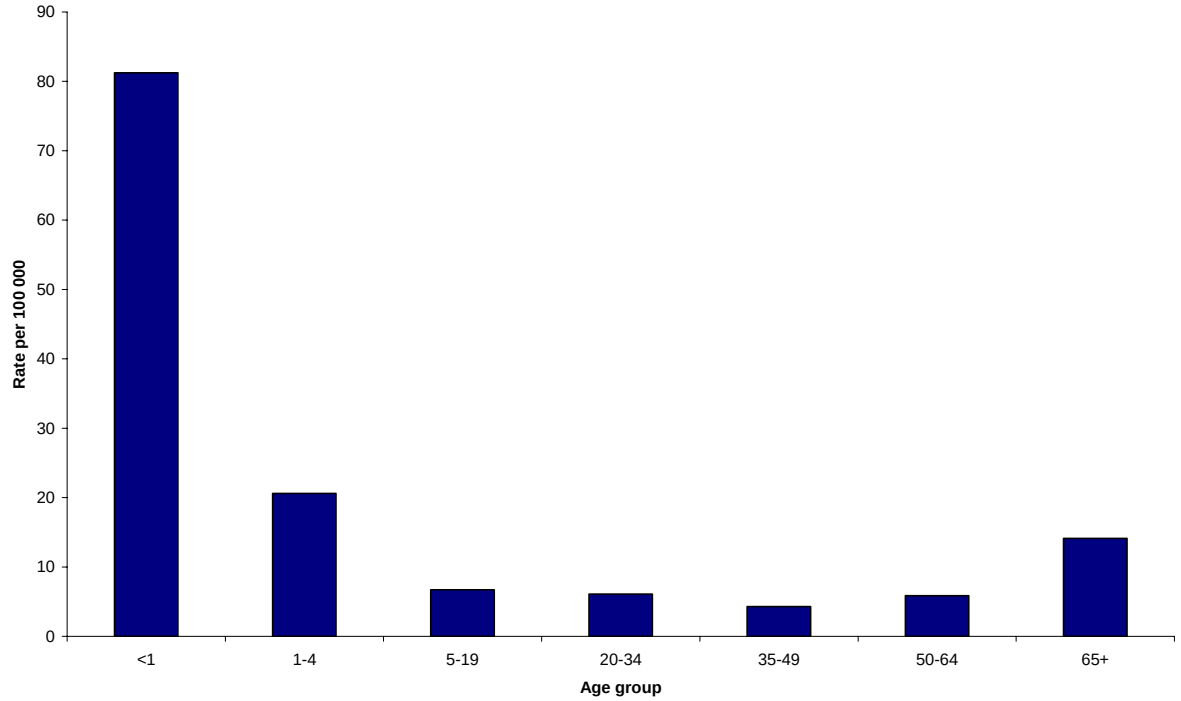
Figure 6. Sentinel swabs, sent, received and tested positive for influenza virus by health district, 2007



3.4. Age Distribution

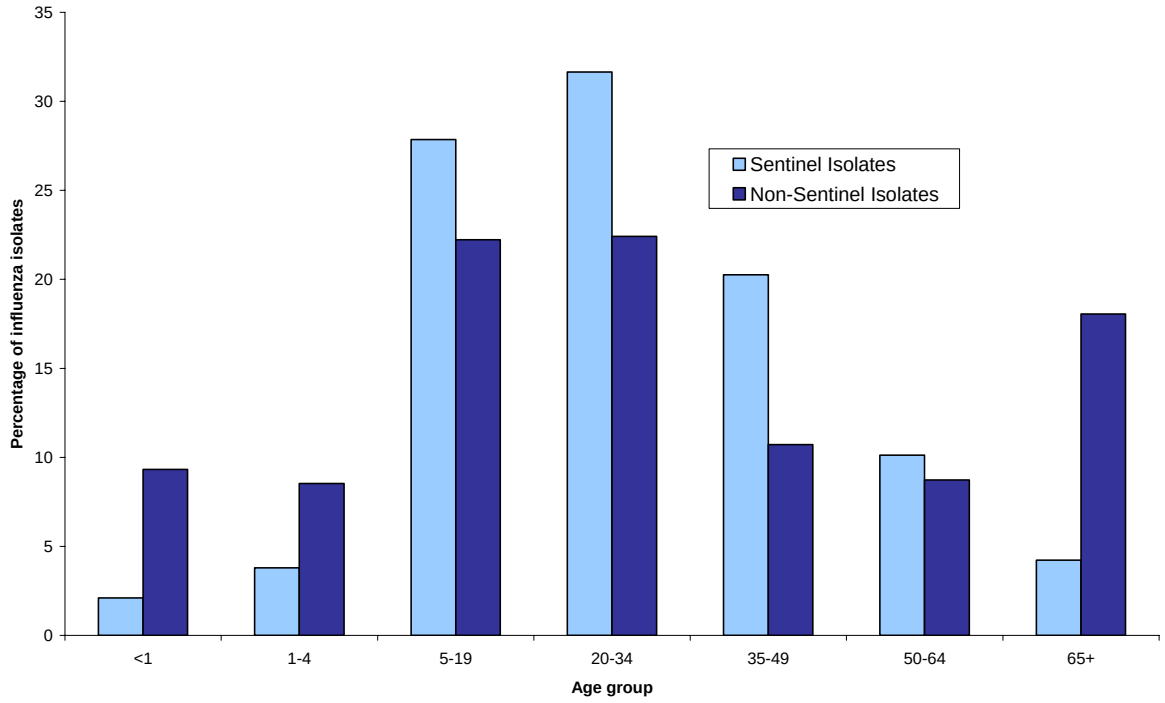
Figure 7 compares the morbidity rates in 2007 by age group. In 2007, the highest morbidity rates occurred in children aged under one year (81.2 per 100 000), followed by children aged 1-4 (20.6 per 100 000) and adults aged 65+ years (14.1 per 100 000).

Figure 7. Morbidity rate by age group, 2007



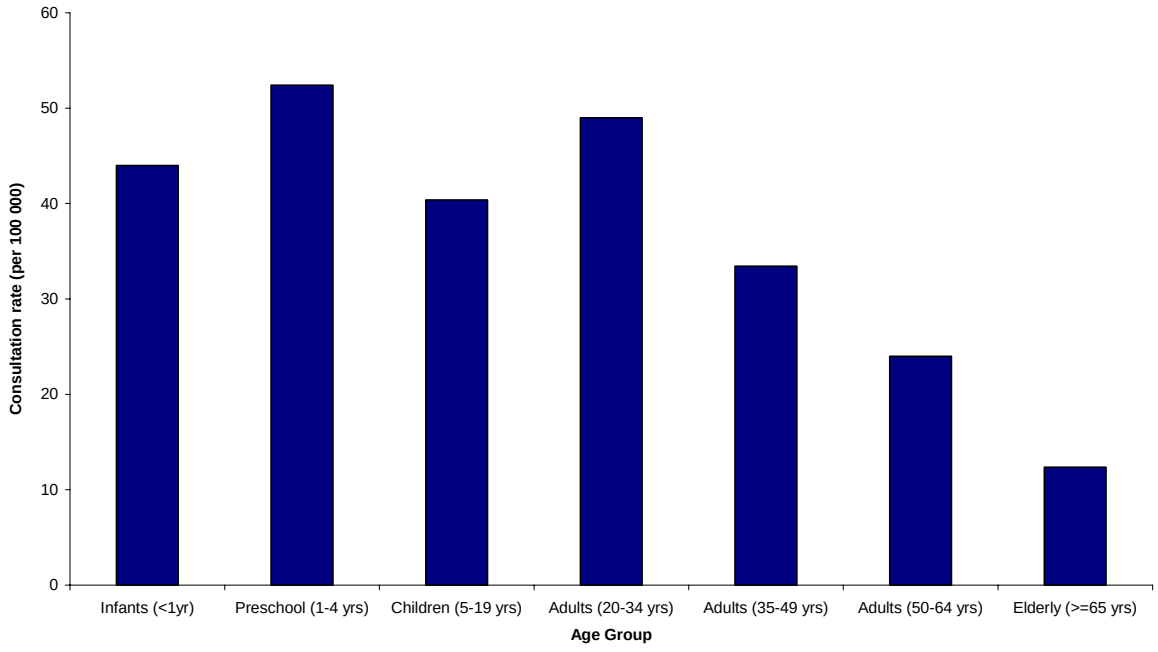
Figures 8 compares the percentage of influenza isolates between sentinel surveillance and non-sentinel for each age group. It is interesting to note that the age group under one year and 1-4 years and patients over 65 years were represented more in laboratory-based surveillance than in sentinel surveillance. This is consistent with the findings from the past 3-5 years.

Figure 8. Percentage of sentinel and non-sentinel influenza isolates by age group, 2007



In addition, rates of ILI by age group were calculated for the sentinel surveillance system. These rates are presented graphically in Figure 9.

Figure 9. Sentinel consultation rate for influenza-like illness by age group, 2007



The highest consultation rate for influenza-like illness was in the children aged 1-4 years and those aged 20-34 years, with an average weekly consultation rate of 52.4 and 49.0 per 100 000 patient population respectively. Infants aged <1 year and those in the 5-19 years had a

rate of 44.0 per 100 000 and 40.4 per 100 000 respectively. Adults aged 35-49 years had a rate of 33.4 per 100 000, and adults aged 50-64 years had a slightly lower rate of 24.0 per 100 000. Elderly people (aged 65 years and over) had had the lowest rate of 12.4 per 100 000.

4. Immunisation Coverage

The uptake of influenza vaccine in New Zealand in 2007 among persons 65 years and over is 64%. Immunisation coverage for at risk individuals under the age of 65 years is estimated at 35%. The number of doses of influenza vaccine used during the 2007 season was 185 doses per 1000 population (down 2% from 189 doses per 1000 in 2006).

Due to vaccine breakthrough and/or failure observed in 2004 (Influenza Annual Report, 2004), the need for surveying influenza vaccine breakthrough/failure was discussed and agreed by health professionals around the country. When GPs take swabs from three ILI patients each week, specimen request forms with necessary demographic information are required to be provided. One extra question is included to record whether the patient has been vaccinated against influenza in the same year as the onset of ILI.

A total of 14 vaccine breakthrough cases were recorded from the national influenza database (Table 2), comprising 1.9% of total isolates (14/744). The clinical effectiveness of influenza vaccines depends on the immunocompetence of the recipient, previous exposure to influenza and influenza vaccines, and the closeness of the match between the vaccine and circulating influenza strains. Of 14 vaccine breakthrough cases, nine cases (64.3%, 9/14) occurred in age groups >50 years. Four cases were in the 20-34 years age group, and one was in the 35-49 years age group. Immunological senescence may explain a higher proportion of vaccine breakthrough cases in the elderly population.

Table 2. Influenza vaccine breakthrough cases by age group, 2007

Age Group (years)	A	Influenza A(H1N1) by PCR	Influenza A(H3N2) by PCR	A/Brisbane/10/2007 (H3N2) - like	A/Wisconsin/67/2005 (H3N2) - like	B	B/Florida/4/2006 - like	B/Shanghai/361/2002-like	Total
<1	0	0	0	0	0	0	0	0	**0**
1-4	0	0	0	0	0	0	0	0	**0**
5-19	0	0	0	0	0	0	0	0	**0**
20-34	0	0	0	1	1	0	1	1	**4**
35-49	0	0	1	0	0	0	0	0	**1**
50-64	1	0	1	1	0	0	1	1	**5**
65+	0	1	0	1	0	2	0	0	**4**
Total	**1**	**1**	**2**	**3**	**1**	**2**	**2**	**2**	**14**

5. Virus Strain Characterisation

5.1. Isolates in 2007

Figure 10 shows influenza virus isolations by type and subtype for each week throughout 2007, and the total percentage contribution of each. Table 3 shows influenza virus isolations by type and subtype for 2007.

The majority of influenza isolates (581/744 or 78.1% of all isolates) were characterised as influenza A. Influenza A(H3N2) represented 43.7% (282/646) of the typed and subtyped isolates and 37.9% (282/744) of the total isolates. Influenza A(H1N1) represented 31.1% (201/646) of the typed and subtyped isolates and 27.0% (201/744) of the total isolates. A total of 163 influenza B isolates were identified in 2007, which represented 25.2% of typed and subtyped isolates (646) and 21.9% of all influenza isolates (744).

Figure 11 shows the general pattern of influenza virus isolations. This indicates the early onset of ILI activity and then a rapid rise to peak in week 31. The majority of influenza A isolates occurred in the middle of the season. The influenza A(H1N1) viruses predominated for the first half of the influenza season (from week 18 to 29). The influenza A(H3N2) predominated for the second half of the season. Influenza B/Yamagata/16/88 lineage viruses (most recently representative B/Shanghai/361/2002-like and B/Florida/4/2006-like viruses) were the predominant lineage representing 22% (142/646) of typed and subtyped viruses. There were only two (0.3%, 2/646) of the influenza B/Victoria/2/87 lineage viruses (most recently representative B/Malaysia/2506/2004-like virus) identified in 2007.

Table 3. Influenza virus isolations by type and subtype, 2007

Virus	All isolates n=744 (%)	Typed/Subtyped n= 646 (%)
Influenza A		
Influenza A subtype H3N2 by PCR	210 (28.2)	210 (32.5)
A/Brisbane/10/2007 (H3N2) - like	21 (2.8)	21 (3.3)
A/Wisconsin/67/2005 (H3N2) -like	51 (6.9)	51 (7.9)
Subtotal A(H3N2)	**282 (37.9)**	**282 (43.7)**
Influenza A subtype H1N1 by PCR	35 (4.7)	35 (5.4)
A/New Caledonia/20/99 (H1N1) - like	135 (18.1)	135 (20.9)
A/Solomon Islands/3/2006 (H1N1) - like	31 (4.2)	31 (4.8)
A (not subtyped)	98 (13.2)	
Subtotal A(H1N1)	**201 (27.0)**	**201 (31.1)**
Influenza B		
B/Florida/4/2006 - like	32 (4.3)	32 (5.0)
B/Malaysia/2506/2004-like	2 (0.3)	2 (0.3)
B/Shanghai/361/2002-like	110 (14.8)	110 (17.0)
B (not antigenically typed)	19 (2.6)	19 (2.9)
Subtotal B	163 (21.9)	**163 (25.2)**
Total	**744 (100)**	**646 (100)**

Figure 10. Total influenza isolates by type and week specimen taken, 2007

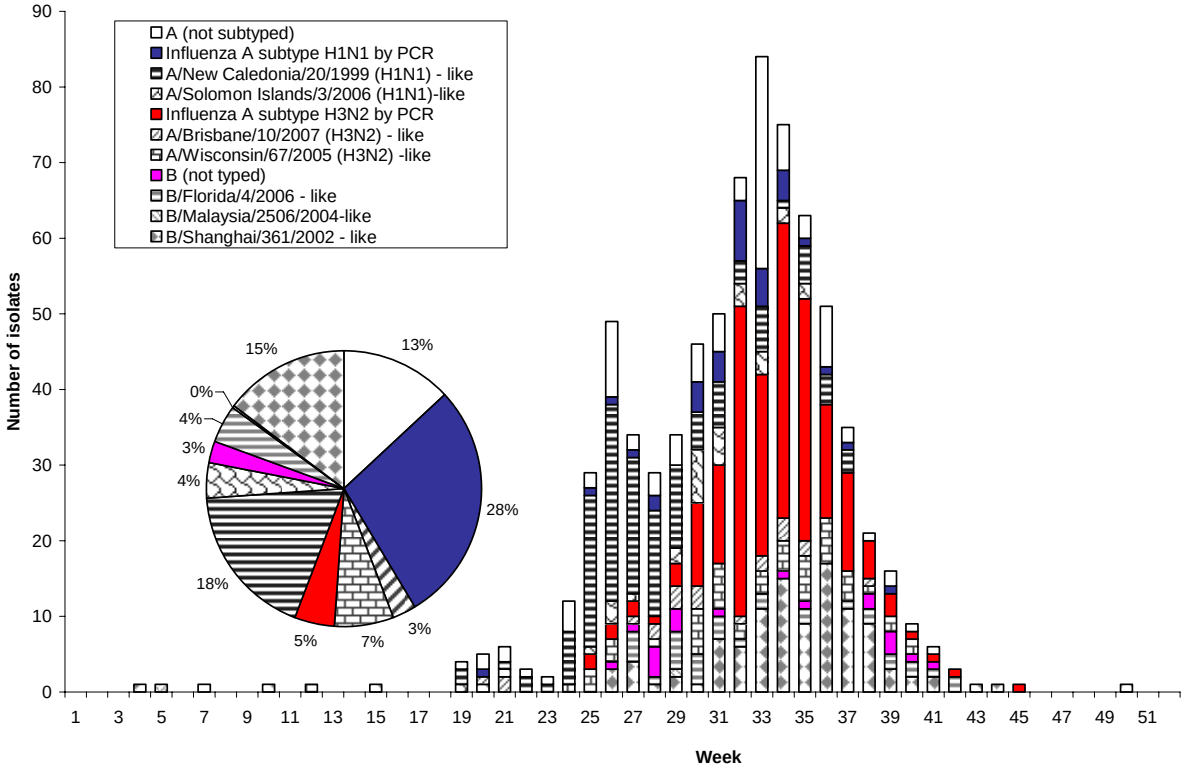
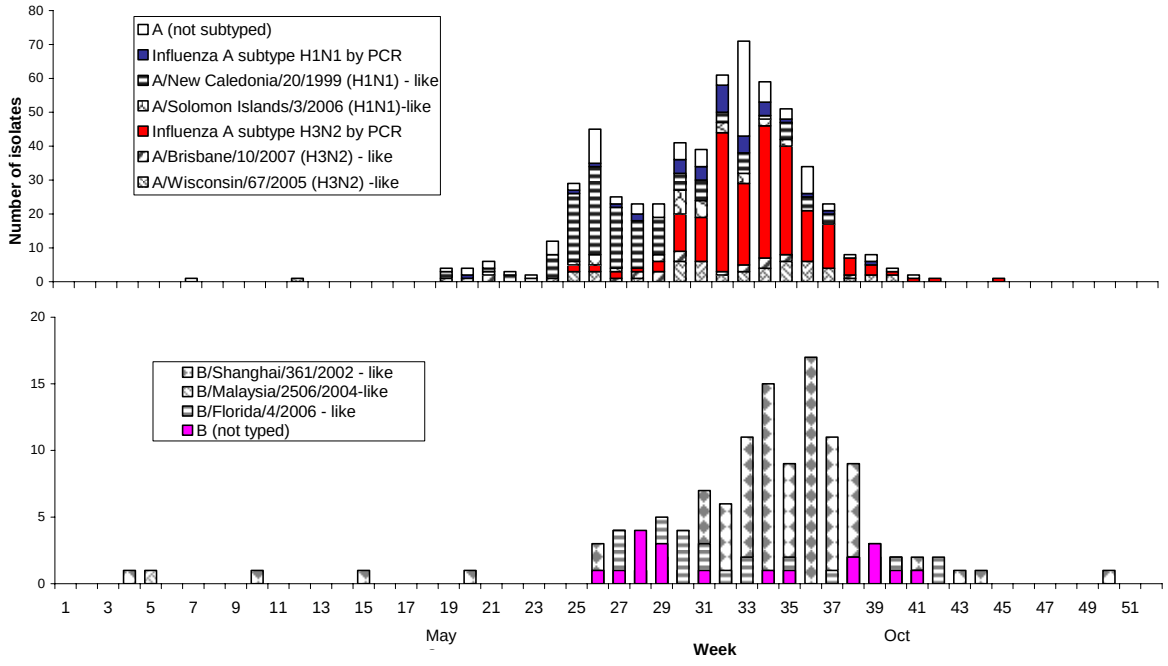


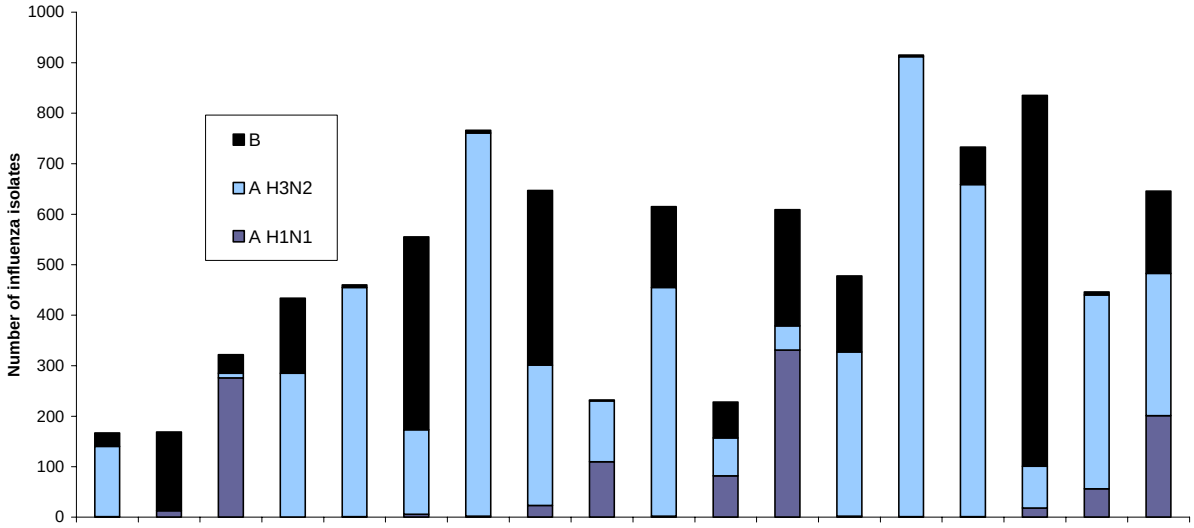
Figure 11. Total influenza virus isolates by type and week specimen taken, 2007



5.2. Changes in Isolates 1990-2007

Figure 12 shows the number and percentage of typed and subtyped (not total) influenza isolates from 1990 to 2007. There are three noticeable changes in terms of predominant patterns:

Figure 12. Influenza isolates by type, 1990-2007



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
B	16%	92%	11%	34%	1%	69%	1%	53%	1%	26%	31%	38%	32%	0%	10%	88%	1%	25%
A H3N2	83%	0%	3%	66%	99%	30%	99%	43%	52%	74%	33%	8%	68%	100%	90%	10%	86%	44%
A H1N1	1%	8%	86%	0%	0%	1%	0%	4%	47%	0%	36%	54%	0%	0%	0%	2%	13%	31%

5.3. Influenza A(H1N1)

During the period from 1990 to 1999 influenza A(H1N1) emerged as predominant circulating strain in 1992 (86%) and six years later in 1998 (47%). However in 2000 and 2001, influenza A(H1N1) predominated in two consecutive years occurring in 36% and 54% of isolates tested. This is in contrast to 2003 and 2004, when only one A(H1N1) was isolated each year. Since 2005, more A(H1N1) viruses were isolated with 18 isolates (2%) in 2005, 56 isolates (13%) in 2006, and 201 isolates (31%) in 2007.

5.4. Influenza A(H3N2)

Influenza A(H3N2) viruses have often been associated with more severe disease and with excess pneumonia and influenza mortality. For example, the highest number of deaths (94) in 1996 in New Zealand was recorded during an A(H3N2) epidemic[5]. During 1993 to 2000, A(H3N2) had been the predominant circulating influenza A strain, however in 2001, A(H3N2) constituted only 8% of typed/subtyped isolates. Influenza A(H3N2) viruses were presented with over 90% of typed/subtyped isolated in 1994, 1996, 2003 and 2004. In 2005, Influenza A(H3N2) co-circulated at lower levels (10%) with influenza B throughout the winter season. In 2006, A(H3N2) was the predominant strain (86% of typed and subtyped isolates) and again in 2007 (44% of typed and subtyped isolates).

5.5. Influenza B

It is well documented that influenza B predominates or co-dominates every second year in southern hemisphere. In New Zealand, influenza B predominated or co-dominated in 1991, 1993, 1995, 1997, 1999 and 2001. However, this pattern has changed since 2001. Influenza B has been the co-predominant strain consecutively in 2001 and 2002, while very low influenza B activity was observed in 2003 and 2004. In 2003, there were only three (0.3%) influenza B isolations but this increased to 10% (74) in 2004. In 2005, influenza B was the predominant strain with 734 isolations (88%), exceeding levels detected in 1995 (69%) and 1997 (53%). In 2006, influenza B activity was recorded at low level (1% of typed and subtyped isolates) but this increased to 25% in 2007.

6. Vaccine Formulation - Southern Hemisphere Trends

In October 2007, the Australian Influenza Vaccine Committee (AIVC), with a New Zealand representative, met to decide on the composition of the influenza vaccine for the 2008 winter season for New Zealand, Australia and South Africa. During these discussions, the following trends were noted:

6.1. Influenza A(H1N1)

Influenza A(H1N1) subtype viruses, which re-emerged in 1977, closely resemble strains that circulated until 1956. Because of this, they initially had little impact in the older population. With further antigenic drift in the subtype, there has been some evidence of increasing impact in the elderly. Two antigenically distinct lines of influenza A(H1N1) have circulated in recent years and these are A/New Caledonia/20/99 and A/Bayern/7/95. In the past few years, however, viruses of the A/New Calendonia/20/99 lineage viruses have completely replaced A/Bayern/7/99-like strains.

The WHO Collaborating Centre for Influenza in Melbourne has analysed 241 A(H1N1) isolates from nine countries since January 2007. Most of recent isolates had antigenically drifted away from A/New Calendonia/20/99 viruses and they were antigenically similar to A/Solomon Islands/3/2006 strains. Current vaccines containing A/Solomon Islands/3/2006 antigen stimulated HA antibodies against recent A(H1N1) influenza isolates, which were of similar titre and frequency to those against the vaccine virus.

Based on the southern hemisphere and global data, the WHO Consultative Group and Australia Influenza Vaccine Committee recommended vaccines containing an A/Solomon Islands/3/2006 (H1N1)-like strain as the H1 component for 2008.

6.2. Influenza A(H3N2)

Influenza A(H3N2) has been frequently associated with severe disease and excess mortality in high-risk groups. This subtype has also shown the greatest tendency for antigenic drift as illustrated by the frequency of vaccine formulation changes recommended by the WHO and the AIVC.

The WHO Collaborating Centre for Influenza in Melbourne has analysed 505 A(H3N2) isolates from 11 countries since January 2007. Influenza A(H3N2) viruses were associated with widespread outbreaks in many southern hemisphere countries including New Zealand. Most recent isolates had antigenically drifted away from A/Wisconsin/67/2005. Current vaccines containing the A/Wisconsin/67/2005(H3N2) antigen stimulated HA antibodies against recent influenza A(H3N2) isolates that were somewhat lower in titre and frequency than to the vaccine virus. As a result, an A/Brisbane/10/2007 (H3N2)-like strain was recommended by WHO and the Australia Influenza Vaccine Committee to be the H3 component of the influenza vaccine for southern hemisphere for 2008.

6.3. Influenza B

Two distinct lines of influenza B have co-circulated in many countries during recent years. This dates from the late 1980's when the B/Panama/45/90 variant of influenza B was first observed. This strain and its further variants-B/Yamagata/16/88 lineage (most recently representative strain-B/Shanghai/361/2002) spread worldwide whereas strains of the previous B/Victoria/2/87 lineage viruses continued to circulate in Asia and subsequently underwent independent evolution as an antigenically distinct lineage (most recent representative strain-B/Malaysia/2504/2004). For reasons not wholly understood, these remained geographically restricted to Asia until 2001. In 2002 the B/Victoria-lineage strains became the predominant viruses worldwide. In 2007, varying proportions of the two lineage viruese were seen in many countries with B/Yamagata lineage strains predominating in New Zealand and Australia but with small numbers.

One hundred and thirty-two influenza B isolates were received in 2007 at the Melbourne WHOCC from 10 countries (15% of total isolates). The majority of isolates (60%) were typed as B/Yamagata-like and reacted well to ferret sera raised against egg grown B viruses of this lineage (e.g. B/Florida/4/2006). Current vaccines containing B/Malaysia/2506/2004 antigen stimulated HA antibodies that were similar in titre to recently isolated B/Malaysia/2506/2004 – like viruses. However, the average post immunisation geometric mean HI titres to recent B/Yamagata/16/88 lineage viruses were reduced. Based on the southern hemisphere and global data, the WHO Consultative Group recommended vaccines containing a B/Florida/4/2006–like strain. The AIVC accepts this recommendation.

In summary, the AIVC agreed to adopt the recommendations made by the WHO consultation group as per the box below.

The recommended influenza vaccine formulation for New Zealand in 2008 is:

- **A(H1N1)** **an A/Solomon Islands/3/2006 (H1N1) - like strain**
- **A(H3N2)** **an A/Brisbane/10/2007 (H3N2) - like strain**
- **B** **a B/Florida/4/2006 - like strain**

7. Discussion

Based on sentinel consultation data using a set of threshold values, the peak of influenza activity in 2007 is described as low. When the peak of weekly consultation rates for influenza-like illness from 1997 to 2007 are compared, 2007 has the second lowest level of influenza activity, with 2000 as the first lowest.

It is estimated that influenza-like illness resulting in a visit to a general practitioner affected over 32 771 New Zealanders in 2007 or about 1.0% of the population. The number of cases reported through the sentinel network is likely to be a considerable underestimate of the true number, as many people do not consult a general practitioner when they have an influenza-like illness.

When the overall pattern for sentinel consultation rates, isolations and influenza hospitalisations are compared for 2007 (Figures 1-3), they follow a similar pattern, peaking in August and then declining to the baseline level in late September. The robustness of the sentinel influenza surveillance has been validated externally by another system, GPSURV.[6] The sentinel surveillance usually operates from May through September. However, in 2000, influenza activity peaked in October through non-sentinel surveillance. Due to the variability of influenza activity from year to year, it is necessary for sentinel surveillance to operate beyond the current May to September period in order to assess influenza activity better.

Consultation rates varied greatly among health districts. The use of a common case definition for the purposes of surveillance should minimise regional differences in the criteria for diagnosis of influenza. However, in health districts where only a single practice or a small number of practices participate, consultation rates are more likely to be subject to variations in individual diagnostic practices. The health district reporting the highest rate was South Canterbury (101.4 per 100 000 patient population).

Figure 9 compares ILI consultation rate in the community among different age groups. Caution is required in interpretation of this data. Because no demographic information on the total patient population is provided from each practice, it was assumed that the total patient population of all sentinel practices collectively had the same age distribution as the New Zealand population. However, individual practices may have differing age distribution of their patient population when compared to census data. Therefore it would be useful to have the demographic information on the total patient population from sentinel GPs in order to obtain the accurate ILI consultation rates among different age groups.

When comparing age data for positive influenza virus isolates from sentinel and non-sentinel surveillance (Figure 8), the non-sentinel system tends to detect more influenza viruses in the under 5's and over 65 years olds than that of the sentinel system. This may reflect the fact that influenza presented more severely in the very young and the elderly populations, resulting in hospitalisations or it may reflect a greater reluctance among sentinel GP's to take swabs from very young children and elderly patients. Overall, these data indicate that sentinel and non-sentinel surveillance complement each other, providing a better description of influenza disease burden for the different age groups.

One of the strengths of the sentinel surveillance system in New Zealand is the combination of disease surveillance (influenza-like illness) and strain surveillance (virological identification). A definitive diagnosis of influenza requires laboratory confirmation, since clinical diagnosis on the basis of clinical symptoms is not highly specific. Consequently, an important part of the sentinel system is for GPs to take nasopharyngeal and/or throat swabs from patients presenting with an influenza-like illness on Monday, Tuesday and Wednesday of each week. During the 2007 season, some health districts had only a small number of swabs or no swabs taken at all which influenced the reported rates in those health districts.

For sentinel surveillance from May to September 2007, four virology laboratories tested 778 respiratory specimens for influenza viruses and 239 (30.7%) specimens were positive for influenza viruses. However, the influenza isolation rate varied among different health districts (Figure 6). Some health districts had an influenza virus isolation rate lower than the national average of 30.7%. Many factors could contribute to low isolation rates, including sampling techniques. Sampling of the respiratory tract for clinical viral isolation should maximise the harvest of virally infected columnar epithelial cells. Ideally, nasopharyngeal washes or aspirates would be the best specimens since they contain a higher cellular content than nasopharyngeal swabs.[7] By comparison, throat swabs or throat washings are of limited use in the diagnosis of influenza since the majority of cells captured by this technique are squamous epithelia. However, a combined nose (i.e. nasopharyngeal) and throat swab can be a useful specimen for influenza virus isolation and it is selected for influenza surveillance because of its convenience. Nasopharyngeal swabs should be cotton-, rayon- or dacron-tipped, plastic-coated swabs. The swab should be inserted deeply into the nasopharynx, rotated vigorously to collect columnar epithelia cells, removed, replaced into viral transport medium (VTM), chilled and couriered to the virology laboratory without delay.

Since 2001, the four virology laboratories have been using the ESR-designed electronic influenza virus input form for data entry. This process requires the retrieval of the necessary demographic data from the hospital information system and re-keying this information onto ESR virus input form. This is time-consuming system and inevitably creates data error. Advances in information transfer using systems such as Health-Link would greatly streamline this process.

Overall, the sentinel surveillance system is very useful in measuring disease burden in the community. However, the results of sentinel surveillance need to be interpreted with caution. For example, sentinel data cannot be extrapolated precisely to the rest of the population since not all people suffering from influenza in the community attend their GP. Also, the sentinel general practices are not truly representative. Practices are not randomly selected and consist of GPs who participate through goodwill, usually due to an interest in influenza surveillance. In addition, ILI consultation rates use the number of patients in the practice as the denominator. These data are provided at the beginning of the season and do not take into account the number of patients entering or leaving the practice during that time. GPs may also see “casual” patients who are not part of the practice population. Despite these problems, the system is useful in meeting the purposes of influenza surveillance, as described in the introduction.

As the impact of influenza can be reduced by annual immunisation, this information is particularly important in raising awareness of the disease amongst health professionals and the public, and planning vaccine formulation and delivery. Influenza vaccines are recommended for persons at risk of developing complications following infection because of

their age or because of some underlying chronic condition, and are available free each year. [8]

In 1997, New Zealand introduced free influenza vaccination to all New Zealanders aged 65 years and older, and set a target of 75% coverage for the year 2000. In 1999 free vaccination was extended to include those under 65 years with certain chronic medical condition.[8, 9] In late 1999, with coverage of the 65 and over group at 55%, it was obvious that the national target was not going to be met. A new promotion group, the National Influenza Immunisation Strategy Group (NIISG) was established in 2000 with the purpose of improving coverage through public and healthcare provider education. The Group is comprised of members from the Ministry of Health, District Health Boards, the Royal NZ College of GPs, the College of Practice Nurses, the Immunisation Advisory Centre, Communications, and the pharmaceutical company that supplies the free vaccine. It is well documented that health professional enthusiasm and support for immunisation is the single most important predictor of a patient being immunised against influenza.[10] For this reason, significant activities of NIISG have been in the area of healthcare professional education. The "Influenza Kit" and "Education Manual" were specifically developed for this purpose. Other education resources include pamphlets, radio and television advertising, healthcare professional education sessions and developing close links with the National Influenza Pandemic Planning Committee. Media evaluation is in place and research has been initiated into attitudes to influenza immunisation in primary health providers and those 65 years and older.[11] A national approach to promotion, coupled with local initiatives, has been a key to lifting coverage to 65% amongst those at greatest risk, people 65 year and older. Quality coverage data are essential for the continuing development of this programme, while continuing surveillance ensures the provision of effective vaccines to reduce the burden of influenza in New Zealand.

Apart from the Acute Flaccid Paralysis programme, the GP sentinel surveillance system for influenza is possibly the only other ongoing syndromic surveillance system in New Zealand. Most other surveillance systems are passive, based on collecting data on diagnosed disease. Active syndromic surveillance systems are being increasingly to detect emerging and re emerging pathogens.[12, 13] Enhanced influenza surveillance is also a key strategy for improving New Zealand's preparedness for pandemic influenza.[14] The GP sentinel surveillance system for influenza would readily adapt to monitor the early stages and progress of pandemic influenza, however objectives for detection of the first pandemic case(s) would not be met by a GP sentinel system due to lack of sensitivity. Hospital-based sentinel surveillance for severe acute respiratory infections could be a way to improve the sensitivity for detection of the early pandemic cases. Enhancement in light of preparations for pandemic influenza could include age, gender, and ethnicity information. In addition, whether or not the patient has been using antivirals or received influenza immunisations could also provide useful information on antiviral resistance and vaccine efficacy. There is therefore a good case for reviewing New Zealand's existing influenza surveillance system in light of these potential enhancements.

8. References

1. Report of the WHO/GEIG Informal Consultation on the Standardization and Improvement of Influenza Surveillance, Monaco. 1991.
2. Dedman DJ, et al., Influenza surveillance in England and Wales: October 1996 to June 1997. CDR Rev, 1997. **13**: p. R212-219.
3. Jennings L, et al., Influenza surveillance and immunisation in New Zealand, 1990-1999. NZPHR, 2001. **8**: p. 9-12.
4. Ministry of Health, Influenza vaccine. [Circular letter] to health professionals. 1996.
5. Jennings LC and Baker S. Government policy change in 1997 was essential for the implementation of an influenza vaccination strategy for New Zealand, ed. Osterhaus ADME, et al, and editors. 2001: Elsevier.
6. Jones N and Marshall R, Evaluation of an electronic general-practitioner-based syndromic surveillance system-Auckland, New Zealand, 2000-2001. MMWR, 2004. **53**: p. 173-178.
7. Monte AS and Kioumehr F, The Tecumseh study of respiratory illness. IX Occurrence of influenza in the community. AMJE, 1975. **102**: p. 553-563.
8. Centers for Disease Control, Update: influenza-associated deaths reported among children aged <18 years - United States, 2003-4 influenza season. MMWR, 2003. **52**: p. 1286-1288.
9. Zambon M, Textbook of Influenza. Laboratory Diagnosis of Influenza, ed. W.R. Nicholson KG, Hay AJ, eds. 1998: London: Blackwell Science Ltd.
10. Hampson AW, Vaccination of the older adult: the Australian experience. Vaccine, 1999. **17**: p. S63-S66.
11. Weir R, Brunton C, and Jennings LC, Attitudes to influenza immunisation amongst General practitioners, Practice nurses and those 65 years and older, in New Zealand Immunisation Conference. 2002: Christchurch.
12. Rana A, et al., Surveillance for unexplained deaths and critical illnesses due to possibly infectious causes, United States, 1995–1998. EID, 2002. **8**: p. 145-153.
13. Outbreaks of avian influenza A (H5N1) in Asia and interim recommendations for evaluation and reporting of suspected cases—United States, 2004. MMWR, 2004. **53**: p. 97-100.
14. WHO. Influenza Pandemic Preparedness Plan: The role of WHO and guidelines for national and regional planning. WHO/CDS/CSR/EDC/99.1. in Geneva: WHO, April 1999.