ESR

SURVEILLANCE REPORT

Influenza surveillance in New Zealand

2012

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INFLUENZA SURVEILLANCE IN NEW ZEALAND 2012

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SUMMARY

Influenza viruses frequently undergo antigenic changes and can cause substantial morbidity and mortality in a short space of time. National influenza surveillance in New Zealand is an essential public health component for assessing and implementing strategies to control influenza. Influenza surveillance in New Zealand monitors the incidence and distribution of influenza in the community, it assists with the early detection of influenza epidemics and identifies the predominant circulating strains. This report summarises the burden of disease in the community due to influenza, the circulating influenza virus strains, hospitalisations and immunisation coverage for 2012.

During the 2012 winter season, 4090 consultations for influenza-like illness (ILI) were reported from a national sentinel network of 85 general practices. It is estimated that ILI resulting in a visit to a general practitioner affected over 48,186 New Zealanders (1.1% of total population) during the season, compared with an estimated 41,133 people in 2011 (0.9% of total population).

Influenza activity peaked in August. Overall, ILI activity in 2012 was at a medium level compared with the 1997–2012 period. ILI consultation rates varied greatly among District Health Boards (DHBs), with the highest rates reported from Waitemata and South Canterbury DHBs.

As a key component of the Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance (SHIVERS), SARI (Severe Acute Respiratory Infections) surveillance has been established and fully functioning since 30th April 2012. The SARI surveillance and NMDS coding recorded high hospitalisation rates for very young and elderly subpopulations. SARI surveillance and NMDS coding also recorded higher hospitalisation rates for Pacific Peoples and Māori than for those of Asian, European or Other ethnic groups.

In 2012, a total of 2425 influenza viruses were detected. Of these, 87.4% were influenza A and 12.6% were influenza B. Of all the viruses typed and sub-typed (2130) during the season, the predominant strain was influenza A(H3N2) at 74.0%, 14.4% were influenza B, and 11.6% were A(H1N1)pdm09 strains. Antiviral susceptibility monitoring indicated that all influenza viruses tested (except two) were sensitive to oseltamivir. The first oseltamivir resistant influenza A(H1N1)pdm09 virus was detected from a 26 year old male who was hospitalised with an acute upper respiratory tract infection within seven days of returning to New Zealand from India. The second oseltamivir resistant influenza A(H1N1)pdm09 virus was detected from 7-month-old Samoan infant girl who was hospitalised with suspected pneumonia and had not travelled overseas prior to hospitalisation.

No significant antigenic drift was detected for influenza A(H1N1)pdm09 viruses. A(H3N2) viruses have genetically and antigenically drifted away from the A/Perth/16/2009-like strain and were closely related to A/Victoria/361/2011-like strain. Two lineages of influenza B viruses (B/Victoria and B/Yamagata lineages) were co-circulating in 2012 with an increased proportion of B/Yamagata lineage viruses. The B/Yamagata lineage viruses were antigenically closely related to the B/Wisconsin/1/2010-like strain. As a result, A(H3N2) and B components were updated for the influenza vaccine for 2013.

The recommended influenza vaccine formulation for New Zealand in 2013 is:

- **A(H1N1)** **an A/California/7/2009 (H1N1)-like strain***
- **A(H3N2)** **an A/Victoria/361/2011 (H3N2)-like strain**
- **B** **a B/Wisconsin/1/2010-like strain**

*Note: A/California/7/2009 is an influenza A(H1N1)pdm09 strain

INTRODUCTION

INTRODUCTION

Influenza viruses frequently undergo antigenic changes, enabling them to evade the host immune response. This poses a real challenge for the prevention and control of influenza. The overarching goal of influenza surveillance is to provide information to public health authorities to facilitate appropriate control and intervention measures, health resource allocation and case management, thereby minimising the impact of influenza on people.

Specifically, New Zealand's influenza surveillance activities aim to:

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

This report summarises the results obtained from influenza surveillance in New Zealand for 2012, and includes some comparisons with previous years. It also includes information on influenza morbidity (obtained from SARI surveillance and the Ministry of Health's National Minimum Dataset), and influenza immunisation coverage data (obtained from Health Benefits Limited).

METHODS

METHODS

General practice sentinel surveillance – epidemiology and virology data

The sentinel surveillance system, in its current form, began in 1991 as part of the World Health Organization's (WHO) Global Programme for Influenza Surveillance. It is operated nationally by the Institute of Environmental Science and Research (ESR) and locally by influenza surveillance co-ordinators in the public health services (PHSs). Sentinel surveillance usually operates in the winter, from May to September (week 18 to week 39). 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 District Health Board (DHB) covered by the PHS (approximately one general practitioner (GP) per 50,000 population).

GPs were required to record the number of consultations for influenza-like illness (ILI) each week and the age group in years (<1, 1–4, 5–19, 20–34, 35–49, 50–64, 65+) of each of these suspected cases on a standardised form.

ILI was defined by a standardised case definition, which is, '*acute upper respiratory tract infection characterised by abrupt onset and two of the following: fever, chills, headache, and myalgia*.' [2]

Each participating GP collected three respiratory samples weekly (ie, a nasopharyngeal or throat swab), one each from the first ILI patient examined on Monday, Tuesday and Wednesday of the week. Further refinement of the sampling scheme has been implemented since 2010. For a general practice with a registered patient population of more than 10,000, a total of six nasopharyngeal or throat swabs were collected, two each from the first two ILI patients examined on Monday, Tuesday and Wednesday of the week. The GPs forwarded these samples to the WHO National Influenza Centre (NIC) at ESR or to hospital virology laboratories in Auckland, Waikato or Christchurch for virus characterisation. Laboratory identification included molecular detection using the polymerase chain reaction (PCR), isolation of the virus or direct detection of viral antigens. Influenza viruses were typed and subtyped as A, B, A(H3N2) or influenza A(H1N1)pdm09.

Information on the number of ILI consultations and swabs sent from each DHB was forwarded to ESR each week (Monday to Sunday) by local co-ordinators. ILI consultation data were received by Wednesday of the following week. Likewise, virology laboratories reported to ESR weekly with the total number of swabs received from each DHB, the influenza viruses identified and updated details on types and strains. ESR reports national information on epidemiological and virological surveillance of influenza weekly, monthly and annually to relevant national and international organisations, including the WHO, and it publishes the results on the website: www.surv.esr.cri.nz/virology/influenza_weekly_update.php

Consultation rates were calculated using the registered patient populations of the participating practices as denominators. From 1992 to 2009, the denominator for the age-specific ILI rate calculation was based on New Zealand census data with the assumption that the age distribution of the GP patient population was the same as the New Zealand population, because age-specific patient population data were not provided by the participating practices. From 2010 to 2012, age-specific ILI consultation rate calculations have used the age-specific patient populations as denominators for all but one general practice (in 2012) where the former calculation method was applied.

The national level of ILI activity is described using a set of threshold values [3, 4]. Based on New Zealand's influenza ILI consultation rates during 1990–1999, various levels of influenza activity such as baseline, normal seasonal influenza, higher than expected influenza activity and severe epidemic level are described by using different ILI consultation rates. For details, see the table below.

Term used		Consultation rate (per 100,000 population)
Baseline		≤49
Normal seasonal activity	low	50–99
	moderate	100–149
	high	150–249
Higher than expected		250–399
Severe epidemic		≥400

HealthStat

HealthStat is a computer-based routine surveillance system based on a nationally representative random sample of approximately 100 general practices that code for ILI. The case definition used for ILI by HealthStat is *'acute upper respiratory tract infection, with abrupt onset of 2+ symptoms from chills, fever, headache and myalgia'*. This surveillance system monitors the number of people who consult GPs with their influenza like illness. HealthStat is based on automated downloads from GP practice management computer systems. These data are provided to ESR by CBG Health Research Ltd on a weekly basis. HealthStat GP-based surveillance does not include virological surveillance.

Analysis is frequency based, with alarms raised by identifying statistical deviations (aberrations) from previous ILI counts. The analysis of the ILI count is based on the cumulative summation algorithm implemented in the Early Aberration Reporting System (EARS) application developed by the Centres for Disease Control and Prevention (CDC), Atlanta, United States. EARS has three sensitivity thresholds (high, medium and low). If the daily call count exceeds a threshold, a flag is signalled.

Healthline

Healthline is the free national 0800 24-hour telephone health advice service funded by the Ministry of Health. Calls made to Healthline are triaged using electronic clinical decision support software. Data collected are daily counts of all symptomatic calls made to Healthline and those triaged for ILI. The Healthline data is reported by ESR on a weekly basis and this can be switched to a daily report if required. Around 70% of all calls to Healthline are symptom related (other calls that are not part of this analysis include queries for information).

Analysis is frequency based with alerts raised by identifying statistical deviations (aberrations) from previous calls. Data are reported for all ages in five age bands (0–4, 5–14, 15–44, 45–64, 65+ years). The analysis of the call frequency is based on the cumulative summation (CUSUM) algorithm implemented in EARS. EARS has three sensitivity thresholds (high, medium and low). If the daily call count exceeds a threshold a flag is signalled.

Cases of ILI are defined as those that are recorded in the Healthline database as having one of the following 18 guidelines: fever (adult), breathing problems, breathing difficulty – severe (paediatric), colds (paediatric), cough (paediatric), cough (adult), fever (paediatric), flu-like symptoms or known/suspected influenza, flu-like symptoms (pregnant), influenza (paediatric), headache, headache (paediatric), muscle ache/pain, sore throat (paediatric), sore throat/hoarseness, sore throat/hoarseness (pregnant), upper respiratory tract infections/colds and upper respiratory tract infections/colds (pregnant).

Hospital-based surveillance for severe acute respiratory infections

Recent global experience with pandemic influenza A(H1N1)pdm09 identified several important surveillance gaps which compromised the assessment and monitoring of the event. One of these gaps was the monitoring of severe respiratory disease. The lack of established surveillance for severe respiratory disease in most countries and the resulting absence of historical data limited our ability to evaluate the severity of the event in the context of previous seasons or observe changes in the behaviour of the virus.

Hospital surveillance for severe acute respiratory infections (SARI) provides evidence to inform public health and clinical practice, reduces the impact of influenza virus infection and other important respiratory pathogens, and supports pandemic preparedness. The SHIVERS project which commenced in April 2012, is an enhanced, active, year-round, population-based surveillance for SARI cases admitted to hospitals in the Auckland region (with a population of 838,000), covering Auckland District Health Board (ADHB) and Counties Manukau District Health Board (CMDHB).

The aims of SARI surveillance are to:

- Establish enhanced, prospective, longitudinal, population-based surveillance for hospitalised SARI cases, ICU admissions and deaths caused by influenza and other respiratory pathogens in Auckland in order to support global influenza surveillance [5].
- Measure the incidence, prevalence, demographic characteristics (including age, sex, ethnicity, and socioeconomic status), clinical spectrum and outcomes for SARI cases, ICU admissions and deaths.
- Identify etiologies of SARI cases, including ICU admissions and deaths attributable to influenza and other respiratory pathogens (eg. respiratory syncytial virus, human metapneumovirus, adenovirus, *Streptococcus pneumoniae*, *Haemophilus influenzae*) using routine methods (PCR, culture and serology) and new molecular methods.
- Determine the accuracy and validity of the data generated from New Zealand's (NZ) existing hospital discharge coding by comparing it with estimates of influenza and pneumonia etiology and incidence obtained from this study.
- Describe any possible increased risk of influenza-related hospitalisation, ICU admission and death associated with conditions such as asthma, pregnancy, diabetes, and high BMI among population sub-groups defined by age, sex, ethnicity, and socioeconomic status.
- Contribute directly to some of the specific aims and objectives of the SHIVERS project by using the data generated from this surveillance.

Any inpatients with suspected respiratory infections admitted overnight to each of the four DHB hospitals in the two DHBs are screened by research nurses daily. Overnight admission has been defined as: *"A patient who is admitted under a medical team, and to a hospital ward or assessment unit"*. Suspected respiratory infections include acute infections and acute exacerbations of chronic respiratory conditions. The scope is broadly covered by the following conditions:

- suspected acute upper respiratory tract infection (including coryza, pharyngitis)
- suspected croup
- suspected bronchiolitis (in children)
- suspected pneumonia
- exacerbations of asthma
- exacerbations of childhood chronic lung disease (including bronchiectasis, cystic fibrosis)
- exacerbations of adult chronic lung disease (including COPD, emphysema, bronchitis)
- respiratory failure
- other suspected acute respiratory infections
- febrile illness with respiratory symptoms (including shortness of breath)
- other suspected acute respiratory infection

As the primary goal of influenza surveillance is to recognize trends, describe patterns of risk and estimate impact, it is not necessary to identify every case. This is also true with estimating disease burden, although special methods are required to understand the sensitivity of the definition and to estimate the missing fraction of cases. As with all case definitions, there should be a balance between sensitivity and specificity. A more sensitive definition will capture a larger proportion of all cases at the cost of testing a large number of cases caused by agents other than influenza. A more specific definition will result in more accurate capture of cases but will miss a larger proportion of the total and perhaps provide a more biased picture of the pattern of disease occurring in the community.

A WHO SARI case definition [6] has been used for all patients with suspected respiratory infections, stated as an acute respiratory illness with:

- a history of fever or measured fever of ≥38°C, and
- cough, and
- onset within the past 7 days, and
- requiring inpatient hospitalisation.

If a patient with suspected respiratory infection meets the SARI case definition, a respiratory sample is collected to test for influenza and other respiratory pathogens. In addition, patient information is captured via a case report form containing the following data elements:

- patient demographics
- history of presenting illness
- co-morbidities
- disease course and outcome, including major treatments, ICU admission and SARI-related mortality
- additional questions to ascertain more detailed information regarding possible epidemiologic risk factors for SARI, including host and environmental factors
- laboratory results.

SARI surveillance has been established and fully functioning since 30 April 2012 as a result of the excellent collaboration among ESR, ADHB, CMDHB, the University of Otago and the University of Auckland, WHOCC St Jude and CDC-Atlanta.

NMDS-coded influenza hospitalisations

Hospitalisation data for influenza (ICD-10AM-VI code I (J09-J11) for 2012 which correlate with previous versions of ICD-10AM (codes J10-J11), were extracted from the New Zealand Ministry of Health's National Minimum Dataset (by discharge date). In this dataset, patients who received less than one day of hospital treatment in hospital emergency departments were excluded from any time series analysis of influenza hospitalisations from 2000 to 2012. Influenza-related hospitalisations were conservatively taken to include only those cases where influenza was the principal diagnosis. Repeat admissions were included because infections with another influenza A subtype or B virus are possible.

Non-sentinel surveillance – virological surveillance for outpatients and hospital inpatients

In addition to influenza viruses identified from sentinel surveillance, year-round laboratory surveillance of influenza (and other viruses) is carried out by the four regional virus diagnostic laboratories at Auckland, Waikato, Wellington and Christchurch Hospitals, and by the WHO NIC at ESR. This type of surveillance is referred to as non-sentinel surveillance. Each week, all viral identifications, including influenza, largely from outpatient clinics and hospital inpatient clinics during routine laboratory diagnostic investigation, are reported to the NIC at ESR. ESR, in turn, collates and reports virology surveillance data nationally.

The NIC at ESR (previously the National Health Institute, New Zealand Communicable Disease Centre) was designated by the New Zealand's Ministry of Health and recognised by the WHO in 1954. Since that time, the NIC has been the key point of contact for both the WHO and the Ministry of Health regarding virological and epidemiological surveillance of influenza. The NIC provides influenza virus isolates to the WHO Global Influenza Surveillance Network, reference testing for hospital laboratories including antigenic and genetic typing, and oseltamivir susceptibility testing. The NIC collates year-round national laboratory testing information on all influenza-positive cases, including basic demographics. Most influenza viruses are forwarded to the WHO Collaborating Centre (WHOCC) in Melbourne for further characterisation.

Immunisation coverage

In 1997, influenza vaccination was made available free to those aged 65 years and older, and in 1999, free vaccinations were extended to all pregnant women and people younger than 65 years who are at high risk of complications from influenza [7, 8].

People younger than 65 years are eligible for free influenza vaccinations if they have any of the following medical conditions:

- cardiovascular disease (ischaemic heart disease, congestive heart failure, rheumatic heart disease, congenital heart disease, cerebrovascular disease)
- chronic respiratory disease (asthma if on regular preventive therapy, other respiratory disease with impaired lung function)
- diabetes
- chronic renal disease
- cancer (current), excluding basal and squamous skin cancers, if not invasive
- other conditions (autoimmune disease, immunosuppression, human immunodeficiency virus, transplant recipients, neuromuscular and central nervous system diseases, haemoglobinopathies, children on long-term aspirin therapy).

The data that medical practitioners provide to Health Benefits Limited to claim reimbursement were used to estimate immunisation coverage in 2012 among those eligible for free influenza vaccinations.

Data used to calculate rates

Denominator data used to determine rates of ILI, hospitalisations, mortality and immunisation coverage were derived from 2012 mid-year population estimates published by Statistics New Zealand.

Ethnicity

For different ethnic groups, numbers hospitalised and rates are based on a prioritised classification of ethnicity, with the Māori ethnic group at the top of the hierarchy, followed by Pacific Peoples, Asian, Middle Eastern/Latin American/African (MELAA) and European or Other Ethnicity (including New Zealander) ethnic groups (Source: Statistical New Zealand 1997:33). The NMDS and SHIVERS project use this same prioritised classification for ethnicity data.

COMMUNITY-BASED SURVEILLANCE

COMMUNITY-BASED SURVEILLANCE

ESR's sentinel GP-based surveillance

In 2012, 85 sentinel practices were recruited from 19 out of 20 DHBs under ESR's sentinel GP-based surveillance. All PHSs began reporting by the third week (20 May 2012). Some sentinel practices did not report every week. The average number of practices participating per week was 81, with an average patient population roll of 376,281 – approximately 8.5% of the New Zealand population.

During the 2012 influenza season (May to September), a total of 4090 sentinel consultations for ILI were reported. Based on this, the cumulative incidence rate of ILI consultations was 1087.0 per 100,000 patient population. This rate is higher than the cumulative incidence rate for 2011 (933.8 per 100,000) but lower than for 2010 (1157.6 per 100,000). The average national weekly consultation rate in 2012 was 50.2 per 100,000 patient population. This rate is higher than the average weekly rates for 2011 (37.1 per 100,000) and 2010 (49.3 per 100,000).

Extrapolating ILI consultations obtained from the general practice patient population to the New Zealand population, it is estimated that an ILI resulting in a visit to a GP affected 48,186 New Zealanders during the 2012 influenza season (1.1% of total population). This is higher than the estimated 41,133 (0.9% of total population) people affected in 2011 but lower than the 50,561 (8.1% of total population) people affected in 2010.

Figure 1 compares the weekly consultation rates for ILI in 2012 with the weekly consultation rates for ILI in 2007–2011. Influenza consultation activity remained at the baseline level from weeks 18 to 26 in 2012, and then increased to a peak in week 31 (30 July–5 August 2012), with a consultation rate of 154.1 per 100,000 patient population. The peak occurred a week later than the first peak in 2011 (week 30, 66.1 per 100,000 patient population) and two weeks earlier than the peak in 2010 (week 33, 151.6 per 100,000 patient population). Consultation activity then gradually declined in 2012, remaining at a low level from week 33 until week 34, and dropping below the baseline consultation rate in week 35.

Figure 1. Weekly consultation rates for ILI in New Zealand, 2007–2012

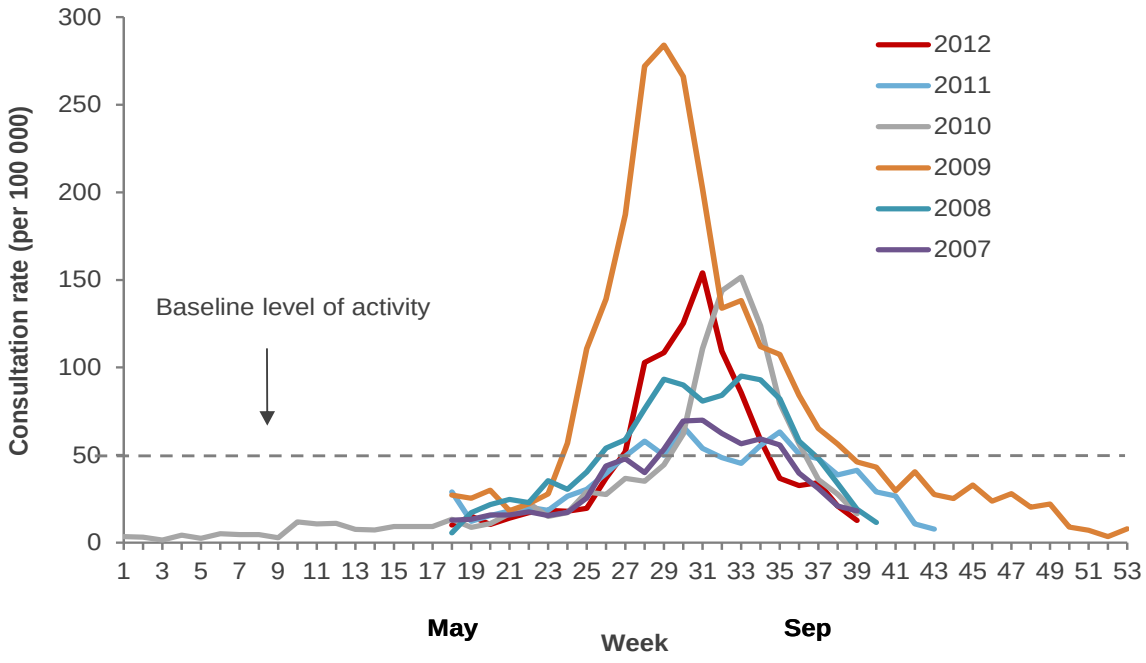
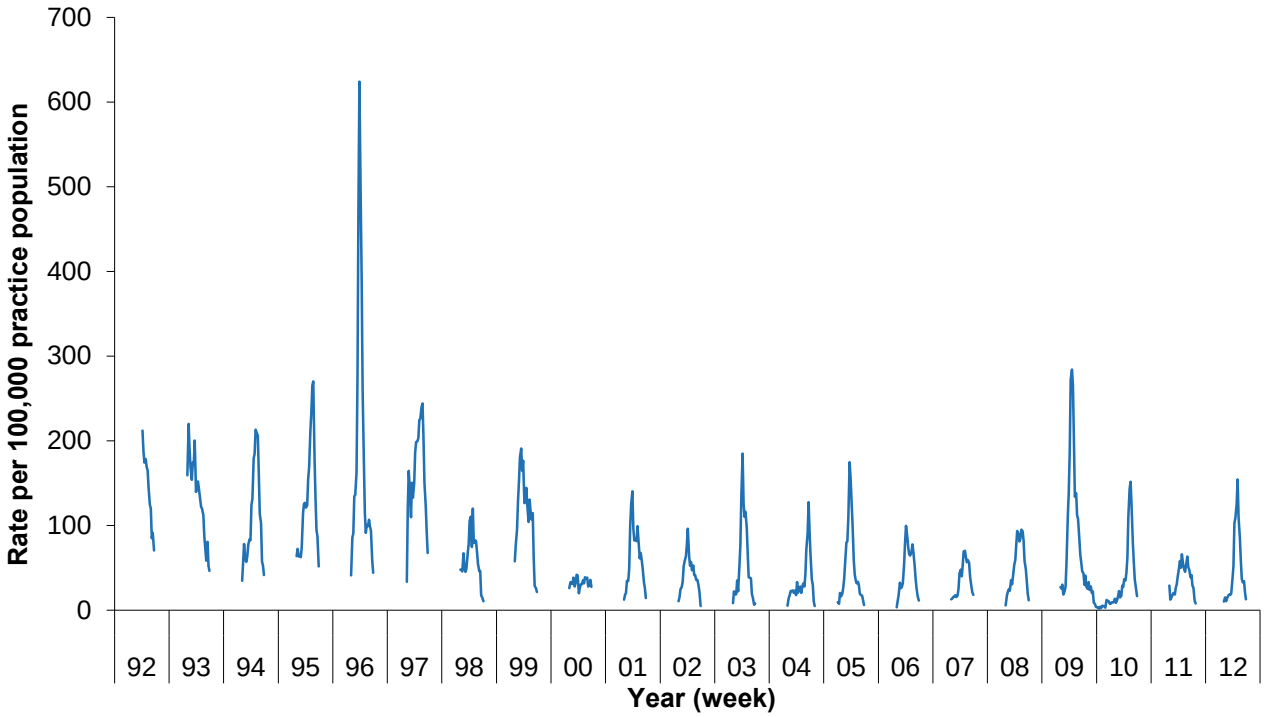


Figure 2 compares the weekly consultation rates for ILI in 2012 with the weekly consultation rates for ILI in 1992–2012. The peak ILI rate in 2012 was in the middle range (11th highest) during 1992–2012. The cumulative incidence rate of 1087.0 per 100,000 patient population was the 12th highest recorded during 1992–2012.

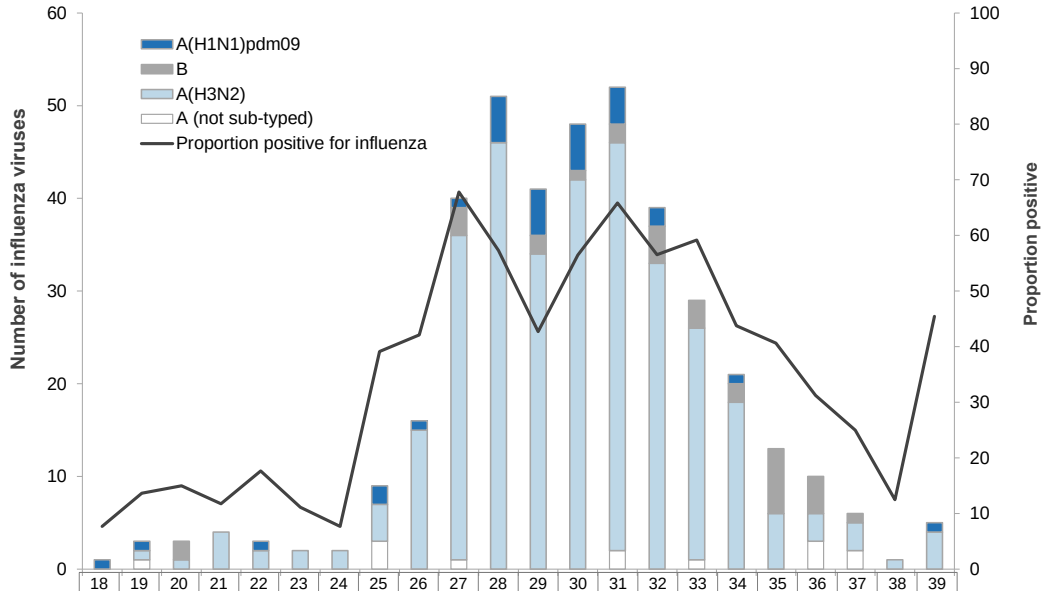
Figure 2. Weekly consultation rates for ILI in New Zealand, 1992–2012



For sentinel virological surveillance during May to September 2012, a total of 895 specimens were tested. Of these, 399 (44.6%) specimens were positive for influenza viruses. This is higher than the 336 viruses identified through sentinel surveillance in 2011 and the 349 viruses identified through sentinel surveillance in 2010.

Figure 3 shows the temporal distribution of influenza viruses from sentinel surveillance from weeks 18–39. Overall, influenza viruses were detected in the same time period in 2012 as they were in 2011. The highest peak of influenza virus detection from sentinel surveillance occurred in week 31 (52 viruses). Influenza A(H3N2) viruses predominated throughout the influenza season, with a peak in week 28 (9–15 July 2012), comprising 90.2% of all viruses.

Figure 3. Influenza viruses from sentinel surveillance by type and week reported, 2012



	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
A (not sub-typed)	0	1	0	0	0	0	0	3	0	1	0	0	0	2	0	1	0	0	3	2	0	0
A(H3N2)	0	1	1	4	2	2	2	4	15	35	46	34	42	44	33	25	18	6	3	3	1	4
B	0	0	2	0	0	0	0	0	0	3	0	2	1	2	4	3	2	7	4	1	0	0
A(H1N1)pdm09	1	1	0	0	1	0	0	2	1	1	5	5	5	4	2	0	1	0	0	0	0	1

A total of 2425 influenza viruses were identified from sentinel and non-sentinel surveillance in 2012. This is higher than the 1268 viruses identified in 2011 and the 2012 viruses identified in 2010.The higher number of viruses detected in 2012 may be due to high volume of testing by PCR. Figure 4 shows the numbers of influenza viruses detected each week through sentinel and non-sentinel surveillance throughout 2012. Most sentinel and non-sentinel viruses (2287, 94.3%) were identified during the sentinel period (weeks 24–39). The peak detection periods for both sentinel and non-sentinel surveillance were broad and occurred from July to August. The highest peak of influenza virus detection from sentinel surveillance occurred in week 31 (52 viruses) and the second highest peak in week 28 (51 viruses). The highest peak of influenza virus detection from non-sentinel surveillance occurred in week 28 (268 viruses). Sporadic influenza viruses were identified as early as March, however, the vast majority (2309, 95.2%) were from specimens taken from June to September 2012.

Figure 4. Total number of influenza viruses detected by surveillance type and week specimen taken, 2012

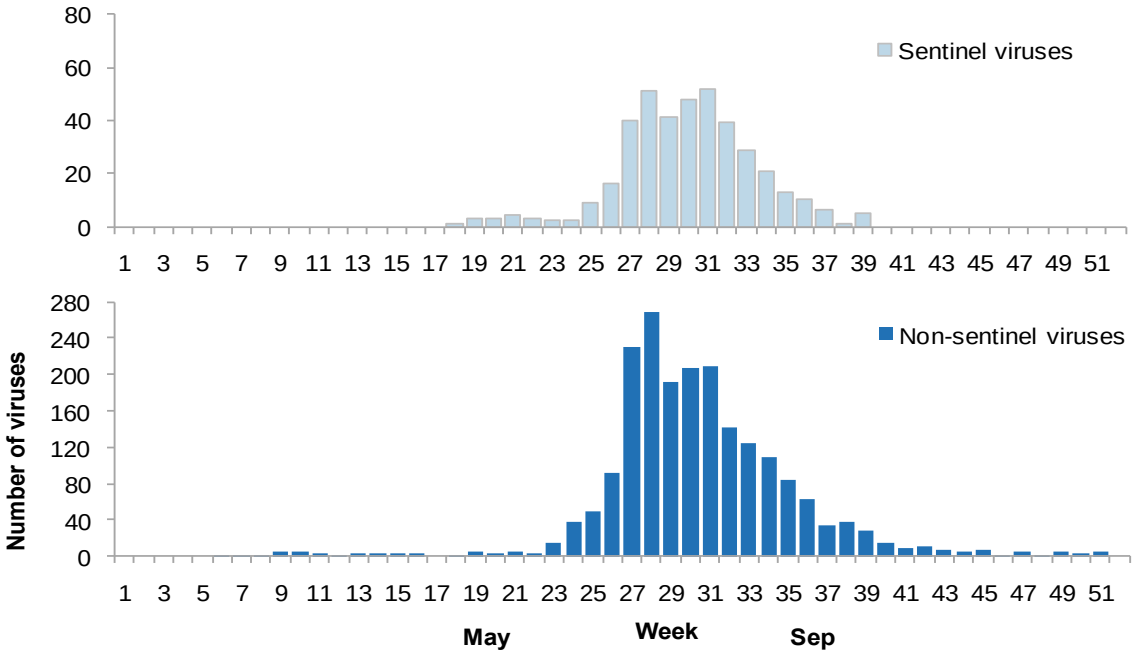
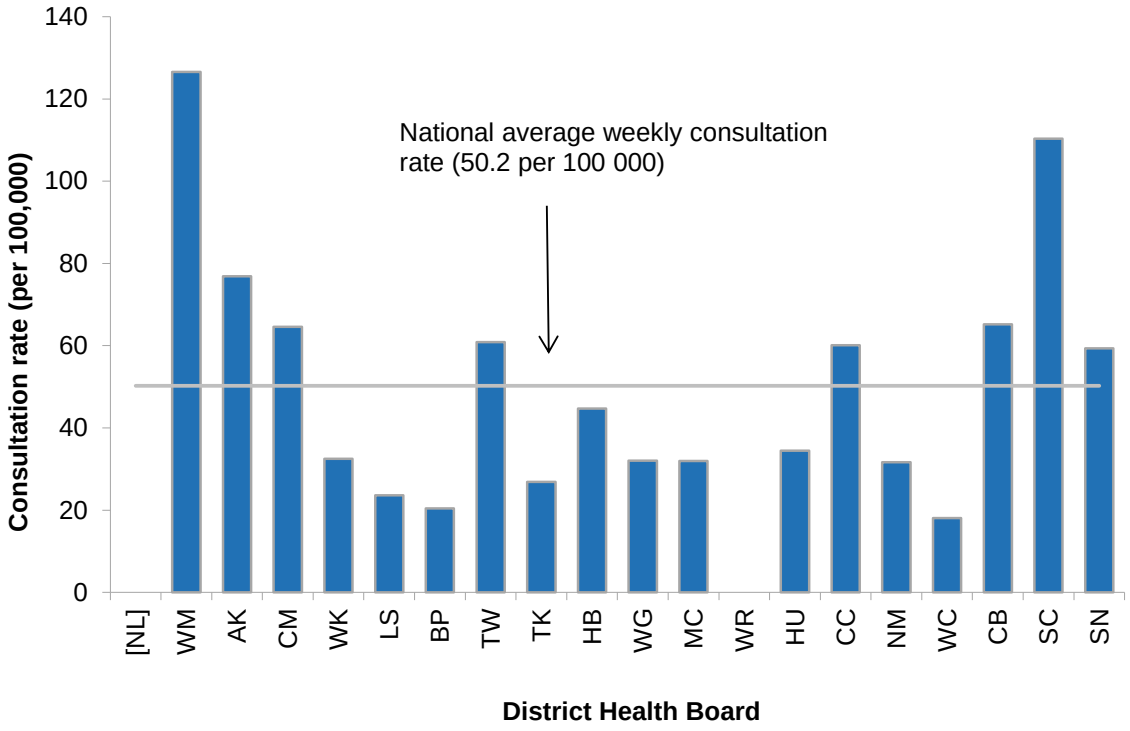


Figure 5 shows the sentinel average weekly consultation rates for each DHB from May to September 2012. Weekly ILI consultation rates per 100,000 patient population varied among DHBs, with rates above the national average in Waitemata (126.6), followed by South Canterbury (110.4), Auckland (76.9), Canterbury (65.2), Counties Manukau (64.6), Tairawhiti (60.9), Capital and Coast (60.1), and Southern (59.4).

Table 1 shows the DHB codes and their descriptions.

Figure 5. Sentinel average weekly consultation rates for influenza by DHB, 2012 (from North to South)



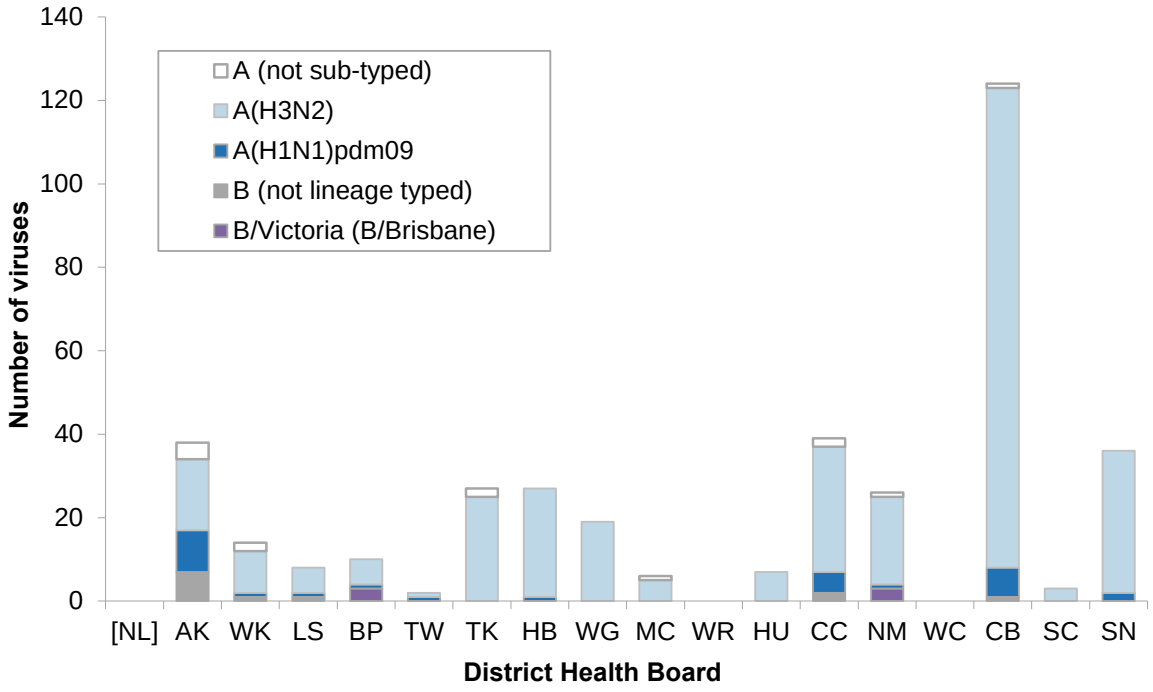
[ ] Did not participate in the influenza sentinel surveillance.

Table 1. DHB codes and descriptions

DHB code	DHB
NL	Northland
WM	Waitemata
AK	Auckland
CM	Counties Manukau
WK	Waikato
LS	Lakes
BP	Bay of Plenty
TW	Tairawhiti
TK	Taranaki
HB	Hawke's Bay
WG	Whanganui
MC	MidCentral
WR	Wairarapa
HU	Hutt Valley
CC	Capital and Coast
NM	Nelson Marlborough
WC	West Coast
CB	Canterbury
SC	South Canterbury
SN	Southern

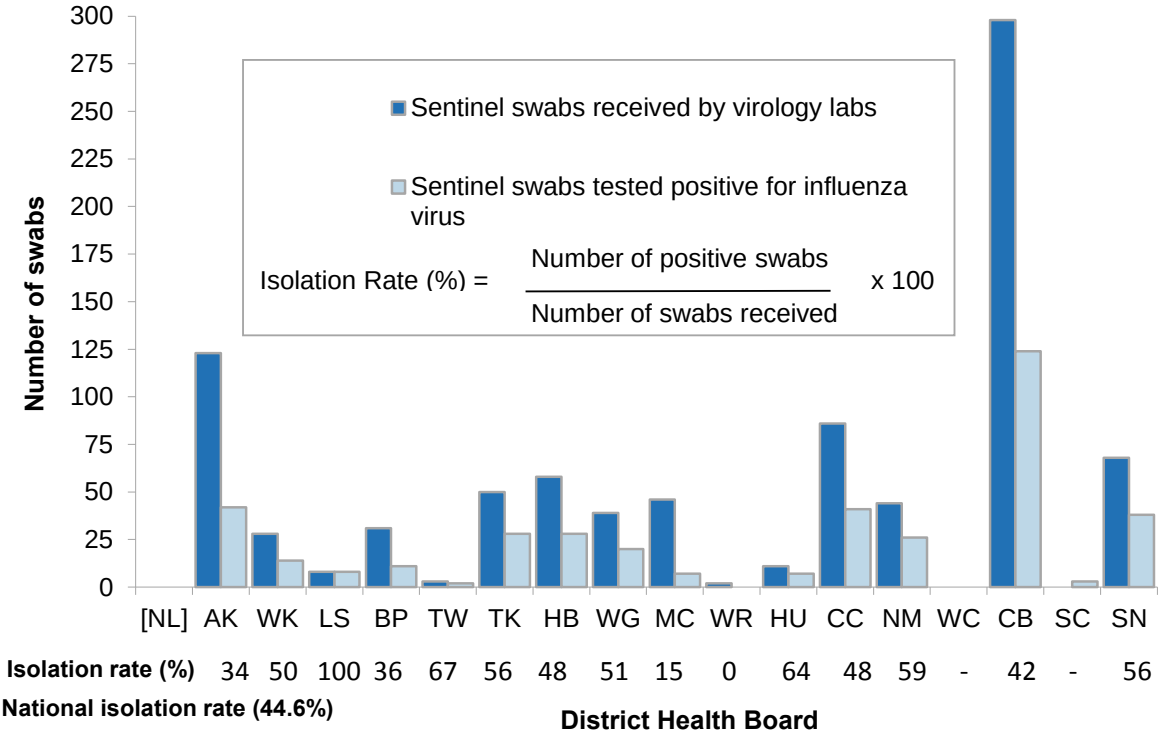
Figure 6 shows the distribution of sentinel influenza viruses based on the DHB from which the specimen (swab) was taken. Most of the viruses came from Canterbury, Auckland and Capital and Coast DHBs. No viruses were identified in Wairarapa and West Coast DHBs. The national influenza virus detection rate for 2012, illustrated in Figure 7, was 44.6% (399 viruses from 895 swabs received), which is higher than in 2011, (39.2%, 336 viruses from 858 swabs received) and 2010 (36.1%, 349 viruses from 966 swabs).

Figure 6. Numbers of laboratory-confirmed influenza viruses from sentinel surveillance by DHB, May to September 2012



NB: Viruses from the Waitemata, Auckland and Counties Manukau DHBs are grouped under Auckland DHB.
[ ] DHB did not participate in the influenza sentinel surveillance.

Figure 7. Sentinel swabs received and tested positive for influenza virus by DHB, 2012



NB: Viruses from the Waitemata, Auckland and Counties Manukau DHBs are grouped under Auckland DHB.

Average weekly ILI consultation rates by age group were calculated for the sentinel surveillance system (Figure 8). The highest cumulative consultation rates for ILI were in children aged 1–4 years (2166.9 per 100,000 patient population) followed by those aged less than 1 year (1557.2 per 100,000 patient population). Elderly people (aged 65 years and older) had the lowest ILI consultation rate of 654.4 per 100,000 patient population.

Figure 8. Sentinel average weekly consultation rates for ILI by age group, 2012

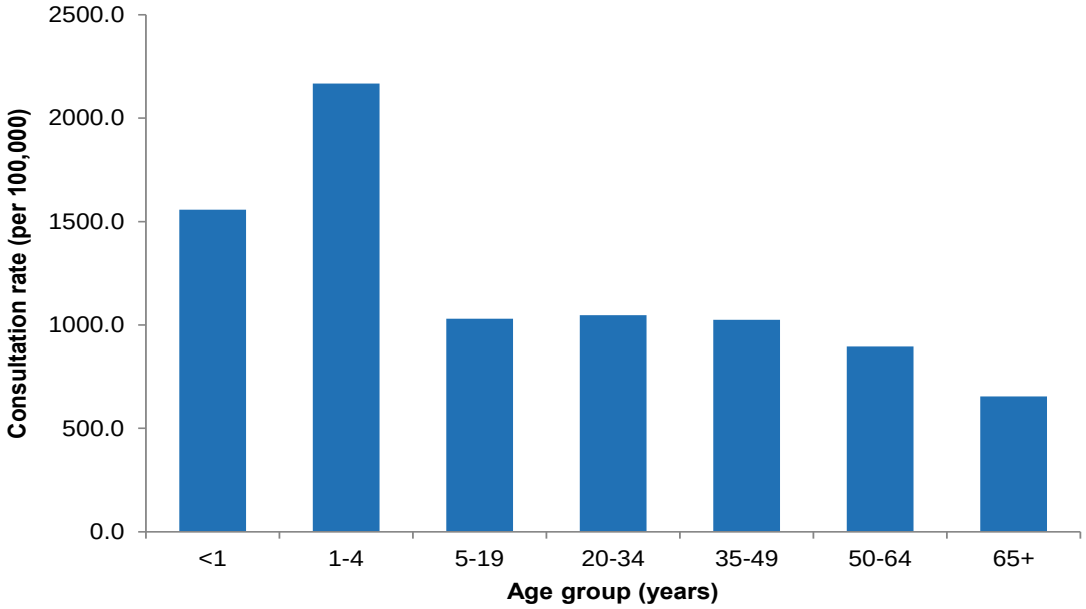
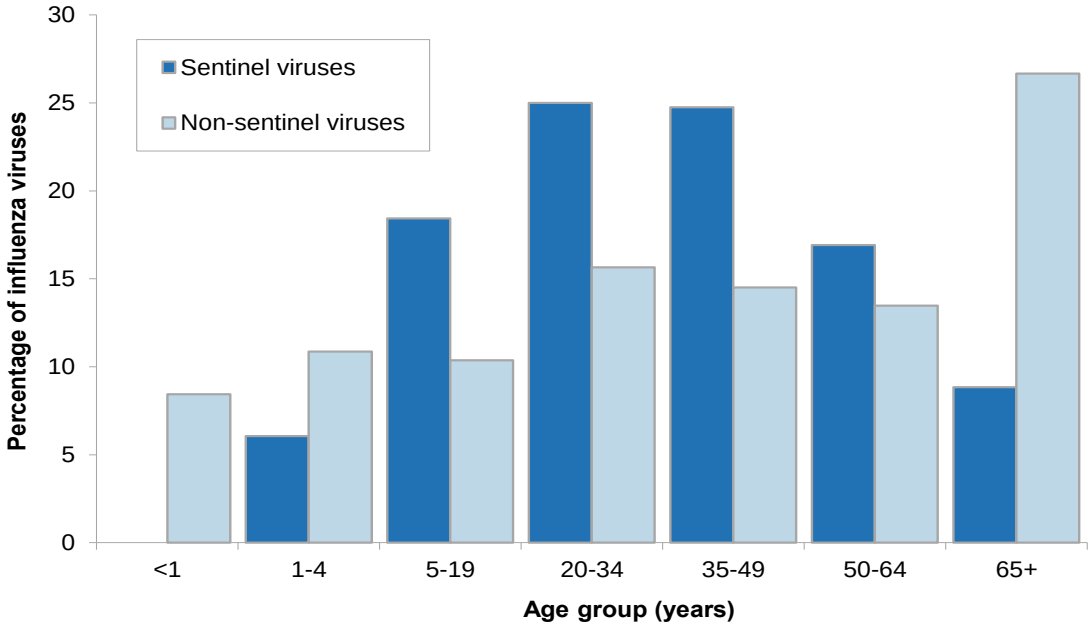


Figure 9 compares the percentage of influenza viruses detected from sentinel and non-sentinel surveillance for each age group. Those aged less than 1 year, 1–4 years and 65 years and older were represented more in non-sentinel surveillance than in sentinel surveillance. This is consistent with findings from the past 11 years. It may reflect the fact that influenza presents more severely in the very young and elderly populations resulting in hospitalisations, or it may reflect a greater reluctance among sentinel GPs to take swabs from very young children and elderly patients. In 2009 and 2010, 50–64 year-old patients were also represented slightly more in non-sentinel surveillance. This differs from findings in previous years.

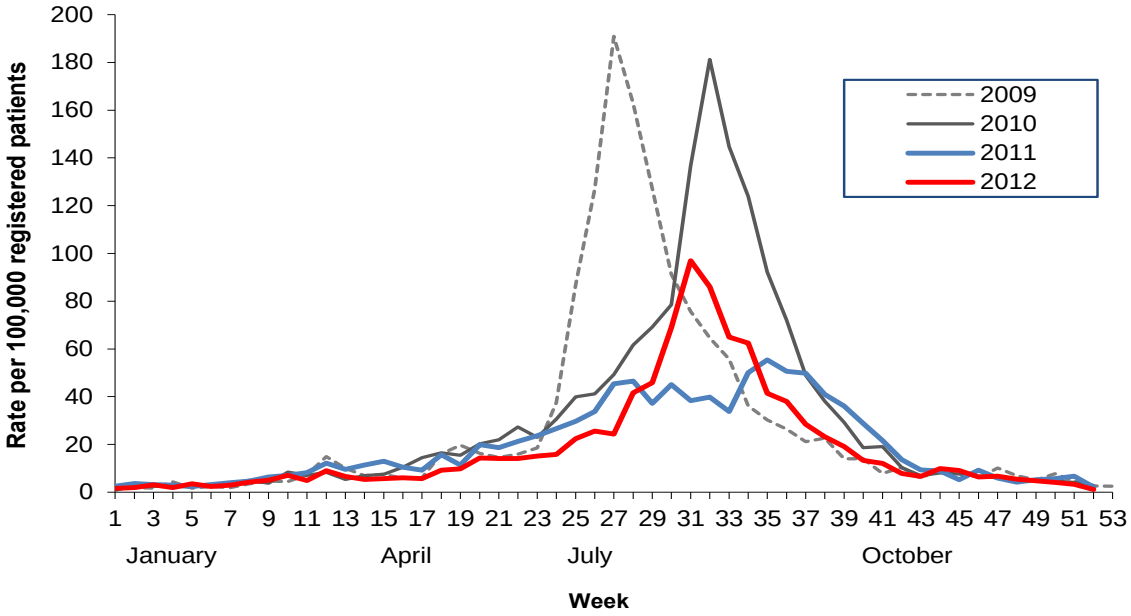
Figure 9. Percentage of sentinel and non-sentinel influenza viruses by age group, 2012



HealthStat GP-based surveillance

Figure 10 shows the weekly rate of ILI per 100,000 registered population from 2009 to 2012. The 2009 and 2010 ILI consultation data showed similar level of influenza activity. This is very different when compared with ESR's sentinel GP-based surveillance, laboratory-based surveillance and hospitalisations where the overall 2009 influenza activity was much higher than the 2010 activity. The HealthStat data in 2009 probably reflected the low sensitivity of the coding practices in 2009. It appears that the coding practices have improved since 2010.

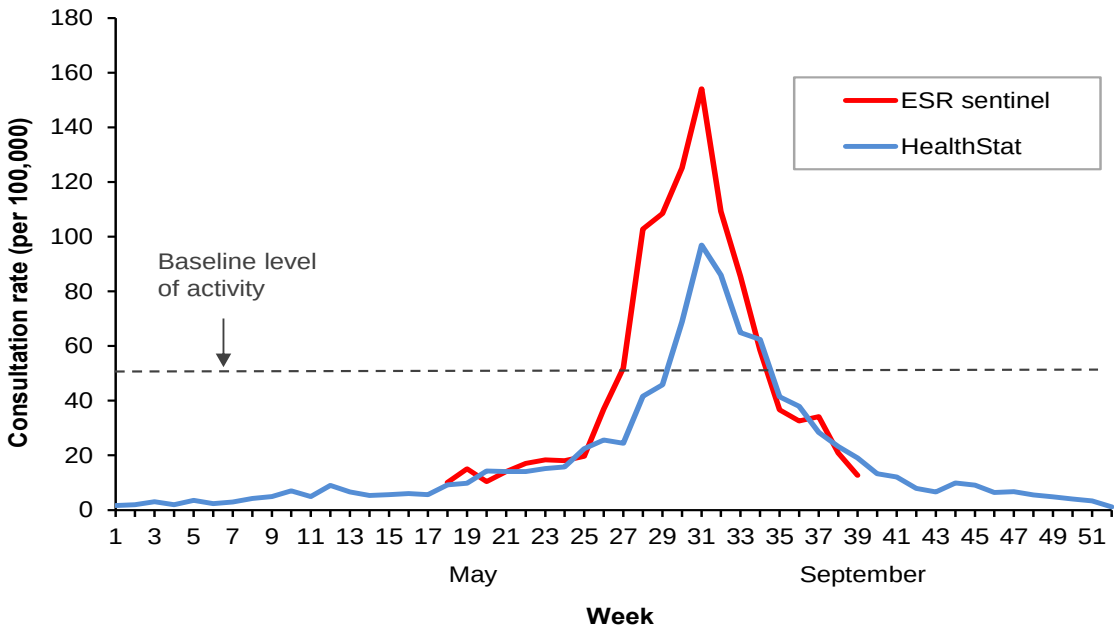
Figure 10. HealthStat ILI consultation rates by week from 2009–2012



Data source: From responding practices of Original HealthStat GP practice panel

Overall, the trend of the HealthStat data in 2012 is similar to ESR's sentinel GP surveillance, but with lower ILI rates overall (Figure 11). ESR's sentinel GP surveillance and Healthstat both showed the peak in week 31 (154.1 per 100,000 and 96.9 per 100,000, respectively).

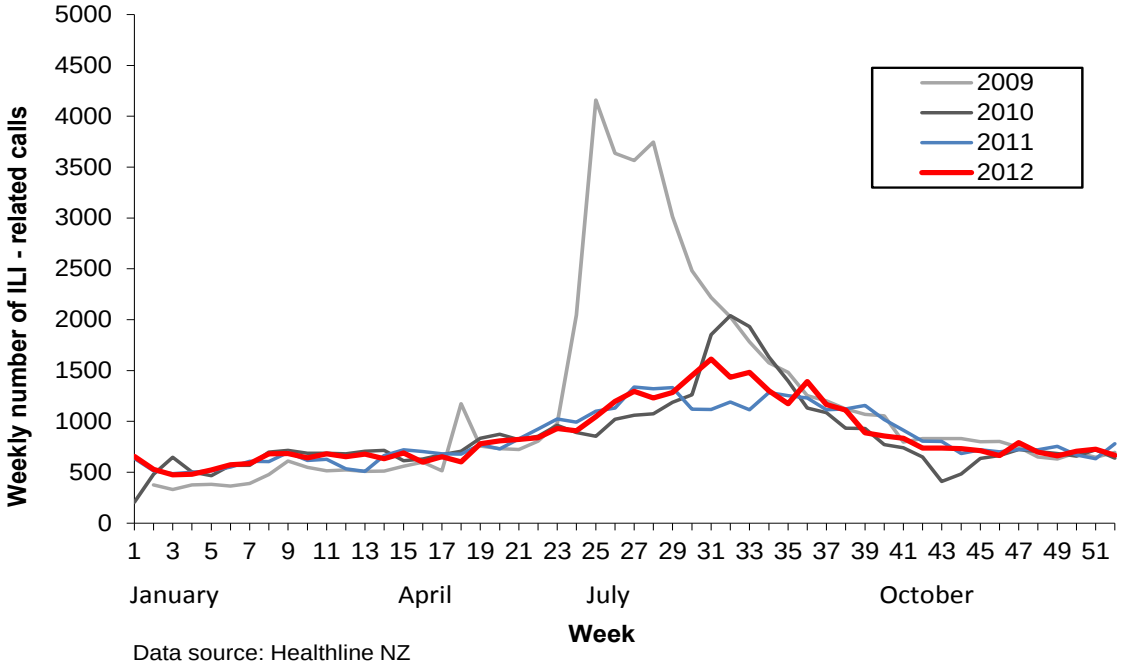
Figure 11. ESR and HealthStat sentinel ILI rates, 2012



Healthline

Figure 12 shows the weekly number of calls to Healthline for ILI from 2009 to 2012. Healthline calls in 2012 were higher than 2011 but lower than 2009–2010. In 2012, Healthline calls peaked at week 31 which correlated with the peak from the ESR sentinel GP surveillance and Healthstat.

Figure 12. Weekly numbers of ILI-related calls to Healthline in 2009–2012



Data source: Healthline NZ

HOSPITAL-BASED SURVEILLANCE

HOSPITAL-BASED SURVEILLANCE

Hospital-based surveillance for severe acute respiratory infections

From 30 April to 30 September 2012, there were 59,124 acute admissions to ADHB and CMDHB hospitals. Of these, 2023 (45.8%) patients met the SARI case definition. Among these SARI patients, 1430 cases (70.1%) had specimens taken. Among the 593 patients without specimens collected, 246 did not provide verbal consent and language barriers prevented another 53 from participating. For 1430 tested SARI cases, 324 (22.7%) had influenza viruses detected, including 70 of influenza B and 256 of influenza A (122 of A(H3N2), 93 of A(H1N1)pdm09 and 41 A (not subtyped)). In comparison to ESR's sentinel surveillance data: for 895 specimens tested, 399 (44.6%) specimens were positive for influenza viruses including 31 influenza B and 368 influenza A (325 A(H3N2), 30 A(H1N1)pdm09 and 13 A (not subtyped)).

A total of 4417 patients with suspected respiratory infections were assessed in ADHB and CMDHB hospitals (Table 2). These patients were distributed across a range of respiratory disease categories, but the majority (3177 or 71.9%) had admission diagnoses/syndrome in four categories: suspected pneumonia, other suspected acute respiratory infection, suspected bronchiolitis in children and exacerbation of adult chronic lung disease. 2023 SARI patients (45.8%) were identified from assessed patients. A high proportion of SARI patients (71.1%, 1438/2023) were identified from patients in four admission diagnosis categories: suspected pneumonia, suspected bronchiolitis in children, suspected acute upper respiratory infection and febrile illness with respiratory symptoms.

Among 2023 SARI cases, 1430 cases (70.7%, 1430/2023) had a respiratory specimen collected. Of the tested SARI cases, 324 (22.7%) had detection of influenza virus. The majority (230 or 71.0%) of influenza positive cases came from the following four admission diagnosis categories: suspected acute upper respiratory infection, suspected pneumonia, febrile illness with respiratory symptoms and other suspected acute respiratory infection.

Of 4417 assessed patients, 2394 patients (54.2%) did not meet the SARI case definition. A total of 419 of these non-SARI cases (17.5%) were tested for influenza (clinician ordered testing). Among the tested non-SARI cases, 37 (8.8%) were positive for influenza viruses. The majority (29 or 78.4%) of the influenza positive non-SARI cases came from the following four admission diagnosis categories: suspected bronchiolitis, suspected pneumonia, febrile illness with respiratory symptoms and other suspected acute respiratory infection. It is noted that suspected bronchiolitis yielded reasonable influenza positive results and this category also had the highest number of patients (165) for influenza testing.

Among 59,124 acute hospitalisations, 2023 SARI cases were identified. This gave the proportion of SARI cases among acute hospitalisations as 34.2 per 1000 hospitalisations. Among all SARI cases, 1705 (84.3%) were residents of ADHB and CMDHB, giving a cumulative SARI incidence of 203.5 per 100,000 population. Among the 1430 tested SARI cases, 324 (22.7%) influenza cases were identified. Out of them, 288 (88.9%) were residents of ADHB and CMDHB, giving cumulative influenza incidence of 34.4 per 100,000 population.

Table 2. Admission diagnoses/syndromes of suspected respiratory infections, SARI and influenza cases

Admission diagnoses/syndrome	Overall (%)	SARI cases	Prop SARI (%)	Total Flu cases	SARI cases tested for flu	Flu+ve SARI cases	Prop Flu+ve SARI (%)	non-SARI cases tested for flu	Flu+ve non-SARI cases	Prop Flu+ve non-SARI (%)
Suspected acute upper respiratory infection (including coryza, pharyngitis)	223 (5.17)	128	57.4	44	96	42	43.8	32	2	6.3
Suspected croup	21 (0.55)	10	47.6	5	8	5	62.5	1	0	0
Suspected bronchiolitis (in children)	697 (15.36)	368	52.8	40	273	33	12.1	165	7	4.2
Suspected pneumonia	1169 (24.83)	719	61.5	104	516	95	18.4	67	9	13.4
Exacerbation of asthma	400 (9.03)	127	31.8	26	85	25	29.4	25	1	4.0
Exacerbation of childhood chronic lung disease (including bronchiectasis, cystic fibrosis)	64 (1.45)	17	26.6	5	15	4	26.7	7	1	14.3
Exacerbation of adult chronic lung disease (including COPD, emphysema, bronchitis)	456 (12.54)	148	32.5	25	104	22	21.2	19	3	15.8
Respiratory failure	42 (0.93)	11	26.2	3	9	3	33.3	5	0	0
Febrile illness with respiratory symptoms (including shortness of breath)	340 (7.17)	223	65.6	51	139	45	32.4	26	6	23.1
Other suspected acute respiratory infection	855 (21.00)	253	29.6	55	175	48	27.4	61	7	11.5
Not provided	100 (1.97)	1	1.0	1	0	0	0	5	1	20.0
Total	**4417 (100)**	**2023**	**45.8**	**361**	**1430**	**324**	**22.7**	**419**	**37**	**8.8**

Figure 13 shows the weekly incidence of SARI cases per 100,000 population for ADHB and CMDHB residents as well as the numbers of SARI and influenza positive cases.

Figure 13. Weekly incidence of SARI, numbers and cases per 100,000 population

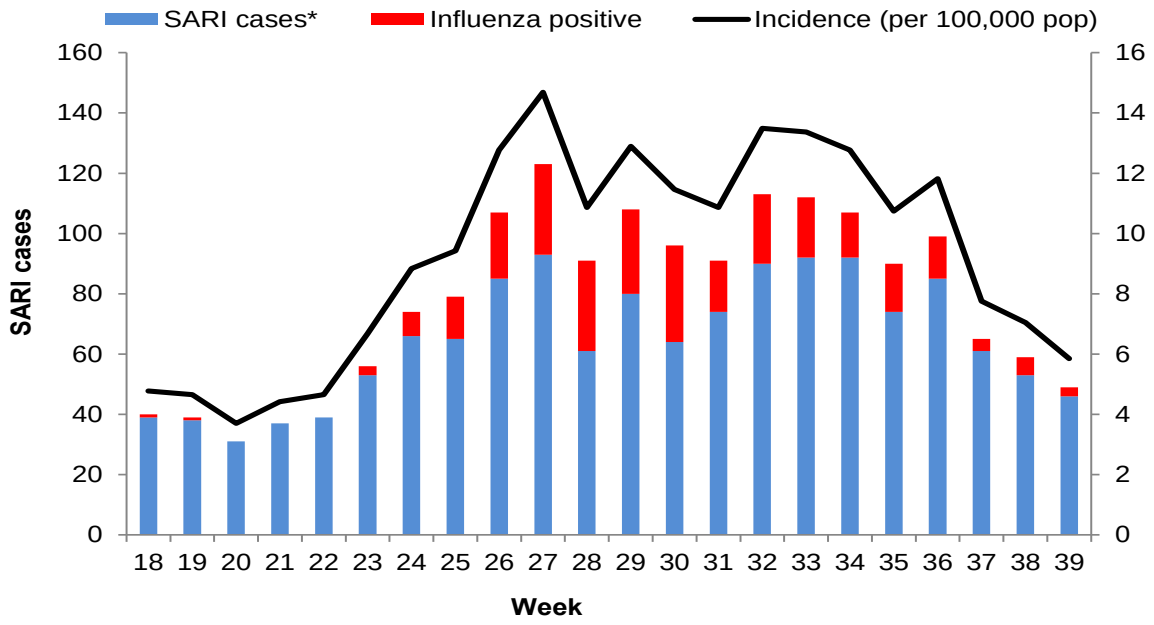


Table 2 shows the cumulative data on the demographic features of the influenza cases, SARI cases, suspected respiratory infections and acute hospital admissions. The cumulative influenza incidence by different age groups during 30 April 2012 to 30 September 2012 presented a U-shape. Infants aged <1 year had the highest influenza hospitalisation rate of 282.1 per 100 000 age group population. This was followed by those aged 80 and over (143.5 per 100 000), 65-79 years (93.4 per 100 000) and 1 to 4 years (63.0 per 100 000). The cumulative influenza incidence by different ethnic groups during 30 April to 30 September 2012 showed that Pacific Peoples had the highest hospitalisation of 92.6 per 100 000. This was followed by Maori (46.4 per 100 000), European or Other (20.8 per 100 000) and Asian (19.2 per 100 000 respectively).

From 30 April to 30 September 2012, a total of 601 ICU admissions were recorded (Table 4). Among them, 85 (14%) met the SARI case definitions. This also gave the proportion of the SARI ICU cases among all SARI cases as 4.2 per 100 SARI cases. Among all SARI ICU cases, 50 (58.8%) were residents of ADHB and CMDHB, giving a cumulative SARI ICU incidence of 6 per 100,000 population.

In addition, of the 65 tested SARI ICU cases, 10 (15.4%) influenza cases were identified. Among them, six (60.0%) were residents of ADHB and CMDHB, giving cumulative influenza related ICU incidence of 0.7 per 100,000 population.

From 30 April to 30 September 2012, a total of 512 hospital deaths were recorded. As this only includes SAR cases residing in the study area, ADHB and CMDHB, rates calculated on less than five cases should be interpreted with caution.

Among the 512 hospital deaths, 14 met the SARI case definitions. This gave the proportion of SARI deaths among total hospital deaths as 27.3 per 1000 deaths. This also gives a case-fatality risk of 0.7% for SARI. Among all SARI death cases, 10 (71.4%) were residents of ADHB and CMDHB, giving a cumulative SARI crude fatality rate of 1.2 per 100,000 population.

In addition, of the 14 fatal cases, 2 (14.3%) influenza cases were identified. These were residents of ADHB and CMDHB, giving a cumulative influenza related fatality incidence of 0.2 per 100,000 population. One SARI death had influenza A(H3N2) detected in an adult Māori female in the age group 50–64 years. Another SARI death had influenza B detected from an Indian male in the age group 65–79 years.

Table 3. Demographic characteristics of SARI and influenza cases, 30 April – 30 September 2012

Characteristics	Admissions	Assessed	SARI & influenza cases among all hospital patients			SARI & influenza cases among ADHB & CMDHB residents			
			SARI Cases (%)	Cases per 1000 hospitalisations	Influenza positive (%*)	SARI cases	SARI incidence (per 100,000)	Influenza cases	Influenza incidence (per 100,000)
Overall	59124	4417	2023 (45.8)	34.2	324 (22.7)	1705	203.5	288	34.4 (30.5, 38.6)
Age group (years)									
<1	2737		398	145.4	41 (13.9)	357	2721.9	37	282.1 (198.7, 388.6)
1- 4	4836		272	56.2	36 (18.6)	231	469.7	31	63.0 (42.8, 89.5)
5-19	7261		103	14.2	23 (29.1)	85	44.7	19	10.0 (6.0, 15.6)
20-34	10496		179	17.1	37 (31.4)	165	84.5	34	17.4 (12.1, 24.3)
35-49	9250		166	17.9	35 (27.8)	155	81.1	32	16.7 (11.5, 23.6)
50-64	9419		262	27.8	56 (29)	252	206.7	53	43.5 (32.6, 56.9)
65-79	8866		300	33.8	53 (23.8)	291	513.0	53	93.4 (70.0, 122.2)
80 and over	6259		173	27.6	31 (24.4)	166	821.3	29	143.5 (96.1, 206.0)
Unknown		2560	170		12 (16.2)	3		0	
Ethnicity									
Māori	8118		336	41.4	49 (18.7)	306	315.2	45	46.4 (33.8, 62.0)
Pacific Peoples	13274		576	43.4	123 (27.6)	551	428.9	119	92.6 (76.7, 110.8)
Asian	8029		169	21	33 (27.5)	158	98.0	31	19.2 (13.1, 27.3)
European or Other	29296		696	23.8	98 (19.6)	613	151.6	84	20.8 (16.6, 25.7)
Unknown	407	2636	246		21 (20.4)	77		9	19.4 (8.9, 36.8)
Hospitals									
ADHB	31819	2057	1122 (54.5)	35.3	146 (20.9)	941	232.6	125	30.9 (25.7, 36.8)
CMDHB	27305	2354	900 (38.2)	33	177 (24.2)	764	176.4	163	37.6 (32.1, 43.9)
Sex									
Female	31190		898	28.8	160 (24.3)	827	192.6	149	34.7 (29.3, 40.7)
Male	27934		944	33.8	150 (21.7)	865	211.9	137	33.6 (28.2, 39.7)

*The percentage of influenza positive cases was calculated as influenza positive cases divided by tested SARI cases.

Table 4. Demographic characteristics of ICU admitted SARI and influenza cases, 30 April – 30 September 2012

Characteristics	Total ICU admissions	All SARI cases	SARI & influenza ICU cases among all hospital patients				SARI & influenza ICU cases among ADHB & CMDHB residents			
			SARI ICU cases	SARI ICU per ICU admissions (per 1000)	% SARI ICU among all SARI	Influenza positive (%)	SARI ICU cases	SARI ICU incidence (per 100,000) [1]	Influenza cases	Influenza incidence (per 100,000) [1]
Overall	601	2023	85	141.4	4.2	10 (15.4)	50	6	6	0.7 (0.3, 1.6)
Age group (years)										
<1	136	398	39	286.8	9.8	2 (6.9)	23	175.4	0	0.0 (0.0, 28.1)
1 to 4	72	272	20	277.8	7.4	1 (7.1)	10	20.3	1	2.0 (0.1, 11.3)
5 to 19	86	103	4	46.5	3.9	1 (25)	2	1.1	0	0.0 (0.0, 1.9)
20 to 34	49	179	4	81.6	2.2	2 (50)	4	2.0	2	1.0 (0.1, 3.7)
35 to 49	78	166	9	115.4	5.4	2 (28.6)	6	3.1	2	1.0 (0.1, 3.8)
50 to 64	92	262	5	54.3	1.9	2 (50)	2	1.6	1	0.8 (0.0, 4.6)
65 to 79	75	300	3	40.0	1.0	0 (0)	3	5.3	0	0.0 (0.0, 6.5)
80 and over	13	173	0	0.0	0.0	0 (0)	0	0.0	0	0.0 (0.0, 18.3)
Unknown	0	170	1	0.0	0.6	0 (0)	0		0	
Ethnicity										
Māori	174	336	25	143.7	7.4	2 (10)	14	14.4	0	0.0 (0.0, 3.8)
Pacific Peoples	140	576	22	157.1	3.8	1 (6.7)	20	15.6	1	0.8 (0.0, 4.3)
Asian	36	169	5	138.9	3.0	3 (60)	3	1.9	2	1.2 (0.2, 4.5)
European or Other	245	696	32	130.6	4.6	4 (16.7)	13	3.2	3	0.7 (0.2, 2.2)
Unknown	6	246	1	166.7	0.4	0 (0)	0	0	0	0.0 (0.0, 7.9)
Hospitals										
ADHB	234	1122	68	290.6	6.1	6 (11.8)	33	8.2	2	0.5 (0.1, 1.8)
CMDHB	367	900	17	46.3	1.9	4 (28.6)	17	3.9	4	0.9 (0.3, 2.4)
Sex										
Female	245	898	39	159.2	4.3	6 (19.4)	24	5.6	5	1.2 (0.4, 2.7)
Male	356	944	44	123.6	4.7	4 (12.5)	24	5.9	1	0.2 (0.0, 1.4)
Unknown	0	181	2	0.0	1.1	0 (0)	2	0	0	

[1]Includes only SARI cases residing in the study area, ADHB and CMDHB, rates calculated on less than five cases should be interpreted with caution.

Table 5. Demographic characteristics of SARI deaths, 30 April – 30 September 2012

Characteristics	Total ICU admissions	All SARI cases	SARI & influenza deaths among all hospital patients				SARI & influenza deaths among ADHB & CMDHB residents			
			SARI death	SARI death per total deaths (per 1000)	% SARI death among all SARI	Influenza positive (%)	SARI death	SARI ICU incidence (per 100,000) [1]	Influenza Cases	Influenza incidence (per 100,000) [1]
Overall	512	2023	14	27.3	0.7	2 (18.2)	10	1.2	2	0.2 (0.0, 0.9)
Age group (years)										
<1	25	398	1	40.0	0.3	0 (0)	0	0.0	0	0.0 (0.0, 28.1)
1 to 4	3	272	3	1000.0	1.1	0 (0)	3	6.1	0	0.0 (0.0, 7.5)
5 to 19	4	103	0	0.0	0.0		0	0.0	0	0.0 (0.0, 1.9)
20 to 34	9	179	0	0.0	0.0		0	0.0	0	0.0 (0.0, 1.9)
35 to 49	35	166	2	57.1	1.2	0 (0)	1	0.5	0	0.0 (0.0, 1.9)
50 to 64	96	262	2	20.8	0.8	1 (50)	1	0.8	1	0.8 (0.0, 4.6)
65 to 79	138	300	3	21.7	1.0	1 (33.3)	3	5.3	1	1.8 (0.0, 9.8)
80 and over	202	173	2	9.9	1.2	0 (0)	2	9.9	0	0.0 (0.0, 18.3)
Unknown	0	170	1	0.0	0.6		0	0	0	
Ethnicity										
Māori	53	336	5	94.3	1.5	1 (20)	4	4.1	1	1.0 (0.0, 5.7)
Pacific Peoples	106	576	1	9.4	0.2	0 (0)	1	0.8	0	0.0 (0.0, 2.9)
Asian	64	169	3	46.9	1.8	1 (50)	2	1.2	1	0.6 (0.0, 3.5)
European or Other	288	696	3	10.4	0.4	0 (0)	2	0.5	0	0.0 (0.0, 0.9)
Unknown	1	246	2	2000.0	0.8	0 (0)	1	2.2	0	0.0 (0.0, 7.9)
Hospitals										
ADHB	304	1122	12	39.5	1.1	1 (11.1)	8	2	1	0.2 (0.0, 1.4)
CMDHB	208	900	2	9.6	0.2	1 (50)	2	0.5	1	0.2 (0.0, 1.3)
Sex										
Female	241	898	5	20.7	0.6	1 (25)	4	0.9	1	0.2 (0.0, 1.3)
Male	271	944	8	29.5	0.8	1 (14.3)	6	1.5	1	0.2 (0.0, 1.4)
Unknown	0	181	1	0.0	0.6		0	0	0	

[1]Includes only SARI cases residing in the study area, ADHB and CMDHB, rates calculated on less than five cases should be interpreted with caution.

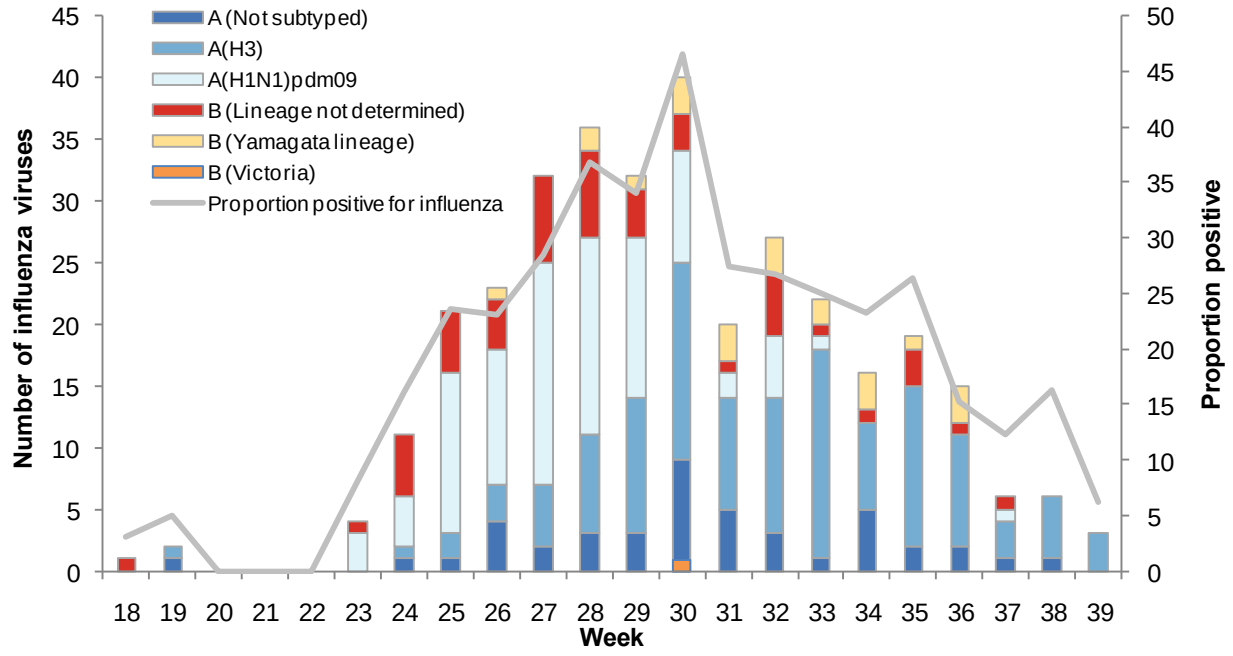
From 30 April to 30 September 2012, 1499 SARI specimens were tested and 334 (22.3%) were positive for influenza viruses (Table 6): A (not subtyped) (44), A(H1N1)pdm09 (96) including 16 A/California/7/2009(H1N1) viruses, A(H3N2) (124) including 45 A/Perth/16/2009(H3N2), B (73) including 22 B/Wisconsin/1/2010-like virus (belonging to the B/Yamagata lineage) and one B/Brisbane/60/2008 virus (belonging to the B/Victoria lineage). Sixty-two influenza specimens (18.6%) had co-detection of influenza and non-influenza viruses. In addition, two influenza specimens had co-detection of influenza A and B viruses.

Table 6. Influenza viruses among SARI cases, 30 April to 30 September 2012

SARI cases virology	Cumulative since 30 April 2012		
	Cases	ICU	Deaths
Influenza viruses			
No. of specimens tested	1499	83	13
No. of positive specimens (%)	334 (22.3)	15 (18.1)	2 (15.4)
Influenza A			
A (not subtyped)	44	3	0
A (H1N1)pdm09	96	7	0
A (H3N2)	124	2	1
Influenza B			
B (lineage not determined)	50	2	1
B (Yamagata)	22	1	0
B (Victoria)	1	0	0
Influenza and non-influenza co-detection (% +ve)	**62 (18.6)**	**1 (6.7)**	**0**

The temporal distribution of the number and proportion of the influenza viruses is shown in Figure 14. Influenza A(H1N1)pdm09 was the predominant strain over A(H3N2) from week 23 (ending 10 June) to week 29 (ending 22 July). Since week 30 (ending 29 July), A(H3N2) became the predominant strain. From week 37 (ending 16 September), the number of influenza viruses detections was at a very low level.

Figure 14. Temporal distribution of the number and proportion of influenza viruses from SARI specimens by type and week



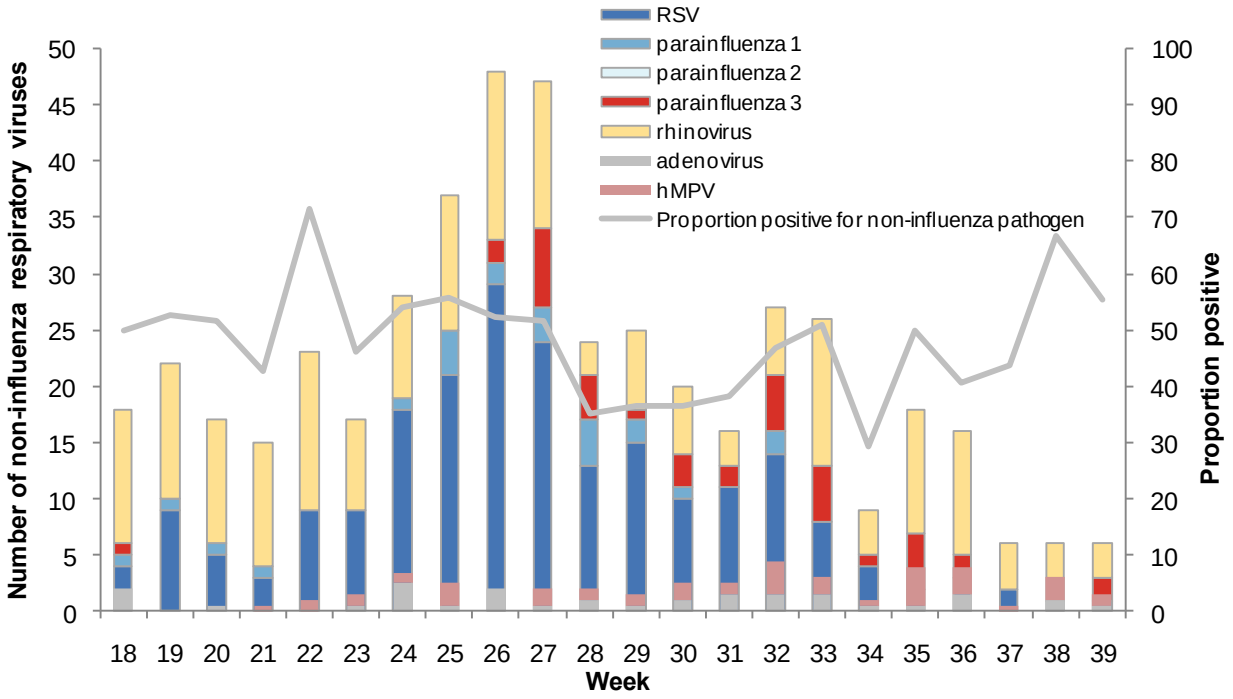
From 30 April and 30 September 2012, 1016 SARI specimens were tested for non-influenza respiratory viruses (Table 7). Of these, 479 (47.1%) were positive with the following viruses found: respiratory syncytial virus (213), rhinovirus (193), parainfluenza virus type 1 (24), parainfluenza virus type 3 (41), adenovirus (39), and human metapneumovirus (52). 413 specimens (86.2%) had single virus detection and 66 (13.8%) had multiple non-influenza respiratory virus detection.

Table 7. Non-influenza respiratory viruses among SARI cases, 30 April 2012 to 30 September 2012

SARI cases virology	Cumulative since 30 April 2012		
	Cases	ICU	Deaths
No. of specimens tested	**1016**	**25**	**6**
No. of positive specimens (%)[1]	**479 (47.1)**	**17 (68.0)**	**2 (33.3)**
Respiratory syncytial virus (RSV)	213	9	0
Parainfluenza 1 (PIV1)	24	0	0
Parainfluenza 2 (PIV2)	0	0	0
Parainfluenza 3 (PIV3)	41	1	0
Rhinovirus (RV)	193	7	2
Adenovirus (AdV)	39	2	0
Human metapneumovirus (hMPV)	52	2	0
Single virus detection (% of positives)	**413 (86.2)**	**13 (76.5)**	**2**
Multiple virus detection (% of positives)	**66 (13.8)**	**4 (23.5)**	**0**

The temporal distribution of the number and proportion of the influenza viruses and non-influenza respiratory viruses is shown in Figure 15. The RSV activity increased in July and August while the rhinovirus activity maintained a constant level from May to August.

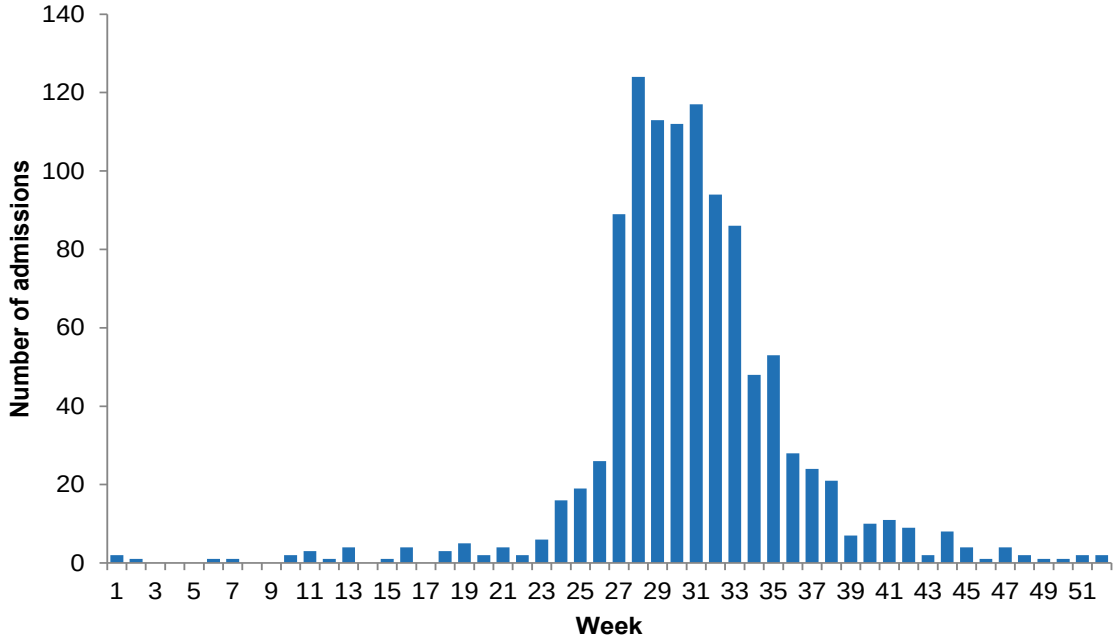
Figure 15. Temporal distribution of the number and proportion of non-influenza viruses from SARI specimens by type and week



National Minimum Dataset (NMDS, Ministry of Health)

Figure 16 shows influenza hospitalisations by week discharged and indicates that 95.0% (1022) of these occurred from June to October. The highest number of hospitalisations (492) occurred in July (weeks 26–30). Hospitalisations and non-sentinel virus numbers peaked in week 28, while sentinel ILI consultations peaked in week 31 and sentinel virus numbers peaked in weeks 31 and 28.

Figure 16. Influenza hospitalisations by week discharged, 2012



The number of influenza hospitalisations in 2012 ranked the second highest during the period from 2000 to 2012. In 2012, there were 1076 hospitalisations for influenza, higher than the 526 hospitalisations reported in 2011 and the 975 hospitalisations reported in 2010 but less than the 1484 hospitalisation reported in 2009. A review of the data from 2000–2011 (Figure 17), demonstrates a substantially higher number of hospitalisations occurred in 2009 and 2010 due to the 2009 pandemic.

Figure 17. Influenza hospitalisations, 2000–2012

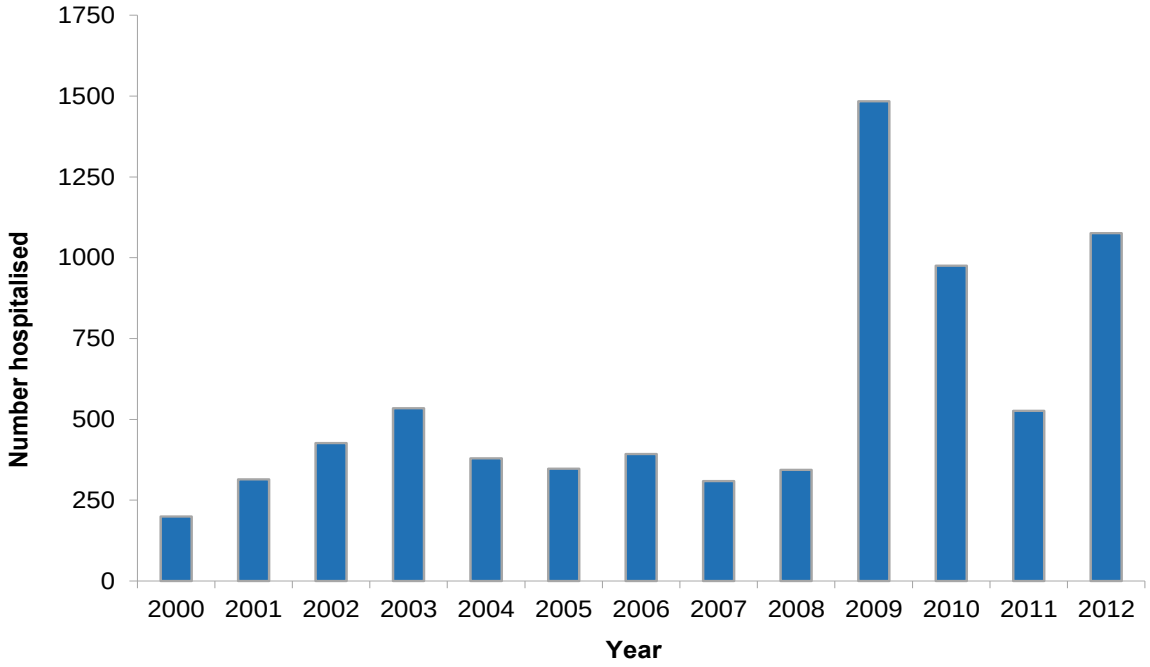
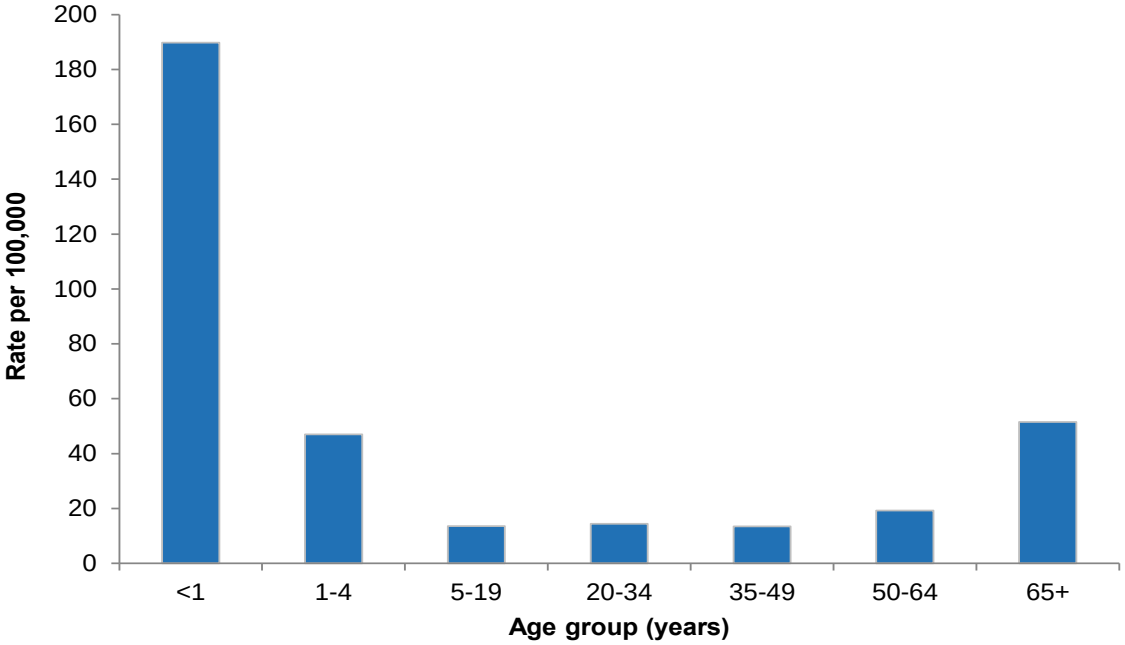


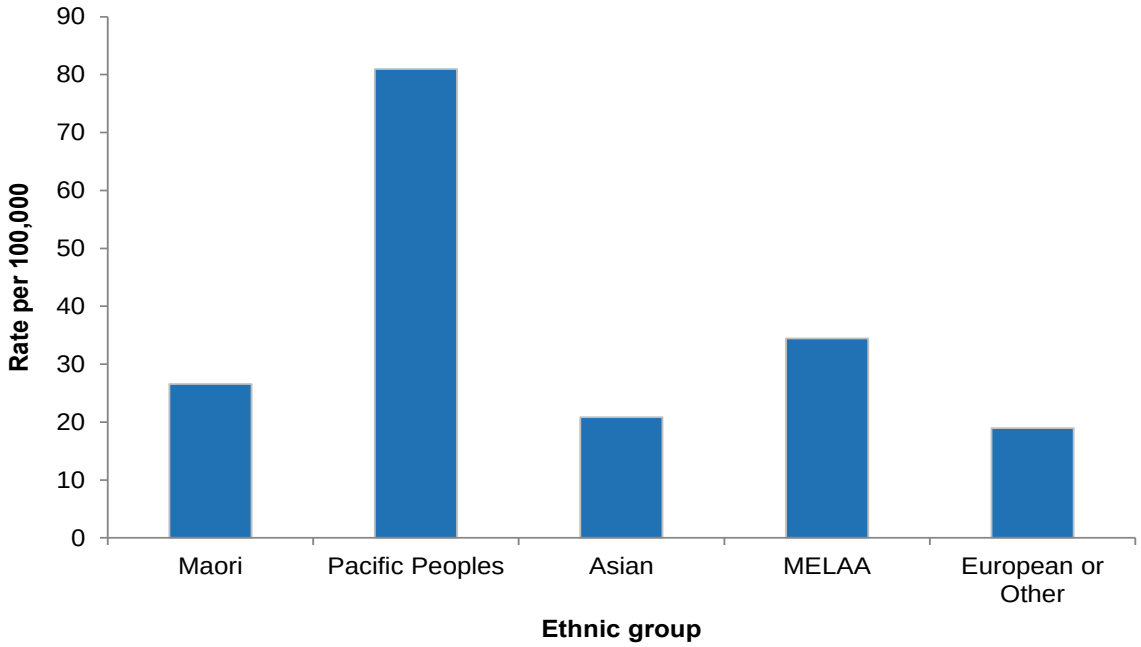
Figure 18 compares the hospitalisation rates in 2012 by age group. In 2012, the highest hospitalisation rates occurred in children aged less than one year (189.8 per 100,000 patient population), followed by adults aged 65 years and over (51.5 per 100,000) and by children aged 1–4 years (47.0 per 100,000).

Figure 18. Influenza hospitalisation rates by age group, 2012



The ethnic distribution of influenza hospitalisations in 2012 is shown in Figure 19. The Pacific Peoples ethnic group had the highest hospitalisation rate (81.0 per 100,000, 216 hospitalised), followed by MELAA 34.4 per 100,000, 13 hospitalised), Māori (26.6 per 100,000, 172 hospitalised), Asian (20.8 per 100,000, 85 hospitalised), and European or Other (18.9 per 100,000, 582 hospitalised).

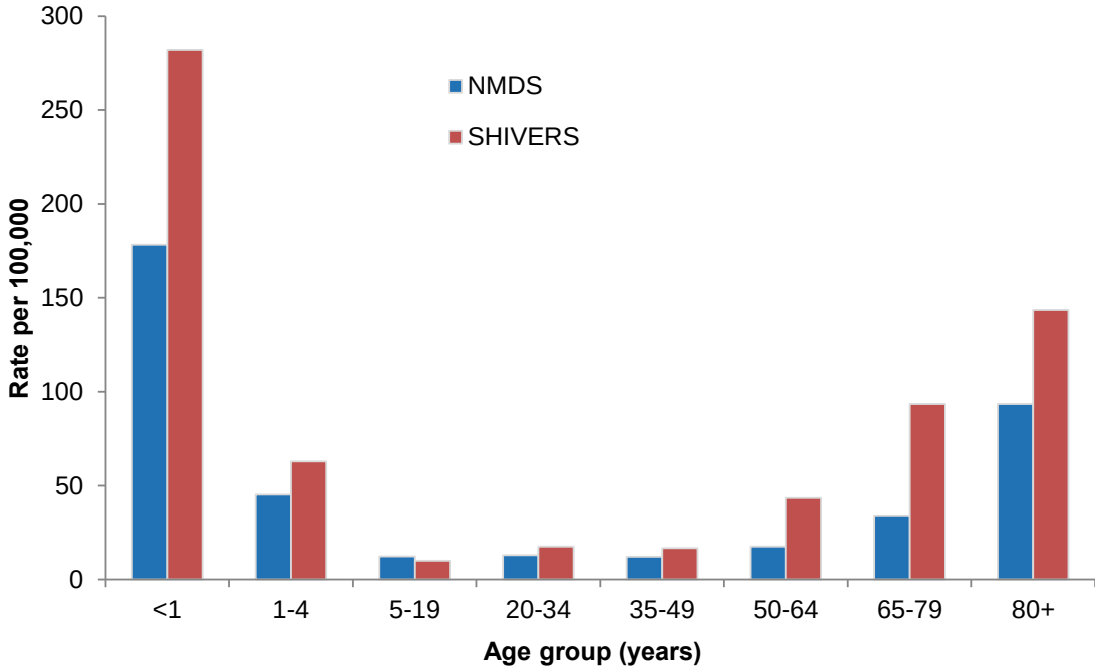
Figure 19. Hospitalisation rates by prioritised ethnic group in 2012



Comparison of SARI and National Minimum Dataset (NMDS) hospitalisations

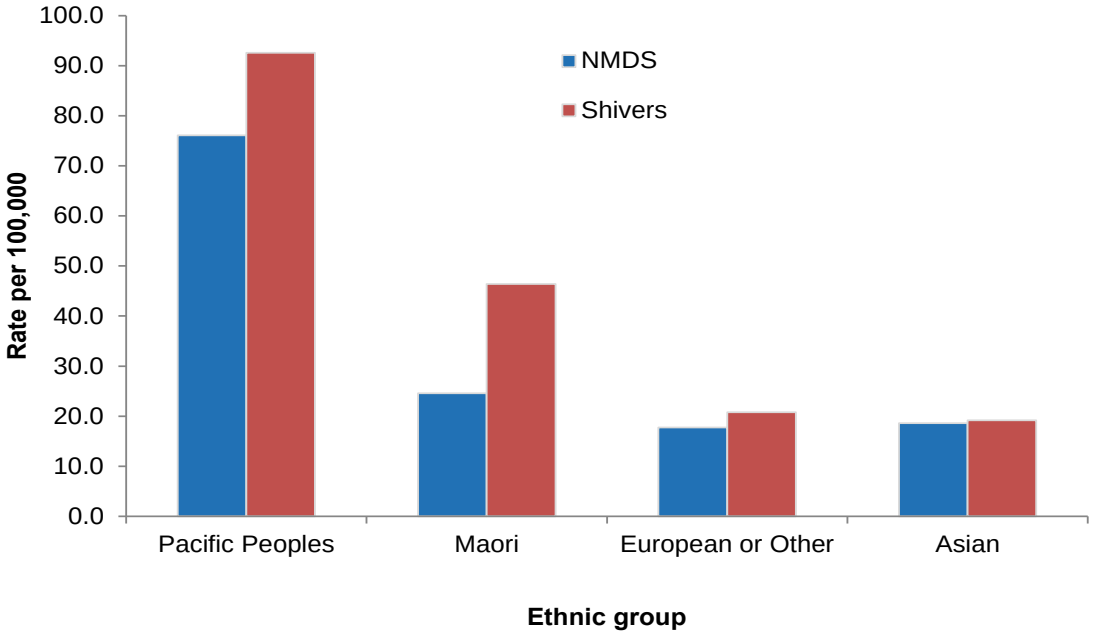
When the SARI influenza hospitalisation rates from SHIVERS were compared to the national NMDS coded influenza hospitalisation rates by age group, both the SARI hospitalisations and national NMDS coded influenza hospitalisations for ADHB and CMDHB recorded the highest influenza hospitalisation rates in the <1 year age group, with rates of 282.1 per 100,000 and 178.2 per 100,000 respectively. This was followed by elderly aged 80 and over (143.5 vs 93.4 per 100,000 respectively), children aged 1 to 4 years (63.0 vs 45.4 per 100,000 respectively), elderly aged 65-79 years (93.4 vs 33.9 per 100,000 respectively) and adults aged 50-64 years (43.5 vs 17.4 per 100,000 respectively) (Figure 20). Higher influenza hospitalisation rates from SARI surveillance are likely to be due to the much higher level of influenza testing of respiratory illness admissions that is occurring as a result of the SHIVERS research programme.

Figure 20. Age-specific influenza hospitalisation rates between the NMDS and SHIVERS data 30 April – 30 September 2012



SARI surveillance also recorded higher influenza hospitalisation rates for Pacific Peoples and Māori than that of the NMDS-coded influenza hospitalisations. When the SARI influenza hospitalisation rates were compared to the national NMDS coded influenza hospitalisation rates by ethnic groups during the period 30 April to 30 September 2012, Pacific Peoples had the highest hospitalisation rate (92.6 vs 76.1 per 100,000 respectively), followed by Māori (46.4 vs 24.6 per 100,000 respectively), European or Other (20.8 vs 17.8 per 100,000 respectively and Asian (19.2 vs 18.6 per 100,000 respectively) (Figure 21). The differences in rates identified by SARI surveillance and NMDS coding appeared largest for those ethnic groups with the greatest burden of disease.

Figure 21. Ethnic-specific influenza hospitalisation rates between the NMDS and SHIVERS data30 April – 30 September 2012

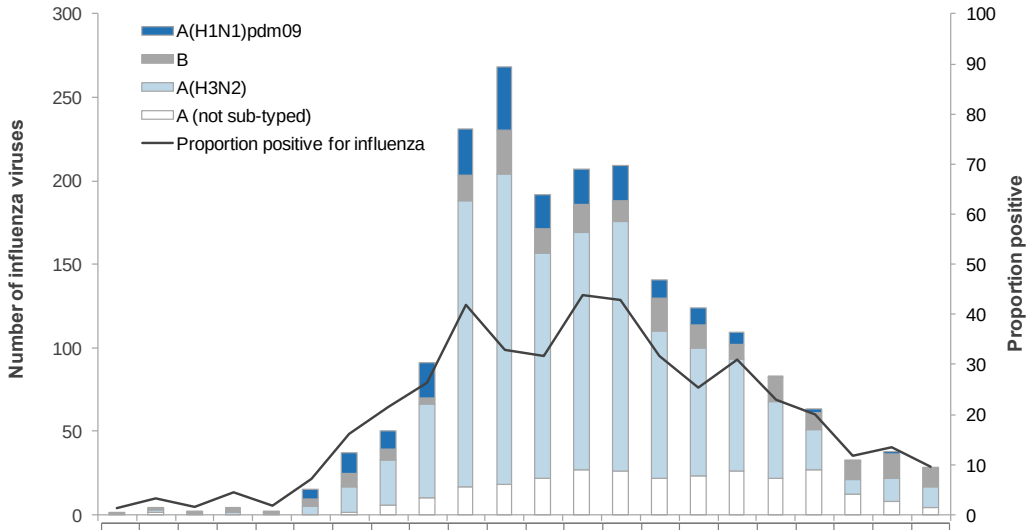


Non-sentinel laboratory surveillance

For non-sentinel surveillance from January to December 2012, a total of 8725 specimens were tested. (One lab was unable to record the number of specimens tested for the entire year). Of these, 2026 (23.2%) specimens tested positive for influenza viruses. This is higher than the 932 and 1663 viruses identified through non-sentinel surveillance in 2011 and 2010 respectively, but lower than the 4276 viruses identified in 2009.

Figure 22 shows the temporal distribution of influenza viruses reported by type and subtype each week from non-sentinel surveillance for weeks 18–39. Again, influenza A(H3N2) virus has become the predominant strain in New Zealand with a peak in week 28 (9–15 July 2012) comprising 69.4% of all viruses.

Figure 22. Influenza viruses from non-sentinel surveillance by type and week reported, 2012



	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
A (not sub-typed)	0	1	0	0	0	0	1	6	10	17	18	22	27	26	22	23	26	22	27	12	8	4
A(H3N2)	0	2	0	1	0	5	16	27	56	171	186	135	142	150	88	77	67	46	24	9	14	13
B	1	1	2	3	1	4	8	6	4	15	26	14	17	12	20	14	9	14	10	11	14	11
A(H1N1)pdm09	0	0	0	0	1	6	12	11	21	28	38	21	21	21	11	10	7	1	2	1	2	0

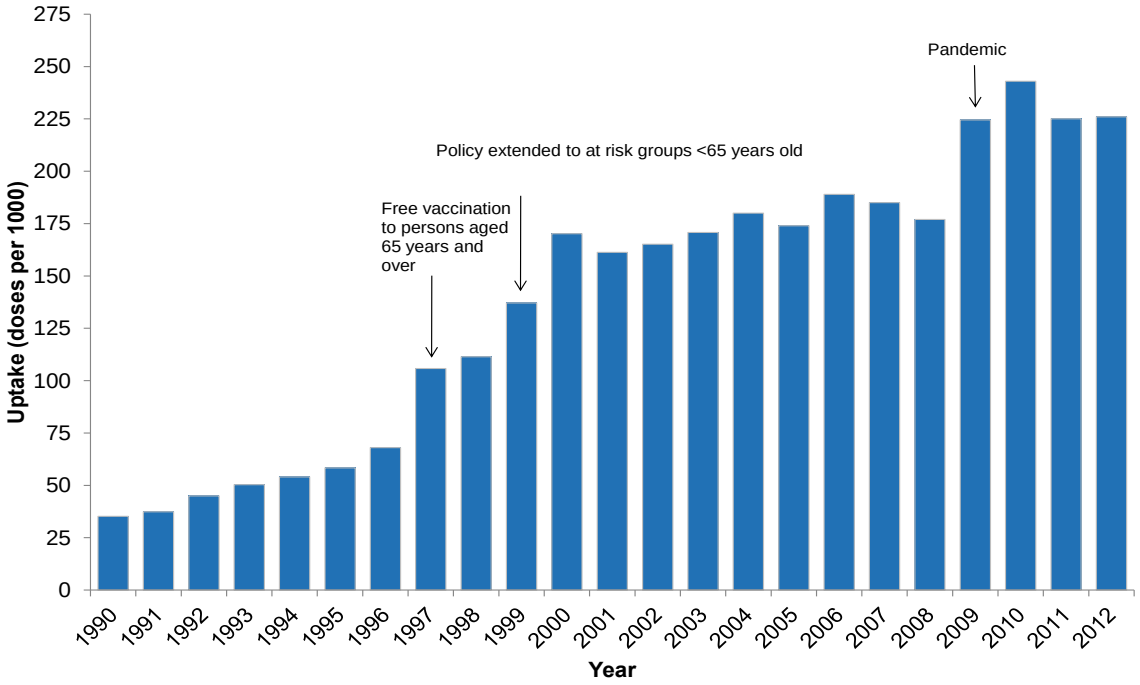
*Data shown from weeks 18–39 only.

IMMUNISATION COVERAGE

IMMUNISATION COVERAGE

The uptake of the seasonal influenza vaccine in New Zealand in 2012 was lower than in 2010 (Figure 23). The number of doses of influenza vaccine (both publically and privately funded), used during the 2012 seasonal influenza immunisation programme was 226 doses per 1000 population, 0.4% higher than the 225 doses per 1000 population administered in 2011. The overall uptake rate for funded vaccine among persons 65 years and older was 64.3%, similar to the uptake rate of 63.0% achieved in 2011 (Immunisation Benefit Claims Data, Ministry of Health 2012).

Figure 23. Influenza vaccine uptake, 1990–2012



Note: In 1997, the Ministry of Health made the influenza vaccination available free to persons aged 65 years and older. In 1999, this policy was extended to at-risk groups <65 years old.

At least 1,000,577 doses of the seasonal trivalent influenza vaccine were distributed in New Zealand in the 2012 season. Table 8 shows the estimated numbers of people that received immunisation for seven age groups.

Table 8. Influenza immunity by age group, 2012

Age group (years)	2012 mid-year population estimates	Total vaccine received	% vaccine uptake (n=612,416)	% vaccine coverage by age group
<1	60,590	693	0.1	1.1
1–4	251,250	8,413	1.4	3.3
5–19	891,720	29,253	4.8	3.3
20–34	905,450	22,244	3.6	2.5
35-49	906,250	48,097	7.9	5.3
50-64	806,460	109,818	17.9	13.6
65+	611,400	393,898	64.3	64.4
Total	**4,433,120**	**612,416**	**100.0**	**13.8**

VIRUS STRAIN CHARACTERISATION

VIRUS STRAIN CHARACTERISATION

Circulating viral strains in 2012

A total of 2425 influenza viruses were detected and reported in 2012. Influenza A viruses represented the majority of influenza viruses (2119/2425 or 87.4% of all viruses) and influenza B consisted of a small proportion (306/2425). The seasonal influenza A(H3N2) strain represented 65.0% (1577/2425) of all viruses and 74.0% (1577/2130) of all typed and subtyped viruses. The influenza A(H1N1)pdm09 virus represented 10.2% (247/2425) of all viruses and 11.6% (247/2130) of all typed and subtyped viruses. Influenza B virus represented 12.6% (306/2425) of all viruses and 14.4% (306/2130) of all typed and subtyped viruses.

Figure 24 shows influenza virus identifications by type and subtype for each week throughout 2012, and the total percentage contribution of each. Table 9 shows influenza virus identifications by type and subtype for 2012.

Figure 24. Total influenza viruses by type and week specimen taken, 2012

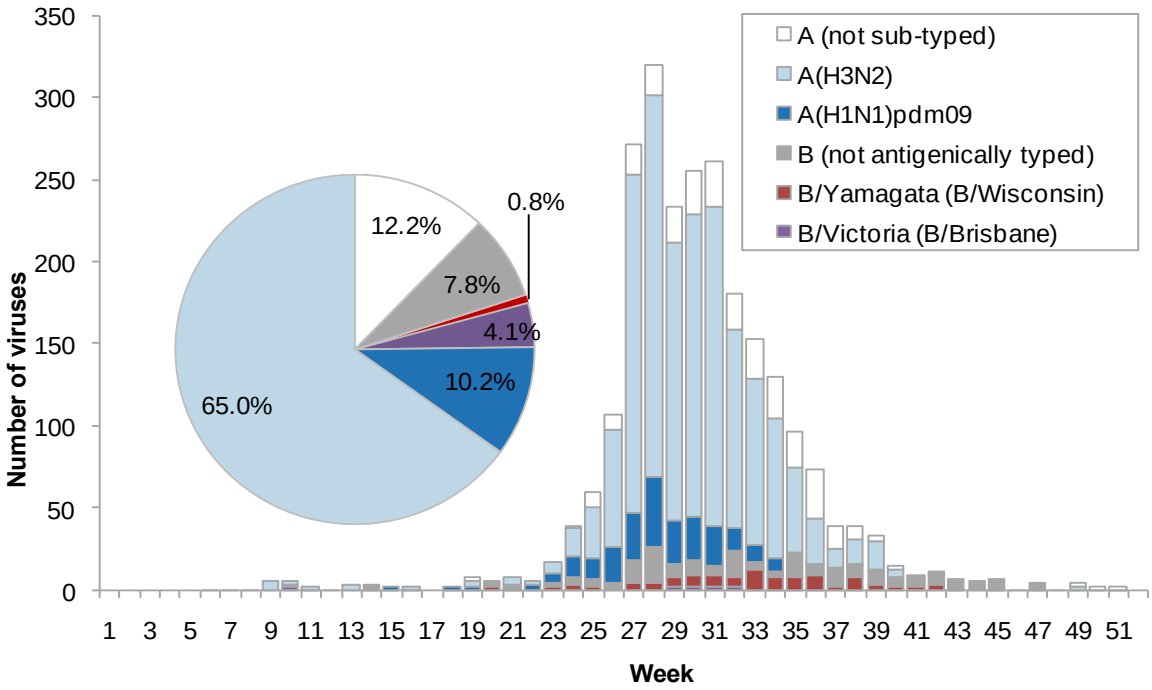


Table 9. Influenza virus identifications by type and subtype, 2012

Viruses	All viruses (%)	Typed/Sub-typed (%)
Influenza A	**295 (12.2)**	
A (not sub-typed)	295 (12.2)	
Influenza A(H1N1)pdm09	**247 (10.2)**	**247 (11.6)**
A(H1N1)pdm09 by PCR	143 (5.9)	143 (6.7)
A/California/7/2009 (H1N1)-like	104 (4.3)	104 (4.9)
Influenza A(H3N2)	**1577 (65.0)**	**1577 (74.0)**
A(H3N2) by PCR	1127 (46.5)	1127 (52.9)
A/Perth/16/2009 (H3N2)-like	450 (18.6)	450 (21.1)
Influenza B	**306 (12.6)**	**306 (14.4)**
B by PCR	188 (7.8)	188 (8.8)
B/Victoria (B/Brisbane)	19 (0.8)	19 (0.9)
B/Yamagata (B/Wisconsin)	99 (4.1)	99 (4.6)
Total	**2425 (100.0)**	**2130 (100.0)**

Figure 25 shows the general pattern of influenza virus identifications. Influenza A and B viruses co-circulated throughout the season.

Figure 25. Total influenza A and B viruses by week specimen taken, 2012

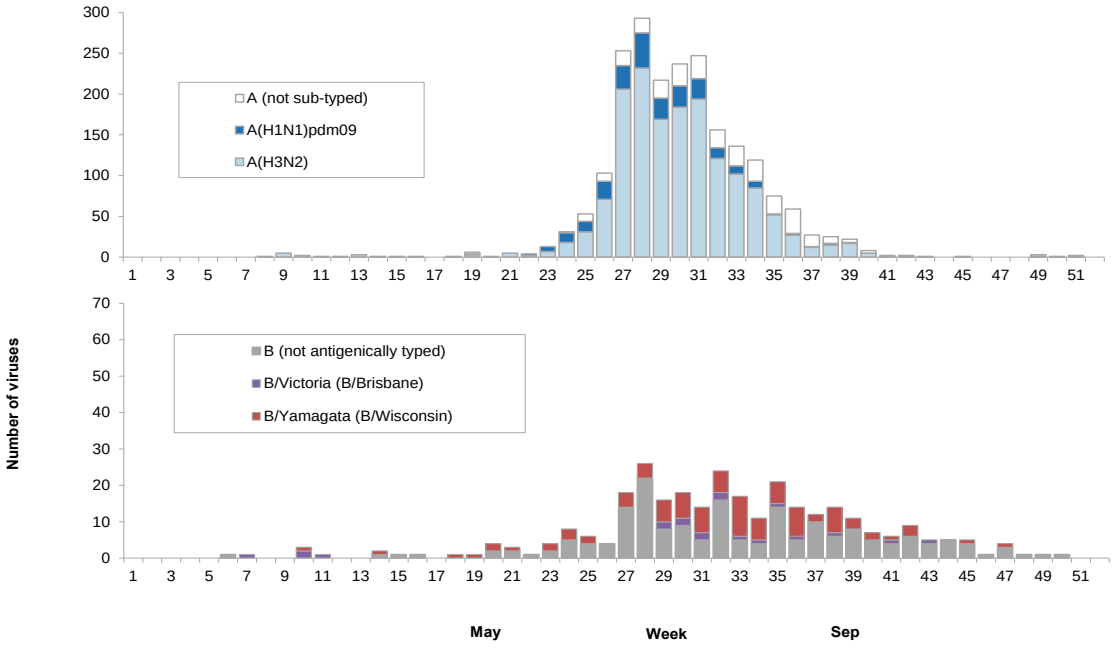
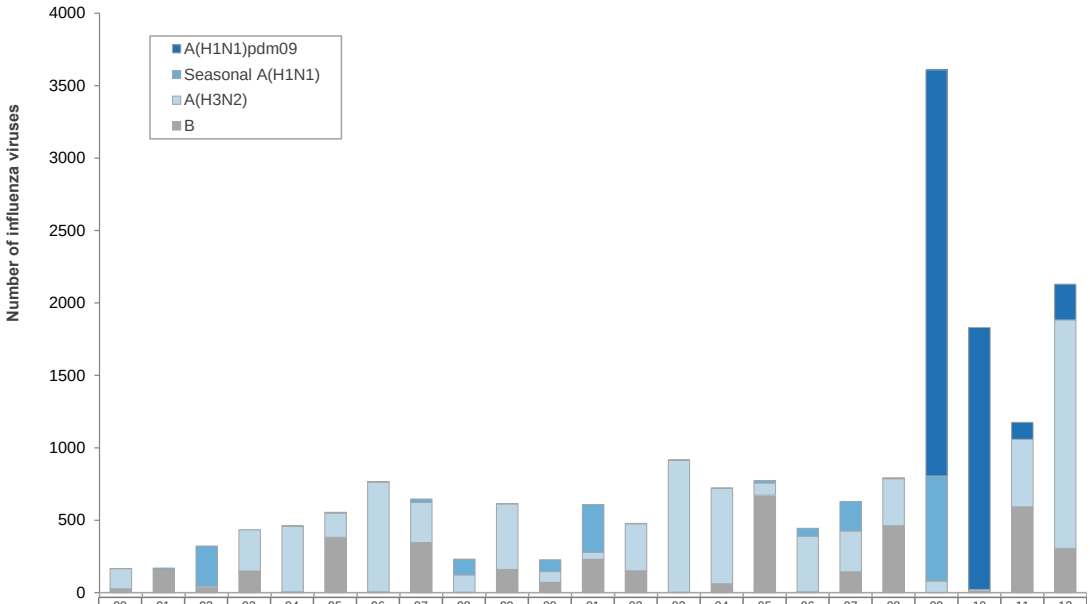


Figure 26 shows the number and percentage of typed and subtyped (not total) influenza viruses from 1990–2012. There are noticeable changes in terms of the predominance patterns.

- The influenza A(H1N1)pdm09 strain predominated in 2009 and 2010.
- The seasonal A(H1N1) strain predominated in three seasons (1992, 2000 and 2001) and was associated with relatively low numbers of hospitalisations (193 in 1992, 228 in 2000 and 379 in 2001). No seasonal A(H1N1) viruses have been detected since 2010.
- The seasonal A(H3N2) strain predominated for 11 seasons (1990, 1993, 1994, 1996, 1998, 1999, 2002, 2003, 2004, 2006, 2007 and 2012). The A/Fujian/411/02 (H3N2)-like strain predominated in 2003, with the highest recorded numbers of hospitalisations from 1990–2008. An A/Wuhan/359/95 (H3N2)-like strain predominated in 1996 with 94 deaths (93 of these occurred in people aged 65 years and older).
- Influenza B strains predominated for six seasons (1991, 1995, 1997, 2005, 2008 and 2011). B/Hong Kong/330/2001-like strain (B/Victoria lineage) predominated in 2005. The disease burden was high in children aged 5–19 years, resulting in three deaths. Since the introduction of the B/Victoria lineage viruses into New Zealand in 2002, this lineage has predominated over the B/Yamagata lineage viruses in three yearly cycles in New Zealand (2002, 2005, 2008 and 2011).

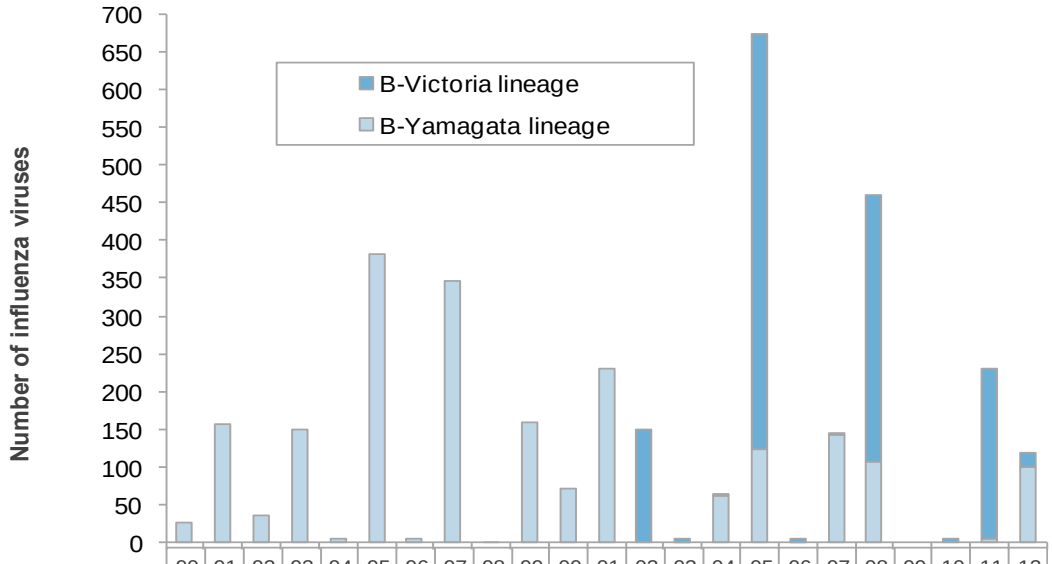
Figure 26. Influenza viruses by type, 1990–2012



	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
A(H1N1)pdm09(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.7	98.8	10.0	11.6
Seasonal A(H1N1)(%)	0.6	7.7	85.7	0.0	0.2	1.1	0.3	3.6	47.4	0.3	36.0	54.4	0.4	0.1	0.1	2.3	12.6	32.1	0.8	20.1	0.0	0.0	0.0
A(H3N2)(%)	83.2	0.0	2.8	65.7	98.7	30.1	99.1	43.0	51.7	73.7	32.9	7.9	68.0	99.6	91.3	10.7	86.3	45.0	41.0	2.2	0.7	39.6	74.0
B(%)	16.2	92.3	11.5	34.3	1.1	68.8	0.7	53.5	0.9	26.0	31.1	37.8	31.6	0.3	8.6	87.0	1.1	23.0	58.3	0.0	0.5	50.3	14.4

Figure 27 shows the number and percentage of all antigenically typed B viruses from 1990 to 2012. Since the introduction of the B/Victoria lineage viruses into New Zealand in 2002, this strain predominated over the B/Yamagata lineage viruses in three yearly cycles in New Zealand (2002, 2005, 2008 and 2011).

Figure 27. Influenza B antigenic types, 1990–2012



	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
B-Victoria lineage (%)	0	0	0	0	0	0	0	0	0	0	0	0	100	33	2	82	60	1	77	0	100	98	16
B-Yamagata lineage (%)	100	100	100	100	100	100	100	100	100	100	100	100	0	67	98	18	40	99	23	0	0	2	84

Influenza A(H1N1)pdm09

In 2012, 104 representative influenza A(H1N1)pdm09 isolates were antigenically subtyped. The results from the WHO National Influenza Centre at ESR and WHOCC-Melbourne indicated that most of the currently circulating influenza A(H1N1)pdm09 viruses are antigenically closely related to the vaccine candidate strain A/California/7/2009 (H1N1) [10].

The genetic analysis was conducted for the hemagglutinatin (HA) gene and neuraminidase gene of representative influenza A(H1N1)pdm09 viruses. The New Zealand isolates along with isolates from Australia and other countries, exhibited increasing genetic diversity with two major subclades designated as groups 7 and 6 (CDC designation, Appendix A and B). However, it appears that these genetic changes have not resulted in significant antigenic changes [11]. No H275Y mutations were detected from any (except one) A(H1N1)pdm09 virus from New Zealand.

Influenza A(H3N2)

In 2012, 405 representative seasonal influenza A(H3N2) isolates were antigenically subtyped. The results indicated that the New Zealand isolates, as well as isolates from Australia and other countries, had a small antigenic drift from the reference strain A/Perth/16/2009 (H3N2) to the A/Victoria/361/2011-like strain. Genetically, A(H3N2) viruses have drifted away from the reference strain A/Perth/16/2009 (H3N2) and are closely related to A/Victoria/361/2011-like strain. The results of the genetic analysis of the HA gene of the representative viruses indicated that most of viruses fell into three main groups designated as groups 3 and 6 (CDC designations, C).

Influenza B

In 2012, representative seasonal influenza B/Victoria lineage isolates (B/Brisbane/60/2008-like) (19) and B/Yamagata lineage isolates (B/Wisconsin/1/2010-like) (99) were antigenically typed. The results indicated that the New Zealand isolates, as well as isolates from Australia and other countries, were antigenically related to the reference strains B/Brisbane/60/2008 and B/Wisconsin/1/2010-like viruses. The results of the genetic analysis of the HA gene of influenza B viruses indicated that the B/Victoria and B/Yamagata lineage viruses fell into group 1 and groups 2 and 3 respectively (CDC designations, D).

Oseltamivir resistance monitoring

The NIC at ESR employed a phenotypic method (fluorometric neuraminidase inhibition assay) for the surveillance of anti-viral drug resistance in influenza viruses. In addition, the NIC employed a molecular method (PCR and sequencing) to monitor the H275Y mutation (histidine-to-tyrosine mutation at the codon of 275 in N1 numbering) which confers resistance to oseltamivir.

In 2012, the fluorometric neuraminidase inhibition assay was used to test a total of 592 influenza viruses. All viruses (except two A(H1N1)pdm09 viruses) were sensitive to oseltamivir with mean IC50 values for A(H1N1)pdm09 at 0.33 nM, A(H3N2) at 0.4 nM and B at 13.3 nM (Table 10). The first oseltamivir resistant influenza A(H1N1)pdm09 was detected from a 26 year old male who was hospitalised with acute upper respiratory infection within seven days of returning New Zealand from India. The results of the fluorometric neuraminidase inhibition assay indicated that the virus had highly reduced sensitivity to oseltamivir with IC50 value of 271 nM, 821 fold higher than the mean of IC50 value (0.32 nM). The sequencing analysis of the neuraminidase gene confirmed that the virus had the H275Y mutation (histidine-to-tyrosine at codon 275 in N1 nomenclature), conferring resistance to oseltamivir. In addition, this virus is genetically closer to the Indian A(H1N1)pdm09 viruses than the New Zealand A(H1N1)pdm09 viruses. The second oseltamivir resistant influenza A(H1N1)pdm09 virus was detected from seven-month-old Samoan girl who was hospitalised with suspected pneumonia and had not travelled overseas prior to hospitalisation. The results of the fluorometric neuraminidase inhibition assay indicated that the virus had highly reduced sensitivity to oseltamivir with IC50 value of 316 nM, 958 fold higher than the mean of IC50 value (0.33 nM). Both patients did not take any oseltamivir medication before and during hospitalisation.

From 2006 to 2007, all influenza A(H1N1) viruses tested were sensitive to oseltamivir. In 2008, only six seasonal A(H1N1) viruses (0.8%) were detected, of which, only four were available for antiviral susceptibility testing and were all resistant to oseltamivir. The results of the fluorometric neuraminidase inhibition assay indicated that the four viruses had highly reduced sensitivities to oseltamivir, with IC50 values in the range of 500–1700 nM, typical of the recently globally emerging oseltamivir-resistant A(H1N1) viruses. Genetic analysis of the neuraminidase gene confirmed that the four viruses had the H275Y mutation (histidine-to-tyrosine at codon 275 in N1 nomenclature), conferring resistance to oseltamivir. None of the patients or their close contacts had received oseltamivir prior to sample collection. In 2009, 25 seasonal A(H1N1) virus were phenotypically tested and all were resistant to oseltamivir. However, all influenza A(H1N1)pdm09 isolates tested between 2009 and 2011 were sensitive to oseltamivir.

Table 10. Antiviral susceptibility to oseltamivir for influenza viruses in New Zealand, 2006–2012

Influenza type/sub-type	2006	2007	2008	2009	2010	2011	2012
Influenza B							
Number of isolates tested	1	132	306	-	1	179	120
Mean IC50* (nM)	-	37.5	26.5	-	-	31.9	13.3
Standard deviation (nM)	-	225	16.9	-	-	15.3	8.41
Minimum IC50 (nM)	-	0.9	0.22	-	-	4.12	3.49
Maximum IC50 (nM)	-	97.4	87.8	-	-	71.3	64.9
Influenza A(H3N2)							
Number of isolates tested	189	45	120	-	1	70	377
Mean IC50 (nM)	0.7	0.38	0.28	-	-	0.46	0.4
Standard deviation (nM)	0.27	0.26	0.17	-	-	0.27	0.2
Minimum IC50 (nM)	0.06	0.07	0.01	-	-	0.06	0.01
Maximum IC50 (nM)	1.4	1.13	1.08	-	-	1.5	1.37
Seasonal influenza A(H1N1)							
Number of isolates tested	18	136	4	25	-	-	-
Mean IC50 (nM)	1.26	0.81	768	1385	-	-	-
Standard deviation (nM)	0.89	0.64	287	1996	-	-	-
Minimum IC50 (nM)	0.2	0.05	573	305	-	-	-
Maximum IC50 (nM)	3	2.7	1184	7912	-	-	-
Influenza A(H1N1)pdm09							
Number of isolates tested	-	-	-	483	334	12	95
Mean IC50 (nM)	-	-	-	0.4	0.68	0.54	0.33
Standard deviation (nM)	-	-	-	0.24	0.41	0.24	0.19
Minimum IC50 (nM)	-	-	-	0.09	0.01	0.19	0.09
Maximum IC50 (nM)	-	-	-	1.4	2.05	0.965	316

*IC50; inhibitory concentration of the drug at which a 50% reduction in enzymatic activity is observed.

SOUTHERN HEMISPHERE VACCINE STRAIN RECOMMENDATIONS

SOUTHERN HEMISPHERE VACCINE STRAIN RECOMMENDATIONS

In October 2012, the Australian Influenza Vaccine Committee (AIVC), including a New Zealand representative, met to decide on the composition of the influenza vaccine for the 2013 winter season for New Zealand, Australia and South Africa. During these discussions, the following trends were noted.

Influenza A(H1N1)

The epidemiological data from the New Zealand 2012 influenza season and most other Southern Hemisphere countries indicated that the influenza A(H1N1)pdm09 virus has replaced seasonal A(H1N1) virus since 2009. The WHOCC-Melbourne analysed 20 influenza A(H1N1)pdm09 isolates from three countries, including New Zealand, since January 2012. The antigenic data from these isolates indicate that the current circulating influenza A(H1N1)pdm09 viruses are antigenically similar to the vaccine candidate strain A/California/7/2009 (H1N1). Current vaccines containing A/California/7/2009 antigen stimulated anti-HA antibodies of similar geometric mean haemagglutination inhibition (HI) titres to the vaccine virus and recent influenza A(H1N1)pdm09 isolates.

Based on Southern Hemisphere and global data, the WHO Consultative Group and the AIVC recommended that the 2012 vaccines contain a pandemic influenza A/California/7/2009 (H1N1)-like strain as the H1 component.

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 WHOCC-Melbourne has analysed 1076 A(H3N2) isolates from 11 countries since January 2012. Most recent isolates were genetically and antigenically drifted away from A/Perth/16/2009-like strain and were closely related to A/Victoria/361/2011-like virus. Current vaccines containing the A/Victoria/361/2011-like antigen stimulated anti-HA antibodies of similar geometric mean HI titres to the vaccine virus and to recent A(H3N2) isolates. As a result, an A/Victoria/361/2011-like strain was recommended by the WHO Consultative Group and the AIVC to be the H3 component of the influenza vaccine for the Southern Hemisphere for 2012.

Influenza B

Two distinct lines of influenza B have co-circulated in many countries during recent years. This dates from the late 1980s when the B/Panama/45/90 variant of influenza B was first observed. This strain and its further variants of the B/Yamagata/16/88 lineage (the most recent representative strain being B/Wisconsin/1/2010) 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 (the most recent representative strain being B/Brisbane/60/2008). For reasons not wholly understood, these remained geographically restricted to Asia until 2001. In 2002, the B/Victoria-lineage strains spread to the rest of the world.

Both recent B/Victoria-like strains (B/Brisbane/60/2008 is the current reference strain) and B/Yamagata-like strains (B/Wisconsin/1/2010 is the current reference strain) continued to be isolated worldwide in 2012. Varying proportions of the two lineages were seen with an increase of the proportion of B/Yamagata/16/88 lineage viruses in many Southern Hemisphere countries. The majority of B/Yamagata/16/88 lineage isolates were antigenically closely related to the B/Wisconsin/1/2010 strain. Current vaccines containing the B/Wisconsin/1/2010 antigen stimulated HA antibodies that were similar in titre to the vaccine virus and to recently isolated B/Wisconsin/1/2010 viruses. In light of the increase in the proportion of B/Yamagata/16/88 lineage viruses relative to B/Victoria/2/87 lineage viruses, the WHO Consultative Group and the AIVC recommended vaccines containing a B/Wisconsin/1/2010 strain be the B component of the influenza vaccine for the Southern Hemisphere for 2013.

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

The recommended influenza vaccine formulation for New Zealand in 2013 is:

- **A(H1N1)** **an A/California/7/2009 (H1N1)-like strain***
- **A(H3N2)** **an A/Victoria/361/2011 (H3N2)-like strain**
- **B** **a B/Wisconsin/1/2010-like strain**

*Note: A/California/7/2009 is an influenza A(H1N1)pdm09 strain

DISCUSSION

DISCUSSION

Sentinel GP based influenza surveillance, as a syndromic surveillance system in New Zealand, is effective in monitoring the burden of disease in the community during an epidemic. It has operated continuously in New Zealand since its establishment in 1991 [3]. Sentinel influenza surveillance is a relatively stable system that monitors year-to-year disease trends in the community. Active syndromic surveillance systems are increasingly being used to detect emerging and re-emerging pathogens [11, 12]. Enhanced influenza surveillance is also a key strategy for improving New Zealand's preparedness for pandemic influenza [13]. The usefulness of sentinel surveillance during a pandemic was tested in 2009 and the system has since been adapted to monitor the early and late stages of a pandemic.

Based on sentinel consultation data, the overall influenza activity in 2012 is described as being at a medium level. Comparing data for the past 16 years (1997–2012), the weekly and cumulative consultation rate peaks for ILI in 2012 were the 11th and 10th highest, respectively. It is estimated that ILI resulting in a visit to a GP affected over 48,186 New Zealanders in 2012 or about 1.1% of the population. The number of cases reported through the sentinel network however is likely to considerably underestimate the true number, as many people do not consult a GP when they have an ILI.

Consultation rates varied greatly among DHBs. The use of a common case definition for the purposes of surveillance should minimise regional differences in the criteria for influenza diagnosis. However, in DHBs 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. Sentinel practices with small registered populations can also result in much greater fluctuations in ILI consultation rates.

Virological surveillance for outpatients and hospital inpatients (also referred to as non-sentinel surveillance) complements sentinel surveillance. Non-sentinel surveillance provides useful information on the characterisation of circulating influenza viruses and monitors the emergence of novel strains with pandemic potential. However, current non-sentinel surveillance does not provide robust epidemiologic data with good denominator information. The recent emergence of the influenza A(H1N1)pdm09 virus highlights the need for surveillance to better define those most at risk for severe acute respiratory illness (SARI) resulting from influenza [14]. Expansion of the existing non-sentinel surveillance to include the systematic collection of epidemiological data on hospitalised SARI cases would enable the factors that place the most vulnerable people at risk to be described and facilitate targeted intervention. This would also establish a platform for respiratory disease surveillance for other respiratory pathogens. It would be beneficial to evaluate the current status of non-sentinel surveillance in New Zealand and consider an expansion of the system to establish a long-term routine national SARI surveillance for hospital inpatients.

In October 2011, the CDC in the United States commissioned ESR to conduct a five-year study on influenza in the Southern Hemisphere including vaccine effectiveness. This study has been referred to as SHIVERS (Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance). It is a multi-disciplinary and multi-centre collaboration among ESR, Auckland and Counties Manukau DHBs, Universities of Otago and Auckland, WHOCC at St Jude Children Hospital in Memphis and CDC in Atlanta. As a key component of the SHIVERS project, SARI surveillance has been established and fully functioning since 30 April 2012 in Auckland and Counties Manukau DHBs.

The highest influenza hospitalisation rate (282.1 per 100,000 respectively) was recorded for children aged less than one year. In addition, high influenza hospitalisation rate (63.0 per 100,000 respectively) was recorded for children 1–4 years. The GP-based sentinel surveillance also recorded the highest ILI consultation rates in children under the age of five years. Overseas studies have also indicated high influenza hospitalisation rates in young children: 300–400 per 100,000 for children less than two years was found in a 25 years prospective USA study [15] and 1038 per 100,000 in children less than one year was recorded in a Hong Kong study during 2004 and 2005 [16]. In addition, interviewing SARI patients revealed that a very small proportion of children aged 6–48 months had had influenza vaccinations. Based on high influenza hospitalisation rates recorded in NZ and overseas for young children aged 0–4 years, it

would be beneficial to provide influenza vaccination for children aged 6–48 months in order to minimise the impact of influenza.

SARI surveillance and NMDS-coded influenza hospitalisations recorded higher influenza hospitalisation rates for Pacific Peoples and Māori than those for Asian, Europeans and other ethnic groups. SARI surveillance and NMDS-coded influenza hospitalisations recorded higher influenza hospitalisation rates for Pacific Peoples and Māori than those for Asian, Europeans and other ethnic groups. Reasons for ethnic differences in hospitalisation rates may include a higher incidence of infection among Pacific and Māori people, a higher prevalence of co-morbidities (such as asthma and diabetes), unfavourable environmental factors (such as household crowding and poor quality housing), behavioural differences in responding to influenza, differences in socio-cultural-economic status, differences in health service utilisation and increased genetic susceptibility [17]. Further studies on the contributing factors to ethnic differences in the risk of contracting severe influenza are needed in New Zealand.

The pandemic influenza A(H1N1)pdm09 identified a major gap in global influenza surveillance capacity that compromised the assessment and monitoring of the event. The lack of any established surveillance for severe disease in most countries, including developed countries, resulted in an absence of historical data to evaluate the severity of the event in the context of previous seasons or to observe changes in the behaviour of the virus. One main objective of the SARI surveillance is to measure the incidence and prevalence of SARI cases including ICU admissions and deaths in a timely manner. Of the 837,696 ADHB and CMDHB residents, 1430 (171/100,000) were hospitalised with severe acute respiratory infections including 50 (6/100,000) ICU admissions and 10 (1.2/100,000) deaths. Influenza viruses were detected in 288 (34/100,000) tested SARI cases, 6 (0.7/100,000) SARI ICU cases and 2 (0.2/100,000) SARI deaths. This SARI surveillance has generated timely disease incidence and severity data on the impact or burden of influenza which could help policy makers develop strategies for mitigating influenza.

One of the strengths of the ILI sentinel surveillance system in New Zealand is the combination of disease surveillance with virus strain surveillance (virological identification). A definitive diagnosis of influenza requires laboratory confirmation, because clinical diagnosis on the basis of clinical symptoms is not specific. In fact, sentinel surveillance is the only syndromic surveillance system that obtains good quality respiratory swabs for verification of clinical diagnosis. Consequently, an important part of the sentinel system is for GPs to take nasopharyngeal and/or throat swabs from patients presenting with an ILI. During sentinel surveillance from May to October 2012, four virology laboratories tested 895 respiratory specimens for influenza viruses, of which 399 (44.6%) specimens were positive. The influenza isolation rate varied among the different DHBs with some DHBs having an isolation rate lower than the national average of 44.6%. Many factors 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 are the best specimens as they contain a higher cellular content than nasopharyngeal swabs [18]. By comparison, throat swabs or throat washings are of limited use in the diagnosis of influenza because the majority of cells captured by this technique are squamous epithelial cells. However, a nasopharyngeal swab can be a useful specimen for influenza virus isolation and it is selected for influenza surveillance because of its convenience. It is recommended that 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, placed into viral transport medium, chilled and couriered to the virology laboratory without delay.

The global emergence and rapid spread of oseltamivir-resistant influenza A(H1N1) viruses carrying an NA gene with an H274Y (histidine to tyrosine mutation at the codon of 274 by N2 numbering) amino acid substitution, has been observed in New Zealand since January 2008. All seasonal influenza A(H1N1) viruses (25) tested in 2009 were resistant to oseltamivir. In contrast, all influenza A(H1N1)pdm09 viruses tested in 2009, 2010 and 2011 were sensitive to oseltamivir. In 2012, two oseltamivir resistant influenza A(H1N1)pdm09 viruses were detected; the first from a 26 year old male who was hospitalised with acute upper respiratory infection within seven days of returning to New Zealand from India and the second from a seven month old Samoan girl who was hospitalised with suspected pneumonia but had not travelled overseas. Oseltamivir-resistant viruses pose challenges for the selection of antiviral medications

for the treatment and chemoprophylaxis of influenza. It has become increasingly important to maintain a national antiviral monitoring programme in New Zealand that provides timely surveillance information to assist clinicians in choosing appropriate antiviral agents for their patients, and assists public health officials making evidence-based decisions on stockpiling antiviral agents and their usage during a pandemic or epidemic. Timely surveillance information also provides compelling reasons for clinicians to test patients for influenza virus infection to select appropriate antiviral medications.

Since 2001, 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 the ESR virus input form. This is a time-consuming process and it inevitably creates data entry errors. Timely reporting for the virology weekly report was one of the biggest challenges during the pandemic response. Advances in information transfer using electronic systems such as Healthlink would streamline this process.

As the impact of influenza on people and health systems can be reduced by annual immunisation, the information on influenza vaccination coverage is particularly important in raising awareness of the disease among health professionals and the public, and for planning the vaccine's formulation and delivery. The National Influenza Immunisation Strategy Group was established in 2000 with the purpose of improving coverage through public and healthcare provider education. A national approach to promotion, coupled with local initiatives, has been key to raising vaccination coverage to 64% including people aged 65 years and older.

Influenza vaccines are recommended for people at risk of developing complications following infection because of their age or because of underlying chronic conditions, and are available free each year [19]. In 1997, New Zealand introduced a programme of free influenza vaccinations to all New Zealanders aged 65 years and older, and set a target of 75% coverage for the year 2000. In 1999, the free vaccination programme was extended to include those under 65 years with specified chronic medical conditions [19, 20]. Quality coverage data are essential for the further development of this programme while continuing surveillance ensures the provision of effective vaccines to reduce the burden of influenza in New Zealand. In addition, to assess the effectiveness of influenza vaccines, it is crucial that influenza vaccines for all ages be included on the national immunisation register.

REFERENCES

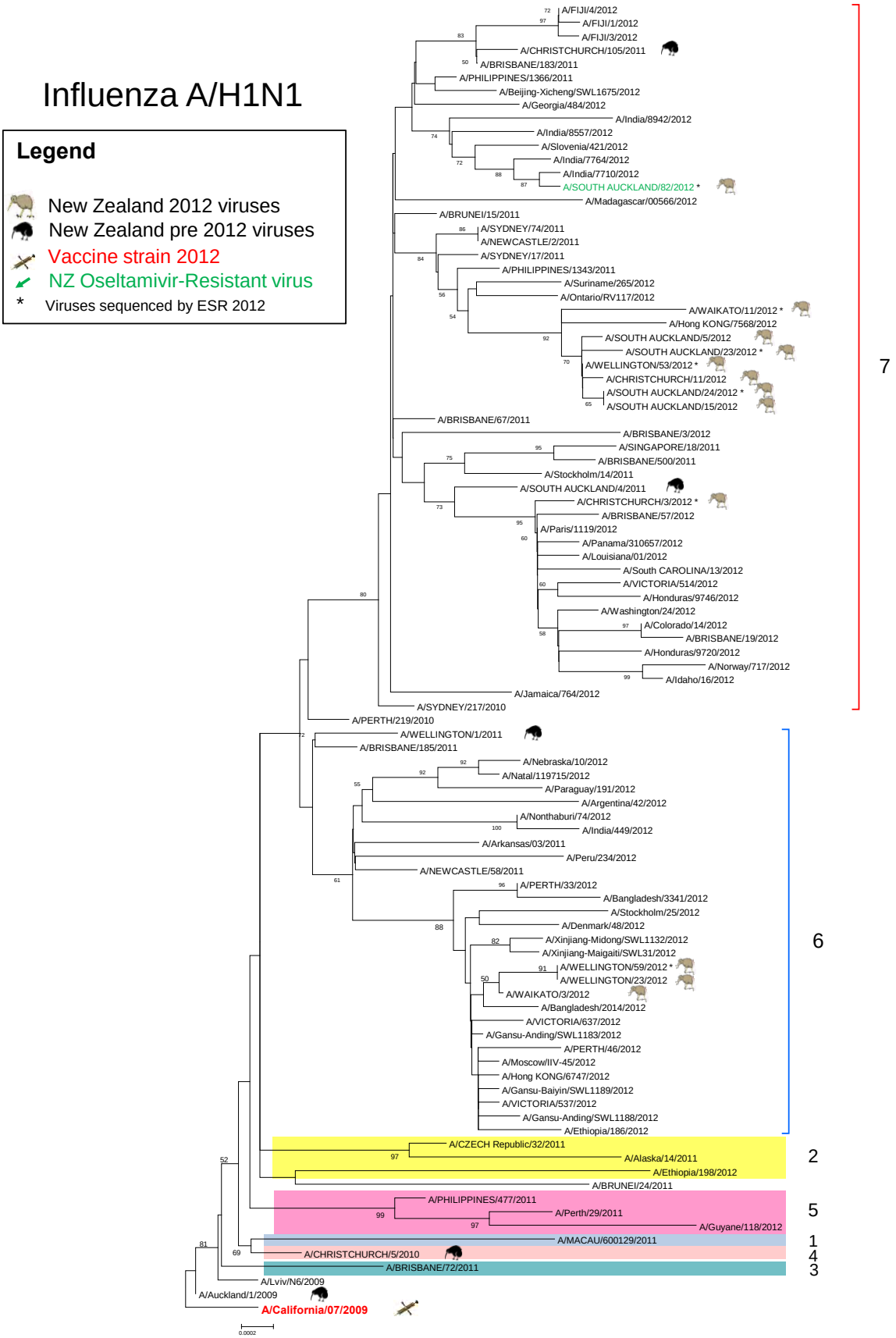
REFERENCES

1. *Report of the WHO/GEIG Informal Consultation on the Standardization and Improvement of Influenza Surveillance, Monaco*. 1991.
2. Huang QS, Lopez LD, McCallum L, Adlam B. 2008. *Influenza surveillance and immunisation in New Zealand, 1997-2006.* Influenza and Other Respiratory Viruses 2(4): 139–145.
3. Dedman DJ et al. 1997. *Influenza surveillance in England and Wales: October 1996 to June 1997.* CDR Rev 13: R212–219.
4. Jennings L et al. 2001. *Influenza surveillance and immunisation in New Zealand, 1990-1999.* NZPHR 8: 9–12.
5. Ortiz JR et al. 2009. *Strategy to enhance influenza surveillance worldwide.* Emerg Infect Dis, 15(8): 1271–78.
6. WHO. 2011. *WHO global technical consultation: global standards and tools for influenza surveillance*. 20 October 2011. Available from: http://www.who.int/influenza/resources/documents/technical_consultation/en/.
7. Ministry of Health. 1996. *Influenza vaccine. [Circular letter] to health professionals*.
8. Jennings LC, Baker S. 2001. 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. Elsevier.
9. Huang Q. 2010. *Recommendation for seasonal influenza vaccine composition for New Zealand 2011*. A report for the Ministry of Health (Client report FW10088) [cited 2011 1 Febuary]. Available from: http://www.surv.esr.cri.nz/PDF_surveillance/Virology/FluVac/FluVac2011.pdf.
10. Barr IG, Cui L, Komadina N, Lee RT, Lin RT, Deng Y, Caldwell N, Shaw R, Maurer-Stroh S. 2010. *A new pandemic influenza A(H1N1) genetic variant predominated in the winter 2010 influenza season in Australia, New Zealand and Singapore.* Euro Surveill. 15(42): 19692. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19692
11. Rana A et al. 2001. *Surveillance for unexplained deaths and critical illnesses due to possibly infectious causes, United States, 1995–1998.* EID. 2002. 8: 145–153.
12. *Outbreaks of avian influenza A (H5N1) in Asia and interim recommendations for evaluation and reporting of suspected cases—United States, 2004.* MMWR 2004. 53: 97–100.
13. WHO. 1999. *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.
14. WHO-Europe. 2009. *WHO Regional Office for Europe guidance for influenza surveillance in humans*. [cited 2011 16 March]. Available from: http://www.euro.who.int/__data/assets/pdf_file/0020/90443/E92738.pdf.
15. Neuzil KM et al. 2002. *Burden of interpandemic influenza in children younger than 5 years: a 25-year prospective study.* J Infect Dis 185(2): 147–52.
16. Chiu, SS et al. 2009. *Virologically confirmed population-based burden of hospitalization caused by influenza A and B among children in Hong Kong.* Clin Infect Dis 49(7): 1016–21.
17. La Ruche G et al. 2009. *The 2009 pandemic H1N1 influenza and indigenous populations of the Americas and the Pacific.* Euro Surveill 4(42).
18. Monte AS, Kioumehr F. 1975. *The Tecumseh study of respiratory illness. IX Occurrence of influenza in the community.* AMJE 102: 553–63.
19. Centers for Disease Control. 2003. *Update: influenza-associated deaths reported among children aged <18 years - United States, 2003-4 influenza season.* MMWR 52: 1286–88.
20. Zambon M. 1998. *Textbook of Influenza*. Laboratory Diagnosis of Influenza. Eds Nicholson KG, Webster RG, Hay AJ. London: Blackwell Science Ltd.

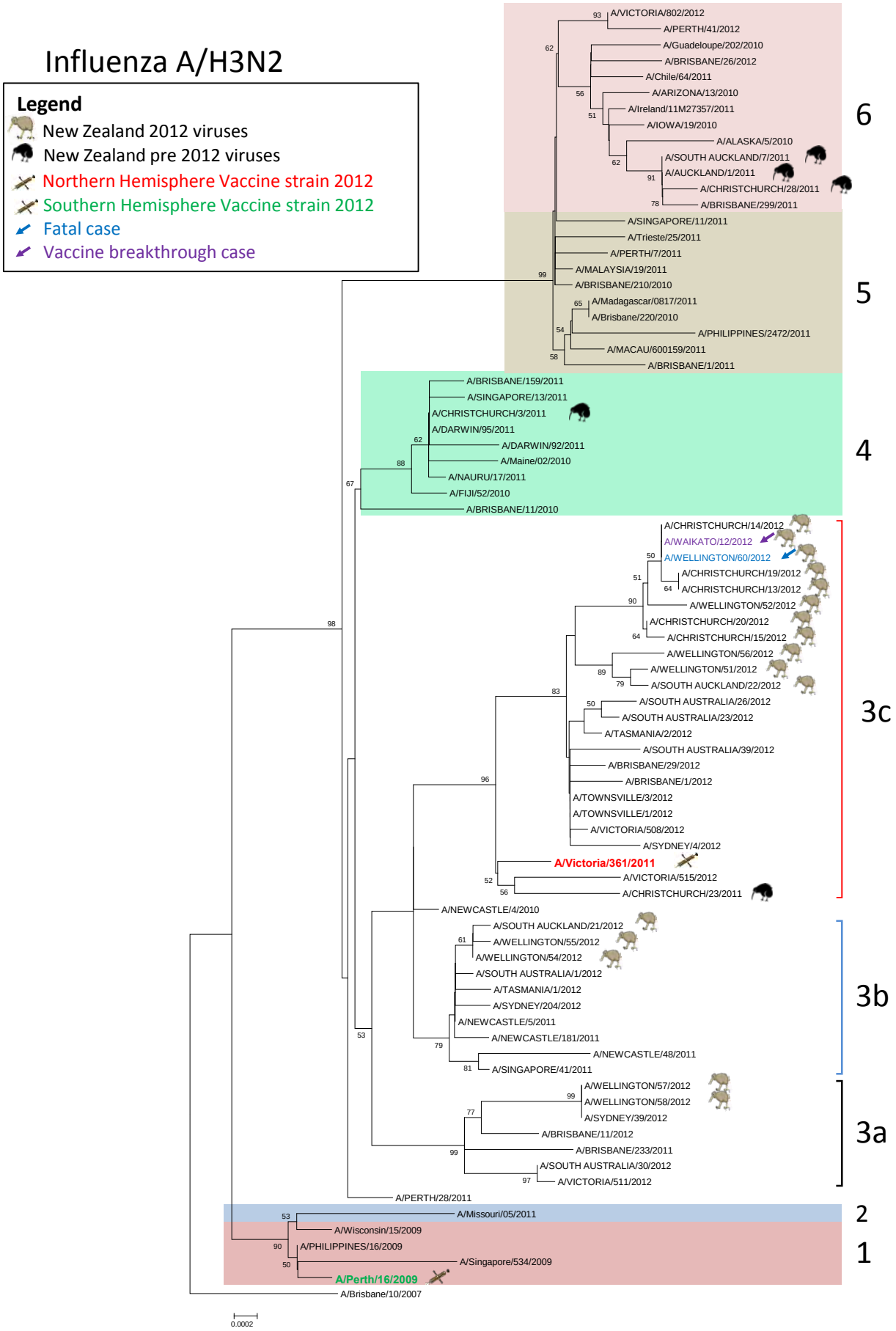
APPENDIX

APPENDIX

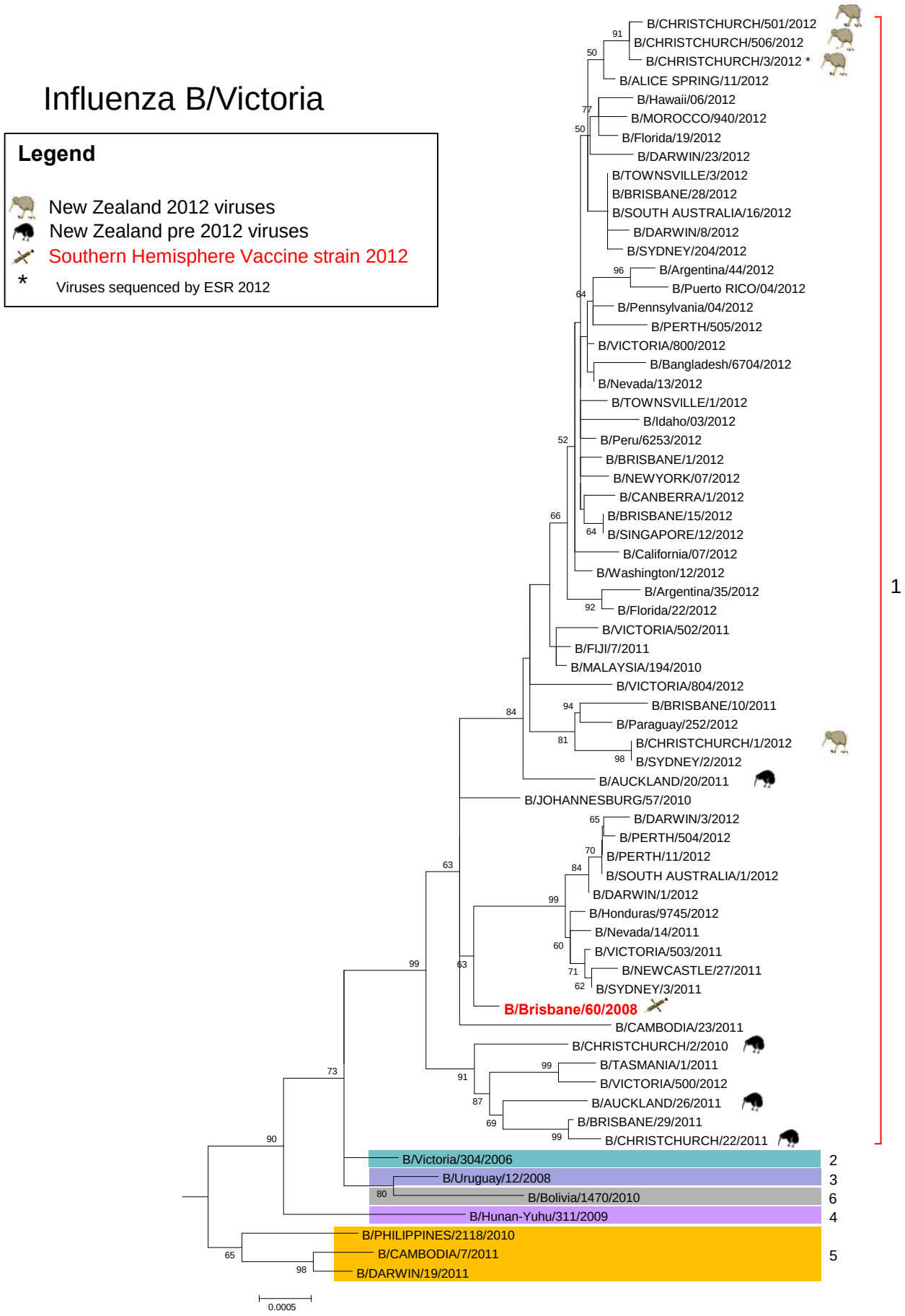
Appendix A. Phylogenetic analysis of HA gene sequence of influenza A(H1N1)pdm09 viruses



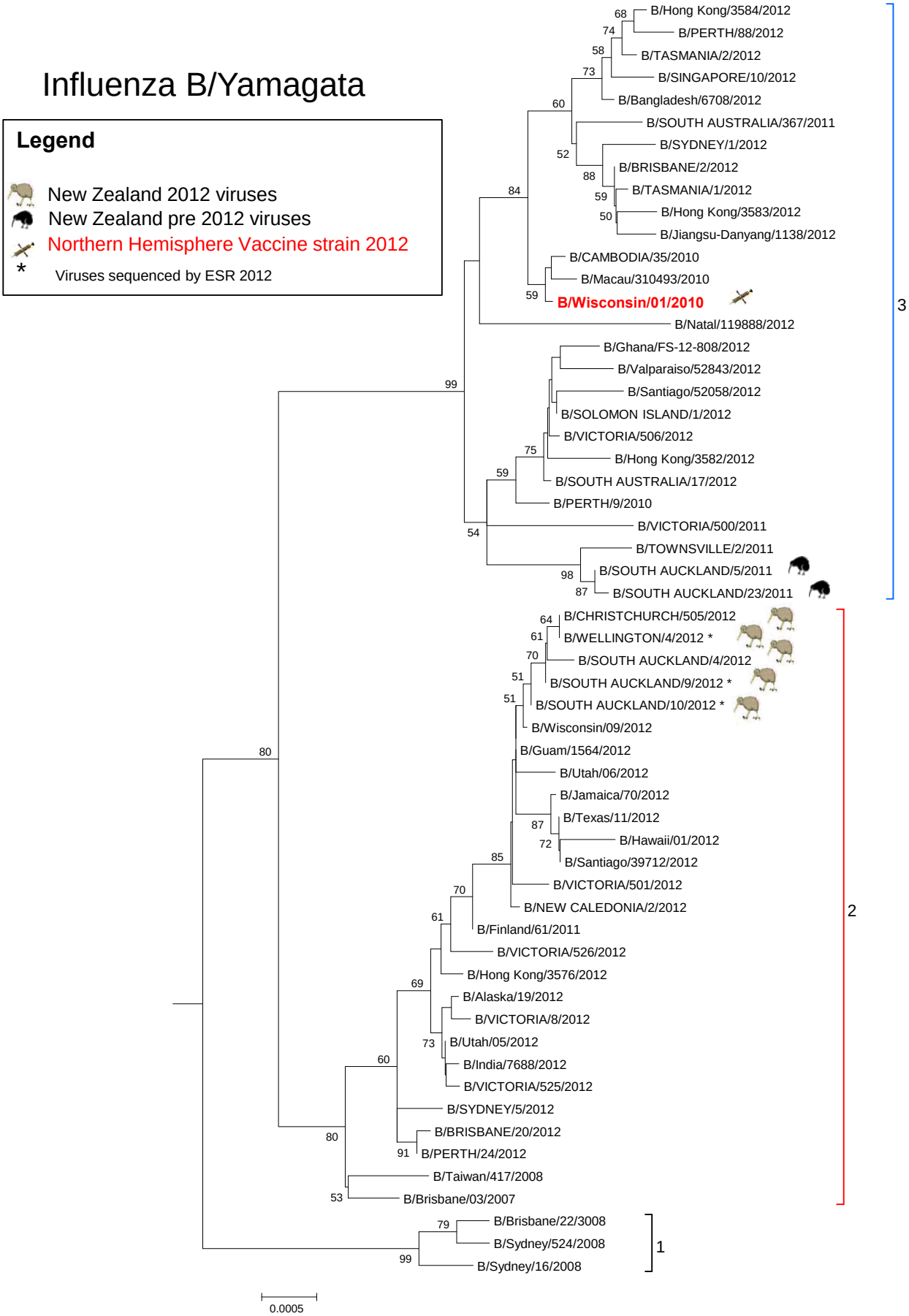
Appendix B. Phylogenetic analysis of HA gene sequence of A(H3N2) viruses



Appendix C. Phylogenetic analysis of HA gene sequence of B/Victoria lineage viruses



Appendix D. Phylogenetic analysis of HA gene sequence of B/Yamagata lineage viruses



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Appendix E. Phylogenetic analysis of NA gene sequence of A(H1N1)pdm09