SURVEILLANCE REPORT

INFLUENZA SURVEILLANCE IN NEW ZEALAND 2014

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THE SCIENCE BEHIND THE TRUTH

Prepared as part of a Ministry of Health contract for scientific services by the Health Intelligence Team, Institute of Environmental Science and Research Limited

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SUMMARY

SUMMARY

Influenza viruses can cause substantial morbidity and mortality in a short time and frequently undergo antigenic changes. National influenza surveillance is an essential public-health tool for assessing and implementing strategies to control influenza. Influenza surveillance in New Zealand monitors the incidence and distribution of influenza, 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 2014.

During the 2014 winter season, 1966 consultations for influenza-like illness (ILI) were reported from a national sentinel network of 60 general practices. It is estimated that an ILI resulting in a visit to a general practitioner (GP) affected over 29,768 New Zealanders (0.7% of total population) during the season, compared with an estimated 25,598 people in 2013 (0.6% of total population).

Influenza activity peaked in August 2014. Overall, ILI activity was at a low level compared with the winter seasons between 1997 and 2013. ILI consultation rates varied greatly among District Health Boards (DHBs), with the highest rates reported from Tairawhiti and Whanganui DHBs.

SHIVERS, the Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance, is an influenza surveillance system based in Auckland and Counties Manukau DHBs.

SHIVERS' hospital-based severe acute respiratory infections (SARI) surveillance and GP-based ILI surveillance showed contrasting sociodemographic patterns. Influenza-associated hospitalisations were more frequent in the very young, older people, Māori and Pacific peoples and those from the most deprived socioeconomic groups. However, influenza-associated GP consultations were higher in preschoolers, school aged children and adults, those of Asian ethnicity and those from the least deprived socioeconomic groups.

In 2014, a total of 4144 influenza viruses were detected. Of these, 88.6% were influenza A and 11.4% were influenza B. Of all the viruses sub-typed and lineage-typed (3486) during the season, the predominant strain was influenza A(H1N1)pdm09 at 69.3%. Antiviral susceptibility monitoring indicated that all influenza viruses were sensitive to zanamivir and all except two A(H1N1)pdm09 viruses were sensitive to oseltamivir.

No significant antigenic drift was detected for influenza A(H1N1)pdm09 viruses. A(H3N2) viruses drifted from the A/Texas/50/2012-like strain to the A/Switzerland/9715293/2013-like strain. Two lineages of influenza B viruses (B/Victoria and B/Yamagata lineages) were co-circulating in 2014, with an increased proportion of B/Yamagata lineage viruses. The B/Yamagata lineage viruses drifted from the B/Massachusetts/2/2012-like strain to the B/Phuket/3073/2013-like strain. As a result, the A(H3N2) and B components have been updated for the influenza vaccine for 2015.

The recommended influenza vaccine formulation for New Zealand in 2015 is:

A(H1N1)	an A/California/7/2009 (H1N1)pdm-like virus*
A(H3N2)	an A/Switzerland/9715293/2013 (H3N2)-like virus
B	a B/Phuket/3073/2013-like virus

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

INTRODUCTION

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INTRODUCTION

Influenza viruses frequently undergo antigenic changes, enabling them to evade the host's 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 measures, health resource allocation and case management at national and international level, and so minimise the impact of influenza on people.

Three active influenza surveillance systems in New Zealand combine epidemiological and virological investigations for influenza:

1. National sentinel GP-based surveillance.

   This system was established in 1989 and is part of the World Health Organization's (WHO) Global Influenza Programme.

   The purpose of this surveillance system is to:

   - improve knowledge of the incidence and distribution of influenza in the community to assist in developing strategies to control influenza through immunisation;
   - enable early detection of influenza epidemics within the community to guide the development and implementation of public health measures; and
   - provide an indication of the predominant strains of influenza virus in the community to help in planning for the most effective influenza vaccine for the subsequent year [1].

2. SHIVERS hospital-based SARI surveillance.

   In October 2011, a five-year, multi-centre and multi-disciplinary project "Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance" (SHIVERS), led by the Institute of Environmental Science and Research (ESR) and funded by the US Centers for Disease Control and Prevention (CDC), was established.

   Hospital-based surveillance for severe acute respiratory infections (SARI) is a key component of SHIVERS. Established on 30 April 2012, it has been fully functioning since then. SHIVERS is a result of collaboration between ESR, Auckland District Health Board (ADHB), Counties Manukau District Health Board (CMDHB), the University of Otago, the University of Auckland, the WHO Collaborating Centre (WHOCC) at St Jude Children's Hospital (Memphis, Tennessee) and the CDC. This is an active, prospective, continuous, population-based surveillance system for SARI cases admitted to four hospitals in the central, east and south Auckland region (population 906,000).

   The aims of SARI surveillance are to:

   - establish enhanced, prospective, longitudinal, population-based surveillance for hospitalised SARI cases, intensive care unit (ICU) admissions and deaths caused by influenza and other respiratory pathogens in Auckland, support global influenza surveillance [2];
   - measure the incidence, prevalence, demographic characteristics (including age, sex, ethnic group and socioeconomic status (SES)), 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 viruses (respiratory syncytial virus (RSV), human metapneumovirus, adenovirus, parainfluenza types 1–3, rhinovirus);

- determine the accuracy and validity of the data generated from New Zealand's 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 admissions and deaths associated with conditions such as asthma, pregnancy, diabetes and high BMI (body mass index) among population sub-groups defined by age, gender, ethnic group and SES;
- contribute directly to some of the other specific aims and objectives of the SHIVERS project by using the data generated from this surveillance.

3. SHIVERS sentinel GP-based ILI surveillance.

   SHIVERS sentinel GP-based ILI surveillance was established on 29 April 2013 and has been fully functioning since then. SHIVERS is a result of collaboration between ESR, the University of Auckland, Primary Health Organisations (Procare, Auckland and East Tamaki Healthcare), sentinel general practices, Auckland Regional Public Health Service, the University of Otago, WHOCC, St Jude Children's Hospital and the CDC.

   The aims of SHIVERS sentinel GP-based ILI surveillance are to:

   - measure the burden of disease that influenza and other respiratory viruses cause in the community;
   - monitor trends in disease that influenza and other respiratory viruses cause in the community;
   - identify at-risk groups that should be prioritised for prevention and control;
   - monitor the antigenic, genetic and antiviral characteristics of influenza viruses associated with influenza-like illness;
   - provide a study base to estimate the effectiveness of the influenza vaccine.

This report summarises the results from influenza surveillance in New Zealand in 2014. It provides information on community-based influenza-like illness and related influenza disease (obtained from national and SHIVERS GP-based influenza surveillance). It also describes hospital-based influenza morbidity and mortality (obtained from SHIVERS SARI surveillance and the Ministry of Health's National Minimum Data Set (NMDS) and Mortality Collection). In addition, it includes passive surveillance data from Healthline and HealthStat, laboratory-based antiviral susceptibility and genetic data as well as influenza immunisation coverage data obtained from the Ministry of Health.

METHODS

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METHODS

National sentinel general practice based influenza surveillance

The national sentinel GP-based surveillance system, began in 1989 and is part of the WHO's Global Influenza Programme. It is operated nationally by the ESR and locally by influenza surveillance co-ordinators in the public health services (PHS). Sentinel surveillance usually operates in the winter, from May to September (weeks 18–39). Local surveillance co-ordinators are recruited to general practices within their region and participate voluntarily. Where possible, the number of practices recruited is proportional to the size of the population in each DHB covered by the PHS (approximately one practice for every 50,000 people).

GPs are required to record the number of consultations for influenza-like illness (ILI) each week and the age group of the patient (<1, 1–4, 5–19, 20–34, 35–49, 50–64, 65 years and over), for each case patient who meets the case definition for ILI, on a standardised form.

For sentinel surveillance, ILI is defined as "an acute upper respiratory tract infection characterised by an abrupt onset and two of the following: fever, chills, headache, and myalgia"[3].

Each participating practice collected three respiratory samples (ie, a nasopharyngeal or throat swab) weekly; from the first ILI patient examined on each Monday, Tuesday and Wednesday. For general practices with a registered patient population of more than 10,000, a total of six nasopharyngeal or throat swabs were collected, one each from the first two ILI patients examined on Monday, Tuesday and Wednesday of each week. The practices forwarded these samples either 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 sub-typed as A, B, A(H3N2) or 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 was received by Wednesday of the following week. Likewise, virology laboratories reported the total number of swabs received from each DHB and the influenza viruses identified to ESR weekly, and updated details on influenza types and sub-types from previous weeks. ESR reports national information on epidemiological and virological surveillance of influenza weekly, monthly and yearly to relevant national and international organisations, including the WHO, with reports published on the ESR website: https://surv.esr.cri.nz/virology.php.

Consultation rates were calculated using the registered patient populations of the participating practices as a denominator. From 1989 to 2009, the denominator for the age-specific ILI rate calculation was based on New Zealand census data. The assumption was that the age distribution of the practice patient population was the same as the New Zealand population. Participating practices did not provide age-specific patient population data. From 2010 to 2014 however, age-specific patient population denominators were available from practices for the consultation rate calculations.

The national level of ILI activity is described using a set of threshold values [4, 5]. Based on New Zealand's ILI consultation rates during 2000–2013 (excluding the pandemic year, 2009), levels of ILI activity for baseline, normal seasonal ILI, higher than expected ILI activity and severe epidemic level are described by using different ILI consultation rates. For details, see Table 1.

Table 1. ILI activity threshold

Term used		Consultation rate (per 100,000 population)
Baseline		≤36
Normal seasonal activity	low	37–70
	moderate	71–110
	high	111–150
Higher than expected		151–399
Severe epidemic		≥400

SHIVERS sentinel practice based surveillance for influenza-like illness

SHIVERS sentinel practices are based in Auckland and Counties Manukau DHBs (ADHB and CMDHB respectively). In these practices, GPs and/or practice nurses screened every patient who is seeking medical attention for an ILI. The case definition is "an acute respiratory illness with a history of fever or measured fever of ≥38°C, AND cough, AND onset within the past 10 days, AND requiring a GP consultation". If a patient meets this definition, a respiratory specimen (nasopharyngeal or throat swab) is collected and tested for influenza and other respiratory pathogens. Information on the patient's demography, clinical history, co-morbidities, vaccination history, regular medication and pregnancy status is also collected from both the patient, and the patient management system.

Together with total practice consultations and registrations, population-based incidence of ILI and ILI-associated influenza incidence is calculated for overall and sub-populations within the two SHIVERS DHBs.

HealthStat

HealthStat is a computer-based surveillance system. HealthStat ILI surveillance is 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 or more symptoms from chills, fever, headache and myalgia" (ie, the same case definition as for national sentinel GP-based surveillance). This surveillance system monitors the number of people who consult GPs with an ILI. HealthStat is based on automated extracts from practice management computer systems. CBG Health Research Ltd provides this data to ESR on a weekly basis. HealthStat ILI surveillance does not include virological surveillance.

Analysis is frequency-based, with flags identifying statistical deviations (aberrations) from previous ILI counts. The analysis of the ILI count is based on the cumulative summation (CUSUM) algorithm implemented in the Early Aberration Reporting System (EARS) application developed by the CDC. EARS had three sensitivity thresholds—high, medium and low. If the daily consultation count exceeded a threshold, a flag is signalled.

Healthline

Healthline is the free national 24-hour 0800 telephone health advice service funded by the Ministry of Health. Calls made to Healthline are triaged using electronic clinical decision support software. The data collected is a daily count of all phone calls from people with symptoms for any illness made to Healthline and those triaged for ILI. The Healthline data is reported by ESR on a weekly basis, with daily reporting if required. About 70% of all calls to Healthline are symptom-related, and other calls (that are not part of this analysis) are queries for information.

Analysis is frequency-based, with alerts raised by identifying statistical deviations (aberrations) from previous patterns of call numbers. Data is reported for all ages in five age bands 0–4, 5–14, 15–44, 45–64 and 65 years and over. The analysis of the call frequency is based on the CUSUM algorithm implemented in EARS.

Cases of ILI are defined in the Healthline database as having one of the following 18 symptoms: 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).

SHIVERS hospital-based surveillance for severe acute respiratory infections

SHIVERS hospital-based surveillance for SARI operates in Auckland and Counties Manukau DHBs. Inpatients with suspected respiratory infections admitted overnight to any of the four DHB hospitals (Auckland City Hospital and the associated Starship Children's Hospital, Middlemore Hospital and the associated Kidz First Children's Hospital) in the two DHBs, are screened by research nurses each day. Overnight admission is defined as "a patient who is admitted under a medical team, and to a hospital ward or assessment unit". Cases are identified through a combination of reviewing the admission diagnoses and interviewing patients about their presenting symptoms. The patients are categorised into one of ten admission diagnostic syndrome groups. Research nurses then interview the patients and document the components of the case definition that are present. They then differentiate patients into those who meet the SARI case definition and those who do not (non-SARI cases).

The WHO SARI case definition [6] used as:

> "An acute respiratory illness with
>
> - a history of fever or measured fever of ≥38°C, and
> - cough, and
> - onset within the past 10 days, and
> - requiring inpatient hospitalisation".

If a patient with suspected respiratory infection met the SARI case definition, a respiratory sample was collected to test for influenza and other respiratory pathogens. In addition, patient information is captured via a case report form that included patient demographics, presenting symptoms and illness, pre-hospital healthcare, medication use, influenza vaccination history, co-morbidities, disease course and outcome (including major treatments, ICU admission and mortality), epidemiologic risk factors and laboratory results.

The total number of all new hospital inpatient acute admissions and newly assessed and tested patients, including ICU admissions and deaths, was collected. This allowed calculation of population-based incidence for SARI and associated influenza cases overall and stratified by age, gender, ethnic group and socioeconomic status among the ADHB and CMDHB resident population (from 2013 census data). Incidence rates were calculated along with 95% confidence intervals (95%CI). In addition, this allowed the calculation of the proportion of SARI and associated influenza cases, including ICU admissions and deaths, by overall and stratified patients, among all acute admissions regardless of residence status. An acute admission is defined as an unplanned admission on the day of presentation at the admitting healthcare facility. Admission may have been from the emergency or outpatient departments of the healthcare facility, a transfer from another facility or a referral from primary care.

A case may have had more than one specimen taken for influenza and non-influenza virus testing. The number of specimens can therefore differ from the number of cases and specimens, and cases may be reported separately.

NMDS-coded influenza hospitalisations

Hospitalisation data for influenza (ICD-10AM-VI codes (J09-J11) was extracted from the New Zealand Ministry of Health's NMDS (by discharge date). In this dataset, patients who spent less than one day in a hospital emergency department were excluded. Influenza-related hospitalisations were conservatively taken to include only those cases where influenza was the principal diagnosis. Repeat admissions were included because infection with a different influenza A sub-type or influenza B virus is possible.

Laboratory-based non-sentinel surveillance—for outpatients and hospital inpatients

In addition to influenza viruses identified from sentinel GP-based surveillance, year-round laboratory-based passive 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 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, which then collated and reported virology surveillance data nationally.

Immunisation coverage

Immunisation benefit claims data from the Sector Services in the Ministry of Health is used. Since information is not available on the number of people in the eligible groups, coverage rates are calculated using the total New Zealand population.

Data used to calculate rates

Population data used to determine rates of ILI, hospitalisations, mortality and immunisation coverage is derived from 2013 mid-year population estimates published by Statistics New Zealand.

New Zealand Deprivation Index (NZDep)

A proxy measure of socioeconomic status (SES) is derived from the deprivation index (NZDep) based on the SARI patient's home address. The NZDep scale measured deprivation on an ordinal scale of 1 to 10 where 1 indicates the individual is living in a household that is in the least deprived decile of all New Zealand households. Upper SES is grouped as deciles 1–2, upper middle SES as deciles 3–4, middle as 5–6, and lower middle SES as deciles 7–8 and low SES as deciles 9–10.

Ethnic group

For different ethnic groups, the number and rates of hospitalisations 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 (including New Zealander) ethnic groups. The NMDS and SHIVERS projects use this prioritised classification for ethnicity data.

Antiviral susceptibility testing

The NIC employed a phenotypic method (fluorometric neuraminidase inhibition assay) for the surveillance of antiviral 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. Antiviral susceptibility testing to neuraminidase inhibitors (oseltamivir and zanamivir) performed for those clinical specimens have yielded viral isolates.

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National sentinel general practice-based surveillance

In 2014, 60 sentinel practices were recruited from 17 of New Zealand's 20 DHBs nationally for sentinel GP-based surveillance. Northland DHB did not participate in 2014. No practices were recruited from Auckland or Counties Manukau DHBs since these two DHBs participated in the SHIVERS ILI surveillance instead. All DHBs began reporting by the second week of surveillance (11 May 2014). Some sentinel practices did not report every week. The average number of practices participating each week was 57, with an average patient roll of 297,480—approximately 6.6% of the New Zealand population.

During the 2014 influenza season (May to September), a total of 1966 sentinel consultations for ILI were reported. Based on this, the cumulative incidence rate of ILI consultations was 660.1 per 100,000 patient population. This rate is higher than the cumulative incidence rate for 2013 (572.5 per 100,000) and lower than in 2012 (1087 per 100,000). The average national weekly consultation rate in 2014 was 30.6 per 100,000 patient population. This rate is higher than the average weekly rate for 2013 (21.6 per 100,000) but lower than in 2012 (50.2 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 29,768 New Zealanders during the 2014 influenza season (0.7% of total population). This is higher than the estimated number of people affected in 2013 (25,598, 0.6% of total population) and lower than in 2012 (48,186, 1.1% of total population).

Figure 1 compares the weekly consultation rates for ILI in 2014 with the weekly consultation rates for ILI in 2010–2013. Influenza consultation activity remained below the seasonal threshold level during the first part of the surveillance period (weeks 18–26) in 2014. It peaked in week 32 (4–10 August 2014), with a consultation rate of 52.7 per 100,000 patient population. The peak occurred five weeks earlier than the peak in 2013 (week 37, 47.3 per 100,000 patient population) and one week later than the peak in 2012 (week 31, 154.1 per 100,000 patient population). Consultation activity then gradually declined.

Figure 1. Weekly consultation rates for ILI in New Zealand, 2010–2014

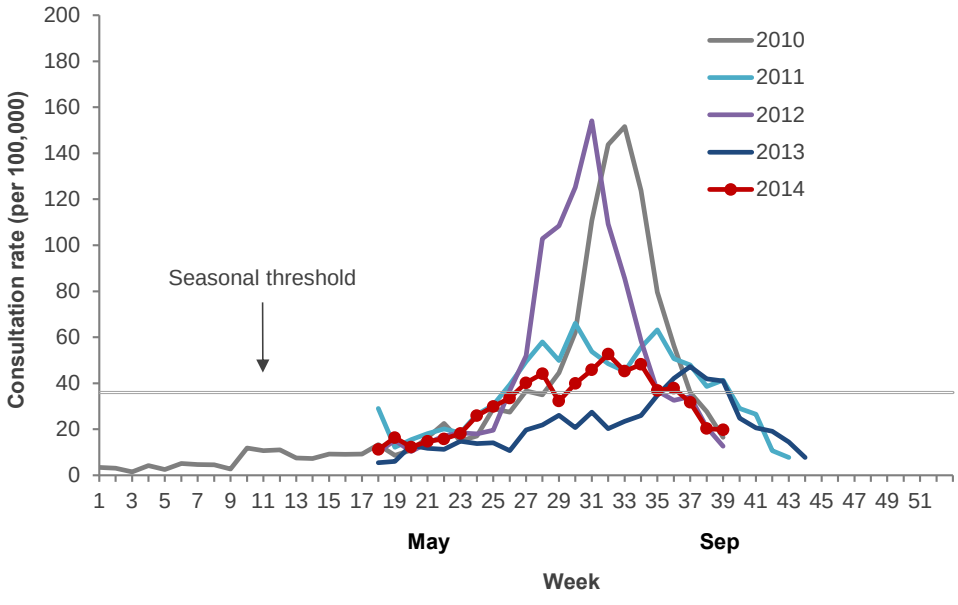


Figure 2 shows the weekly national consultation rate for 2014 in comparison to the average epidemic curve in 2000–2013 (excluding 2009).

Figure 2. Weekly consultation rates for influenza-like illness in New Zealand in 2014 in comparison to the average epidemic curve in 2000–2013 (excluding 2009)

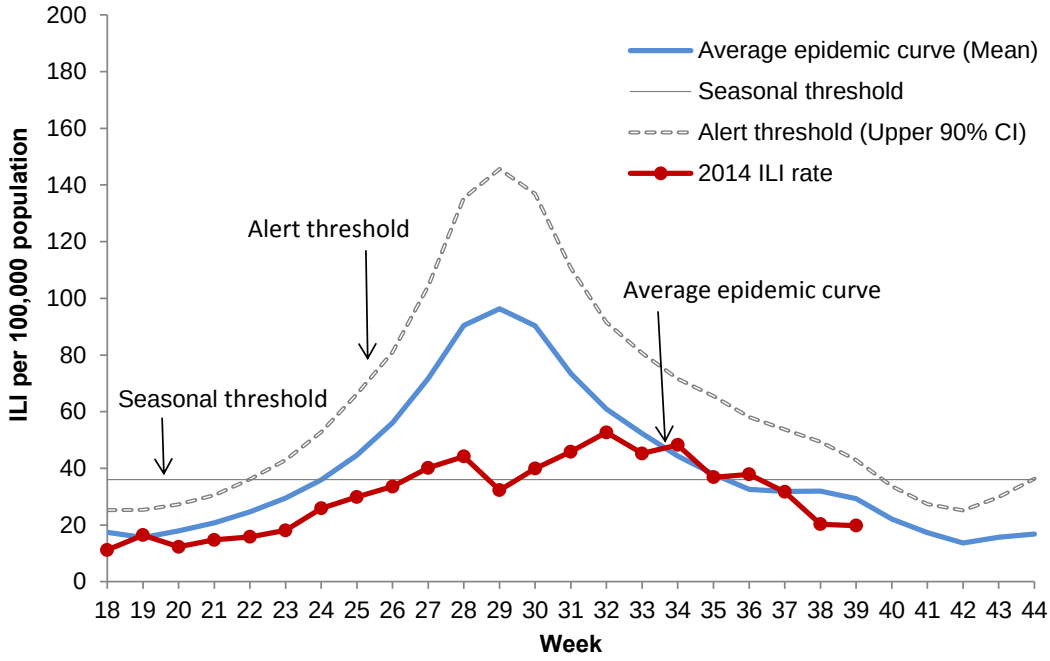
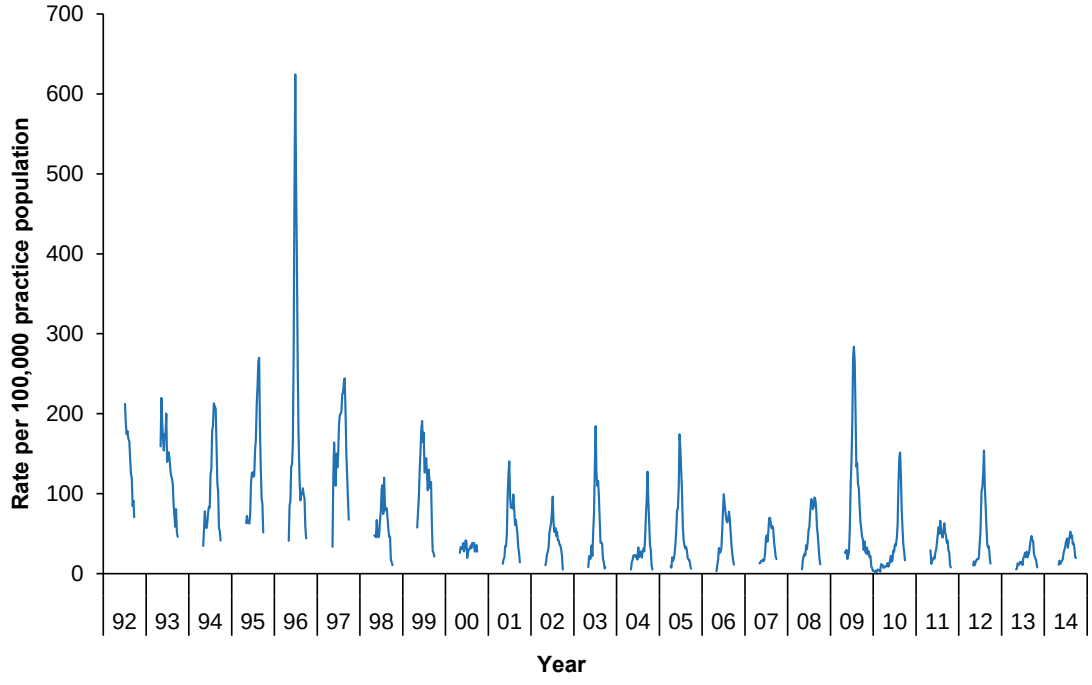


Figure 3 compares the weekly consultation rates for ILI in 2014 with the weekly consultation rates for ILI in 1992–2013. The peak ILI rate in 2014 was the third lowest during the period 1992–2014 (second lowest was in 2013 and the lowest was in 2000). The cumulative incidence rate of 660.1 per 100,000 patient population was the second lowest recorded from 1992 to 2014.

Figure 3. Weekly consultation rates for ILI in New Zealand, 1992–2014



Cumulative ILI consultation rates by age group were calculated for the sentinel surveillance system (Figure 4). The highest cumulative consultation rates for ILI were in children aged 1–4 years (1025.4 per 100,000 patient population) followed by those aged 35–49 years (780.9 per 100,000 patient population). Older people (aged 65 years and older) had the lowest ILI consultation rate of 299.4 per 100,000 patient population.

Figure 4. Sentinel cumulative consultation rates for ILI by age group, 2014

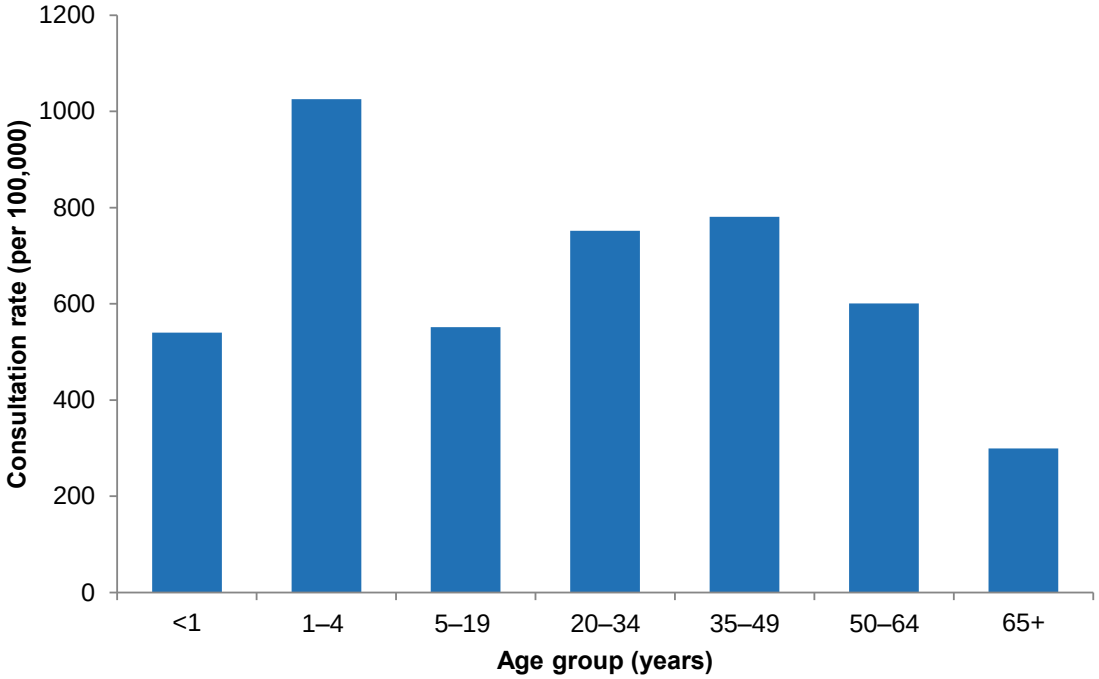
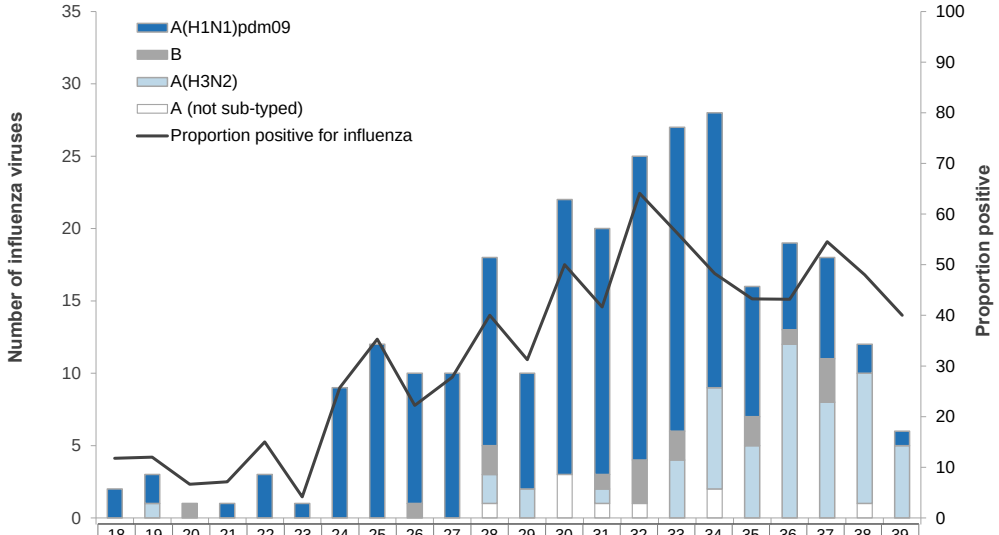


Figure 5 shows the temporal distribution of influenza viruses from sentinel surveillance from weeks 18–39. The highest peak of influenza virus detection from sentinel surveillance occurred in week 34 (28 viruses). Influenza A(H1N10)pdm09 viruses predominated in most of the influenza season (weeks 25–34), with a peak in week 32 (4–10 August), comprising 84% of all viruses detected.

Figure 5. Influenza viruses from sentinel surveillance by type and week reported, 2014



	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	0	0	0	0	0	0	0	0	0	1	0	3	1	1	0	2	0	0	0	1	0
A(H3N2)	0	1	0	0	0	0	0	0	0	0	2	2	0	1	0	4	7	5	12	8	9	5
B	0	0	1	0	0	0	0	0	1	0	2	0	0	1	3	2	0	2	1	3	0	0
A(H1N1)pdm09	2	2	0	1	3	1	9	12	9	10	13	8	19	17	21	21	19	9	6	7	2	1

The temporal distribution of the influenza viruses detected from the sentinel surveillance is compared to influenza viruses detected from all other surveillance systems (non-sentinel surveillance) (Figure 6). The highest peak of influenza virus detection from sentinel surveillance occurred in week 34 (28 viruses) and week 33 (354 viruses) from non-sentinel surveillance. Influenza viruses were identified sporadically as early as January from non-sentinel surveillance. Overall, a total of 4144 influenza viruses were identified from both sentinel and non-sentinel surveillance in 2014. This is higher than in 2013 (2326) and 2012 (2425). Non-sentinel surveillance data includes the SHIVERS data.

Figure 6. Total number of influenza viruses detected by surveillance type and week specimen taken, 2014

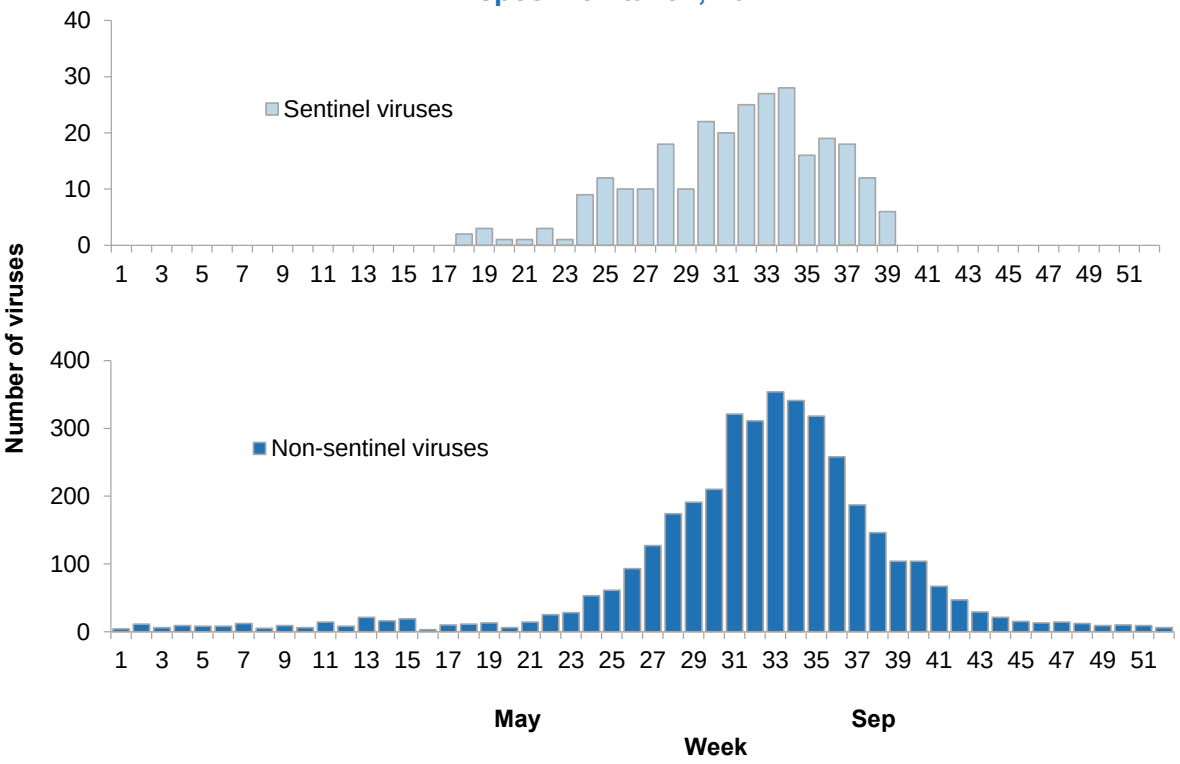
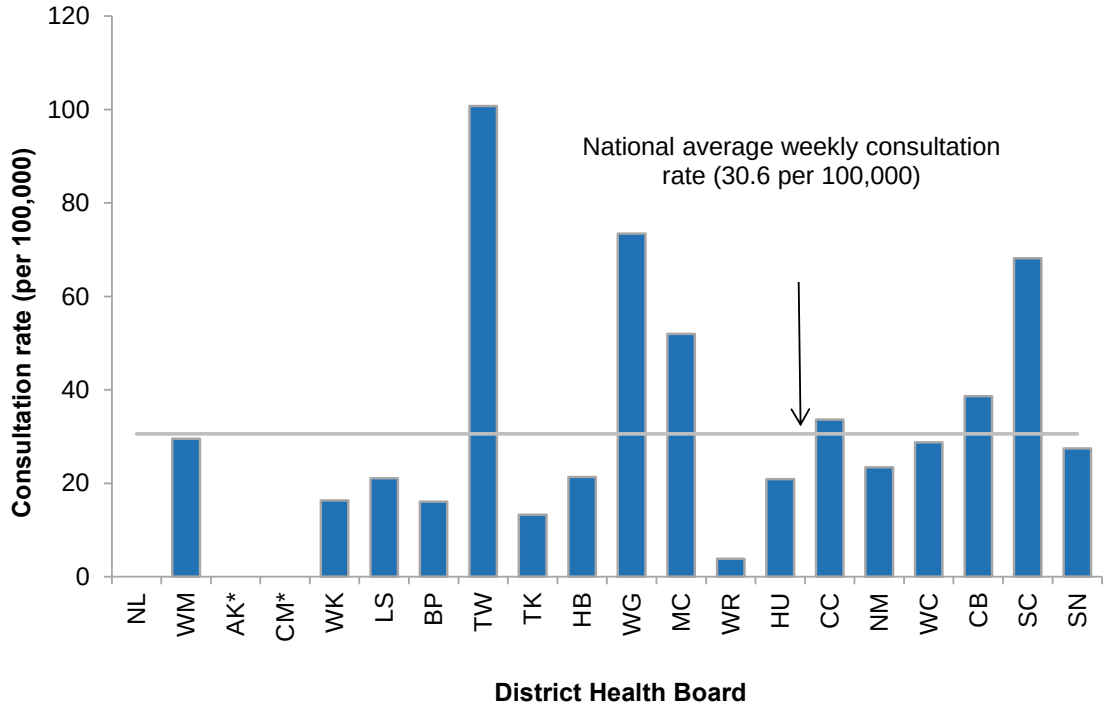


Figure 7 shows the sentinel average weekly consultation rates for each DHB from May to September 2014. Weekly ILI consultation rates per 100,000 patient population varied among DHBs, with rates above the national average in Tairawhiti (100.7), Whanganui (73.4), South Canterbury (68.1), MidCentral (52), Canterbury (38.6), and Capital & Coast (33.7). See Table 2 for the DHB abbreviations.

Figure 7. Sentinel average weekly consultation rates for influenza by DHB from North to South, 2014



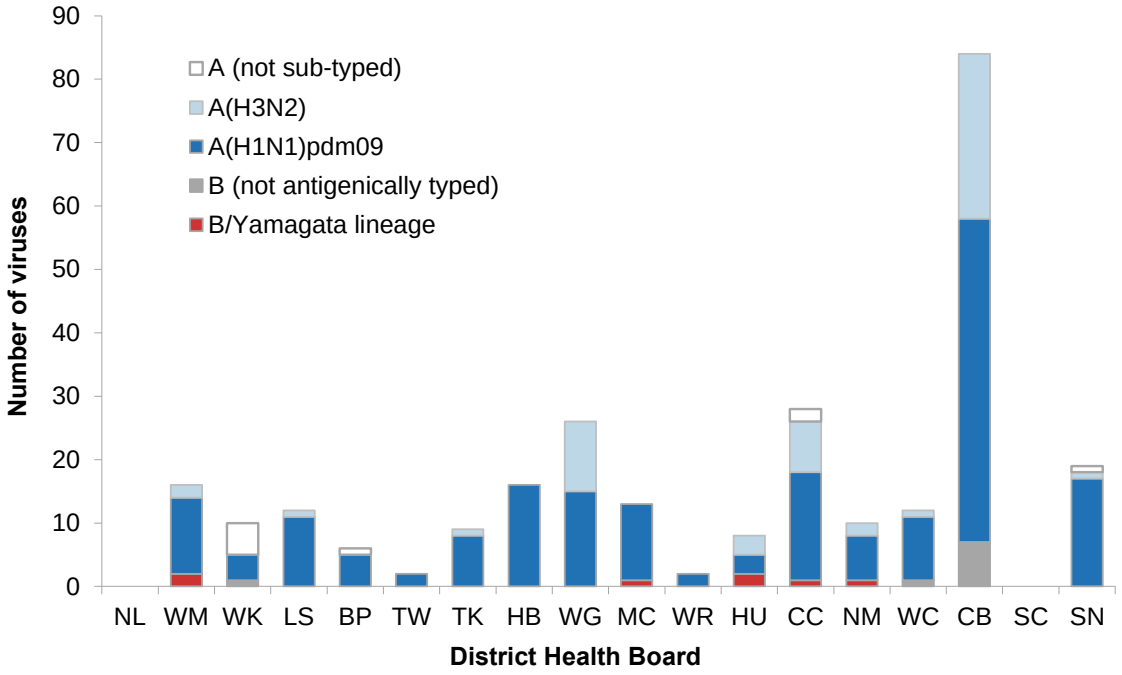
Note: DHBs marked * did not participate in the national influenza sentinel surveillance, but did participate in the SHIVERS sentinel practice based surveillance. For details, see relevant section of this report.

Table 2. DHB codes and descriptions

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

Figure 8 shows the distribution of sentinel influenza viruses based on the DHB from which the specimen (swab) was taken. Most viruses came from Canterbury, Capital & Coast, and Whanganui DHBs. No viruses were identified from Northland and South Canterbury DHBs.

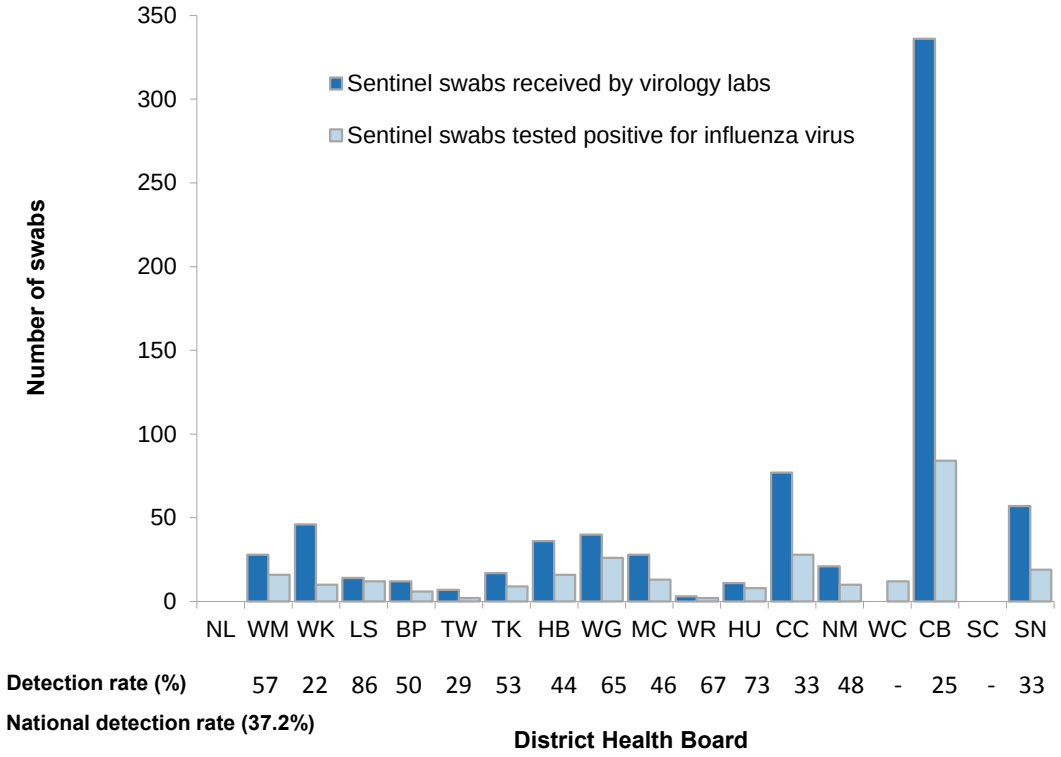
Figure 8. Numbers of laboratory-confirmed influenza viruses from sentinel surveillance by DHB, May to September 2014



Note: Auckland and Counties Manukau DHBs did not participate in the national influenza sentinel surveillance. They participated in SHIVERS sentinel GP-based surveillance. For details, see relevant section of this report.

Figure 9 shows the number of swabs received and tested for influenza virus by DHB in 2014.

Figure 9. Sentinel swabs received and tested positive for influenza virus by DHB, 2014



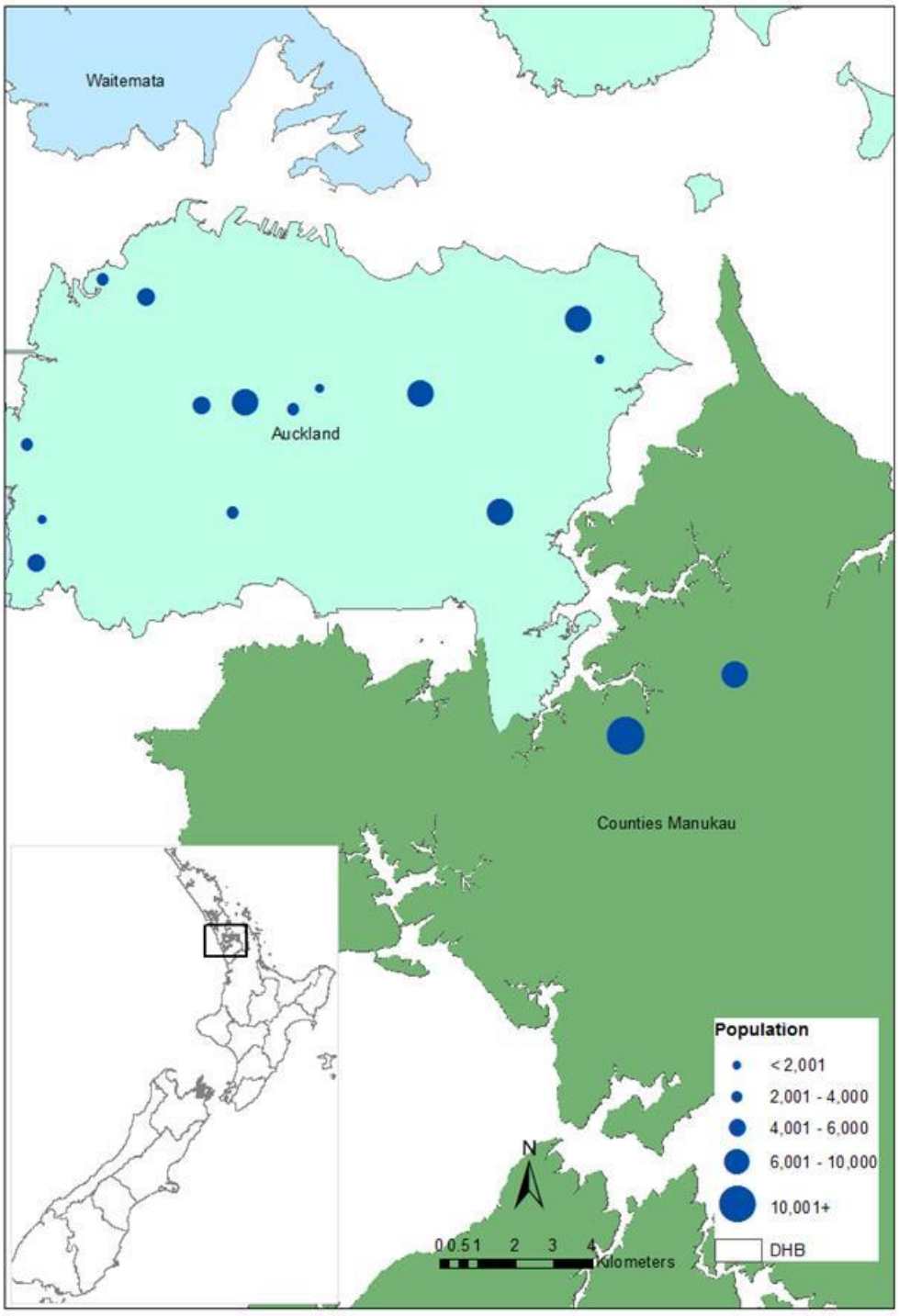
Note: The swabs from the West Coast, South Canterbury were reported under Canterbury DHB.

The national influenza virus detection rate for 2014 (was 37.2% (273 viruses from 733 swabs received), which is higher than in 2013 (32.6%, 196 viruses from 602 swabs received), and lower than in 2012 (44.6%, 399 viruses from 895 swabs received).

SHIVERS sentinel GP-based ILI surveillance

The SHIVERS sentinel general practices were based in two DHBs in the Auckland region. The ADHB and CMDHB serve a combined population of 905,634 residents. Of this population, 97,291 patients were enrolled at the 16 sentinel general practices (Figure 10). This is approximately 10.7% of the total ADHB and CMDHB population.

Figure 10. Geographical distribution of SHIVERS sentinel practices in ADHB and CMDHB



A comparison of the characteristics of the ADHB and CMDHB enrolled patient populations shows some differences in the ethnic and socioeconomic distributions. The population in ADHB is slightly older, has a higher proportion of European ethnicity and a higher SES than the CMDHB

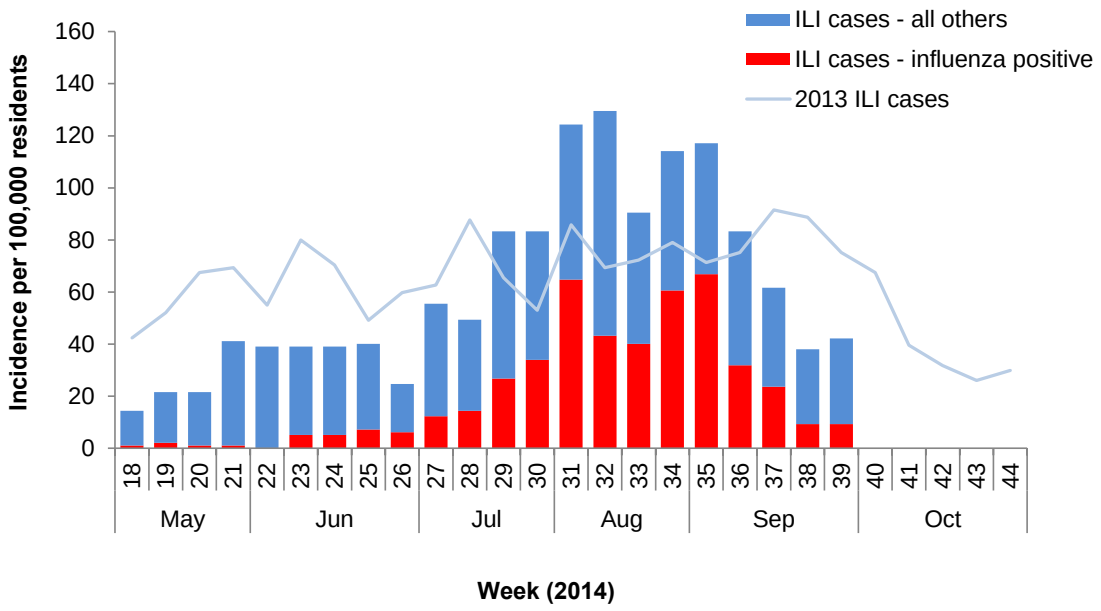
population, which is slightly younger, has a higher proportion of Pacific peoples and Asian ethnicity and a lower SES.

The SHIVERS ILI surveillance operated between 28 April and 28 September 2014.

In the 16 sentinel practices, from 28 April to 28 September 2014, a total of 472,825 GP consultations were recorded and 1473 cases (0.3%) met the ILI case definition. Among the patients that met the ILI case definition, 1438 (97.6%) had a specimen tested for influenza. Of these, 497 (34.6%) cases had influenza virus detected. The number of ILI and influenza cases during the surveillance period is shown in Figure 11. Influenza peaked in week 35 (ending 31 August).

The temporal distribution of ILI-associated influenza cases (ILI cases with an influenza positive result) and ILI cases without an influenza positive result, from 28 April to 28 September 2014, is shown in Figure 11.

Figure 11. Weekly ILI and influenza positive incidence, 28 April to 28 September 2014



Of the 1473 ILI cases identified, 17% were children aged less than five years and 5.8% were adults aged 65 and older. Of the 1473 ILI cases, 1340 were enrolled patients residing in ADHB or CMDHB. This gives an ILI incidence rate of 1353.7 per 100,000 patient population (Table 3). A total of 453 cases from ADHB and CMDHB residents were positive for influenza viruses. This gives an ILI-associated influenza incidence of 465.6 per 100,000 patient population.

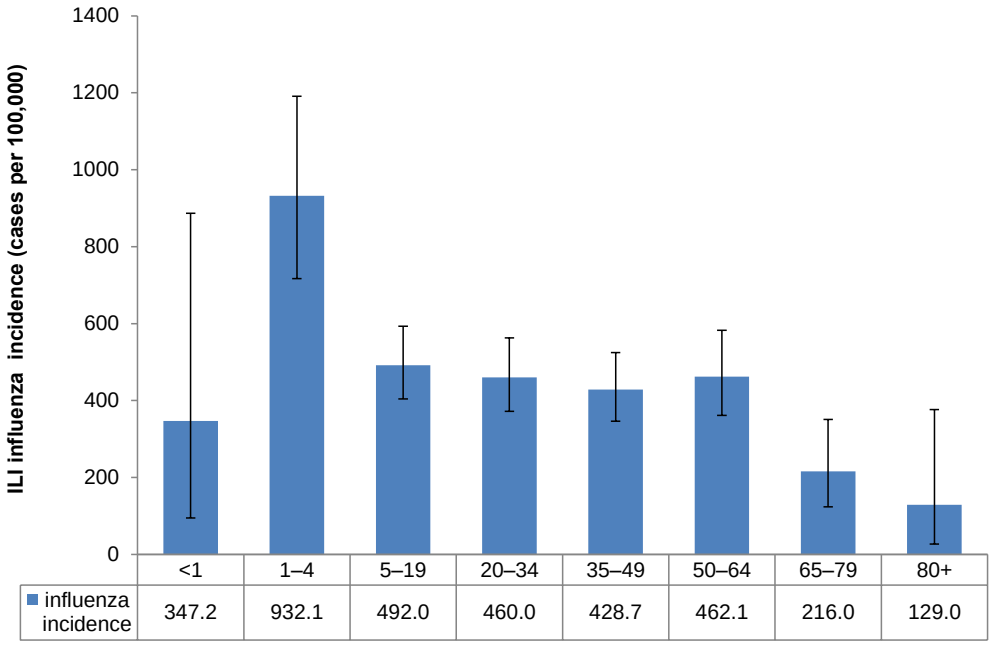
Table 3. Demographic characteristics of ILI and influenza cases, 28 April to 28 September 2014

Characteristics	ILI & influenza cases among sentinel practices			ILI & influenza cases among ADHB & CMDHB residents	
	ILI cases	ILI cases per 1000 consultations	Influenza positive (%*)	ILI incidence (per 100,000)	Influenza incidence (per 100,000)
Overall	**1473**	**3.1**	**497 (34.6)**	**1353.7**	**465.6 (423.8, 510.4)**
Age group (years)					
<1	39	2.9	4 (10.5)	2951.4	347.2 (94.7, 886.6)
1–4	211	6.0	67 (32.7)	2944.2	932.1 (717.0, 1191.0)
5–19	359	3.8	114 (32.4)	1525.8	492.0 (404.2, 593.2)
20–34	291	3.7	110 (39.4)	1179.2	460.0 (371.8, 562.6)
35–49	285	2.7	100 (35.3)	1161.7	428.7 (346.2, 524.9)
50–64	202	2.4	81 (40.9)	1145.5	462.1 (361.1, 582.5)
65–79	75	1.6	18 (24.7)	891.0	216.0 (123.5, 350.6)
>80	11	0.7	3 (30.0)	472.9	129.0 (26.6, 376.5)
Unknown	0	0.0			
Ethnicity					
Māori	78	2.6	26 (34.2)	993.3	350.6 (224.7, 521.2)
Pacific peoples	210	3.0	84 (41.0)	748.7	330.8 (260.7, 413.9)
Asian	238	4.0	95 (40.8)	1376.0	560.8 (448.8, 692.2)
European and others	945	3.0	291 (31.6)	1657.8	510.4 (451.0, 575.4)
Unknown	2	3.4	1 (50.0)		
DHB					
Auckland	1068	3.1	356 (34.1)	1698.1	566.6 (508.8, 629.2)
Counties Manukau	272	3.2	105 (39.6)	730.4	281.6 (229.4, 342.0)
Others	133	3.2	36 (27.7)	0.0	
Sex					
Female	851	3.3	264 (31.8)	1469.2	468.4 (411.2, 531.2)
Male	622	2.9	233 (38.3)	1223.9	462.5 (402.5, 529.0)
Unknown	0	0.0		0.0	
NZ Dep					
1	451	3.4	143 (32.7)	1928.4	615.6 (516.8, 727.8)
2	271	2.8	90 (33.6)	1310.9	445.9 (355.3, 552.5)
3	204	2.6	64 (32.5)	1207.0	389.6 (298.1, 500.1)
4	260	3.4	108 (42.7)	1339.0	579.6 (464.5, 714.4)
5	249	3.5	82 (33.2)	997.1	344.3 (271.8, 430.1)

*Calculated as a percentage of ILI cases tested for influenza viruses. (This may differ from percentage of ILI samples tested for influenza viruses.)

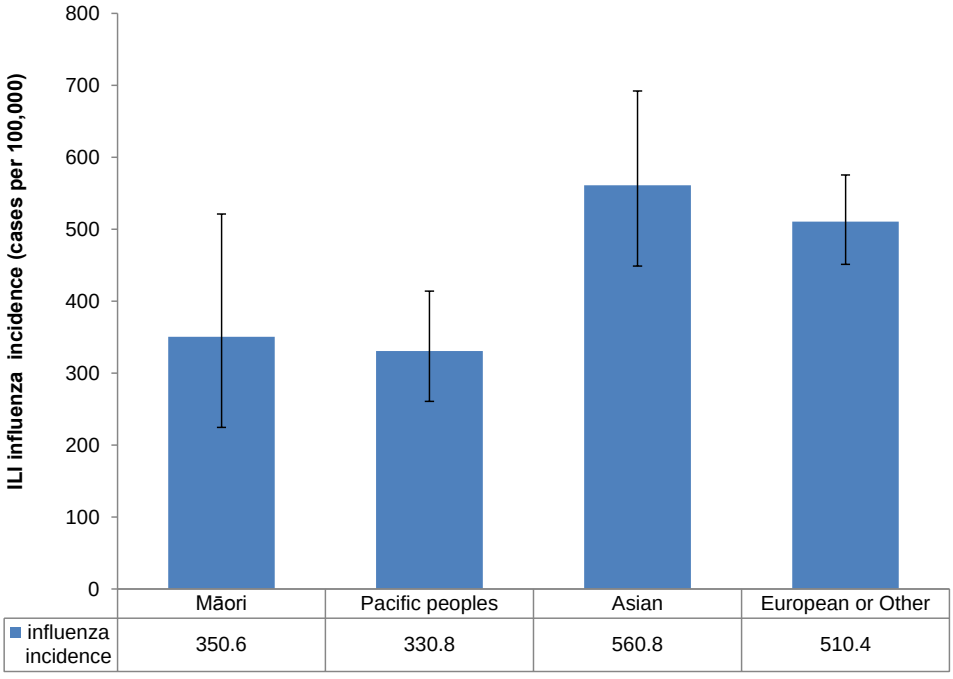
The ILI-associated influenza incidence by age group from 28 April to 28 September 2014 is shown in Figure 12. Children aged 1–4 years had the highest ILI-associated influenza rates, followed by those aged 5–19 years, 50–64 years, and 20–34 years. Adults aged 80 years and above had the lowest ILI-associated influenza rates. However, differences were only statistically significant for the 1–4 years age group compared to all other age groups except for the <1 year age group.

Figure 12. ILI-associated influenza incidence rates by age-group, 28 April to 28 September 2014



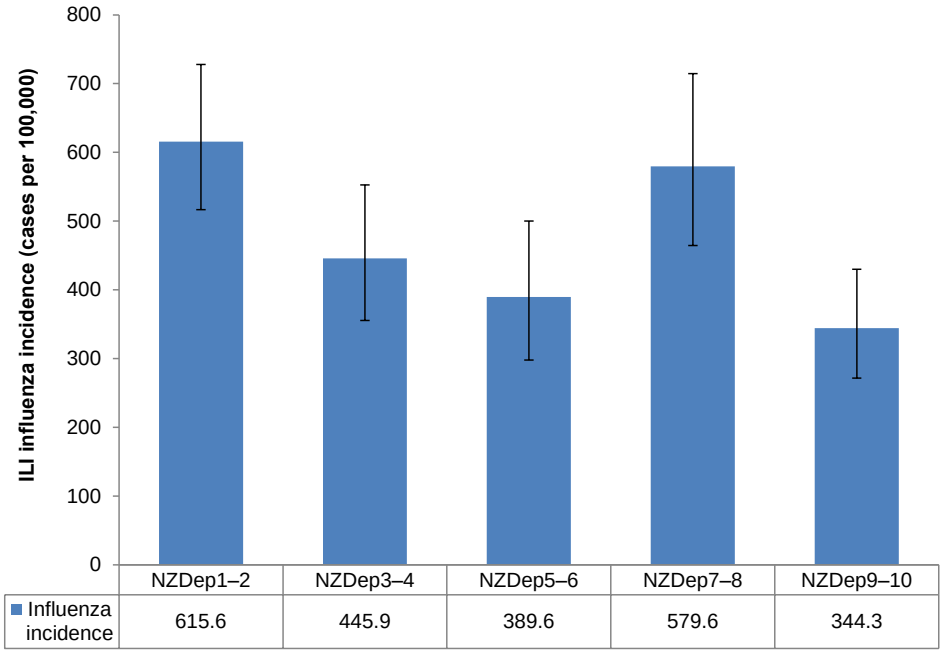
The ILI-associated influenza incidence by ethnic group from 28 April to 28 September 2014 is shown in Figure 13. People in the Asian ethnic group had the highest ILI-associated influenza incidence and Pacific peoples had the lowest. However, differences were only statistically significant between the Asian and European or Other ethnic group compared to Pacific peoples.

Figure 13. ILI-associated influenza incidence by ethnic groups, 28 April to 28 September 2014



The neighbourhood deprivation distribution of ILI-associated influenza cases is shown in Figure 14. The most deprived quintile (NZDep9–10) had the lowest incidence rate compared to the other four. However, differences were only statistically significant between NZDep 1–2 compared to NZDep 5–6 and NZDep 9–10.

Figure 14. ILI-associated influenza incidence by deprivation index (NZDep), 28 April to 28 September 2014



Influenza viruses

From 28 April to 28 September, a total of 1441 specimens from patients with ILI were tested for influenza viruses, with 498 (34.6%) testing positive. The details are given in Table 4. Influenza A(H1N1)pdm09 was the predominant strain.

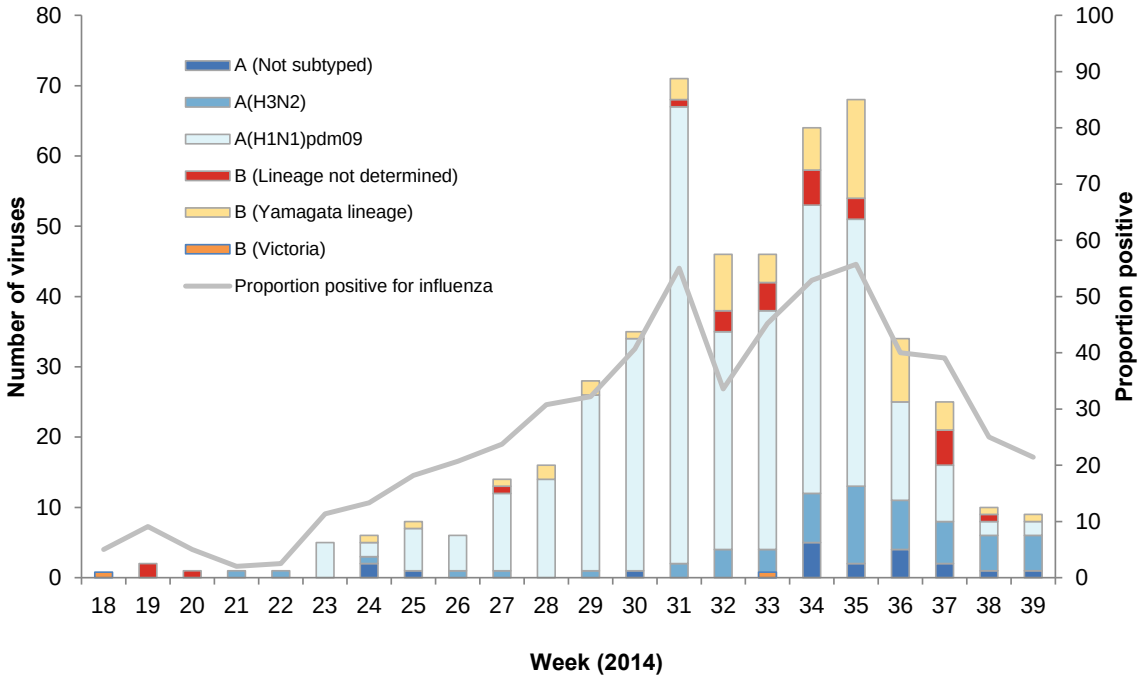
Table 4. Influenza viruses in ILI cases, 28 April to 28 September 2014

Influenza viruses	ILI Cases
No. of specimens tested	1441
No. of positive specimens (%)[1]	498 (34.6)
Influenza A	412
A (not subtyped)	19
A (H1N1)pdm09	336
A(H1N1)pdm09 by PCR	158
A/California/7/2009 (H1N1) - like	178
A(H3N2)	57
A(H3N2) by PCR	30
A/Texas/50/2012 (H3N2) - like	27
Influenza B	86
B (lineage not determined)	1
B/Yamagata lineage	82
B/Yamagata lineage by PCR	24
B/Massachusetts/2/2012 - like	58
B/Victoria lineage	3
B/Victoria lineage by PCR	1
B/Brisbane/60/2008 - like	2
Influenza and non-influenza co-detection (% +ve)	42 (8.4)

[1]Number of specimens positive for at least one of the listed viruses. (Note: A specimen may be positive for more than one virus.)

The temporal distribution of the number and proportion of the influenza viruses is shown in Figure 15. Influenza A (H1N1)pdm09 was the predominant strain from week 23 (ending 8 June) to week 37 (ending 14 September). The proportion of specimens positive for influenza A(H3N2) and influenza B increased from week 32 (ending 10 August) to week 39 (ending 28 September).

Figure 15. Temporal distribution of the number and proportion of influenza viruses from ILI specimens by type and week, 28 April to 28 September 2014



Non-influenza respiratory viruses

From 28 April to 28 September 2014, a total of 1439 ILI specimens were tested for non-influenza viruses and 471 (32.7%) tested positive. Details are given in Table 5.

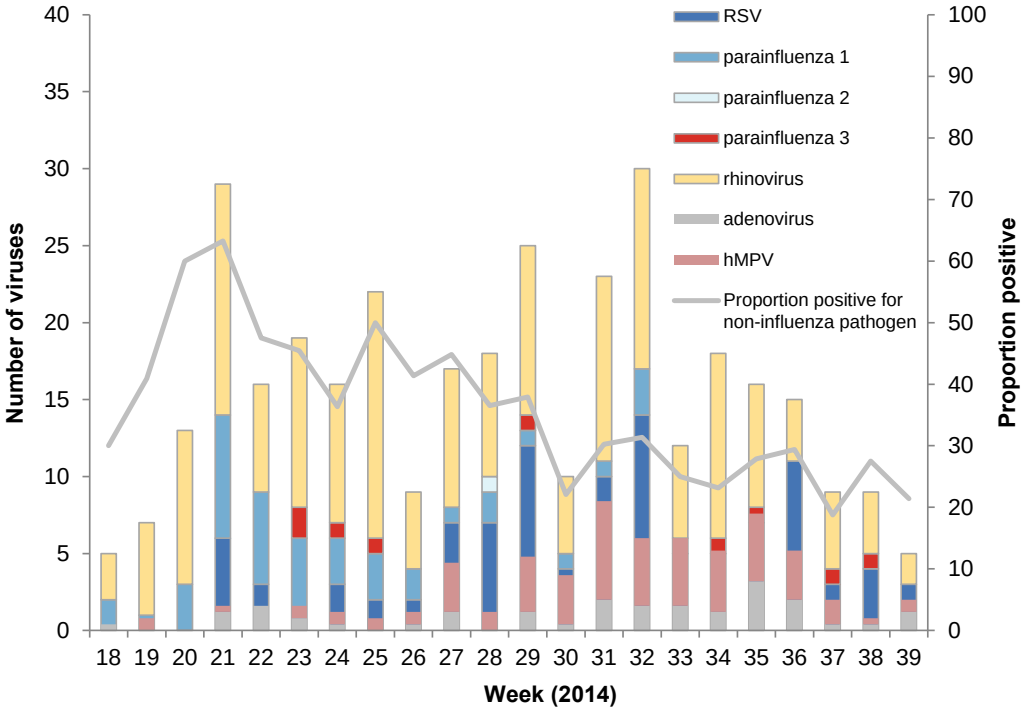
Table 5. Influenza and non-influenza respiratory viruses among ILI cases, 28 April to 28 September 2014

Non-influenza respiratory viruses	ILI Cases
No. of specimens tested	1439
No. of positive specimens (%)[1]	471 (32.7)
Respiratory syncytial virus (RSV)	108
Parainfluenza 1 (PIV1)	43
Parainfluenza 2 (PIV2)	1
Parainfluenza 3 (PIV3)	10
Rhinovirus (RV)	181
Adenovirus (AdV)	53
Human metapneumovirus (hMPV)	113
Single virus detection (% of positives)	437 (92.8)
Multiple virus detection (% of positives)	34 (7.2)

[1]Number of specimens positive for at least one of the listed viruses. (Note: A specimen may be positive for more than one virus.)

The temporal distribution of the number and proportion of non-influenza viruses is shown in Figure 16. The highest RSV activity was recorded from week 28, 29 and 32 (weeks ending 13 July–10 August). RSV activity was also high in week 36 (ending 7 September). The proportion of rhinovirus among all non-influenza viruses remained at a constant level throughout the study period.

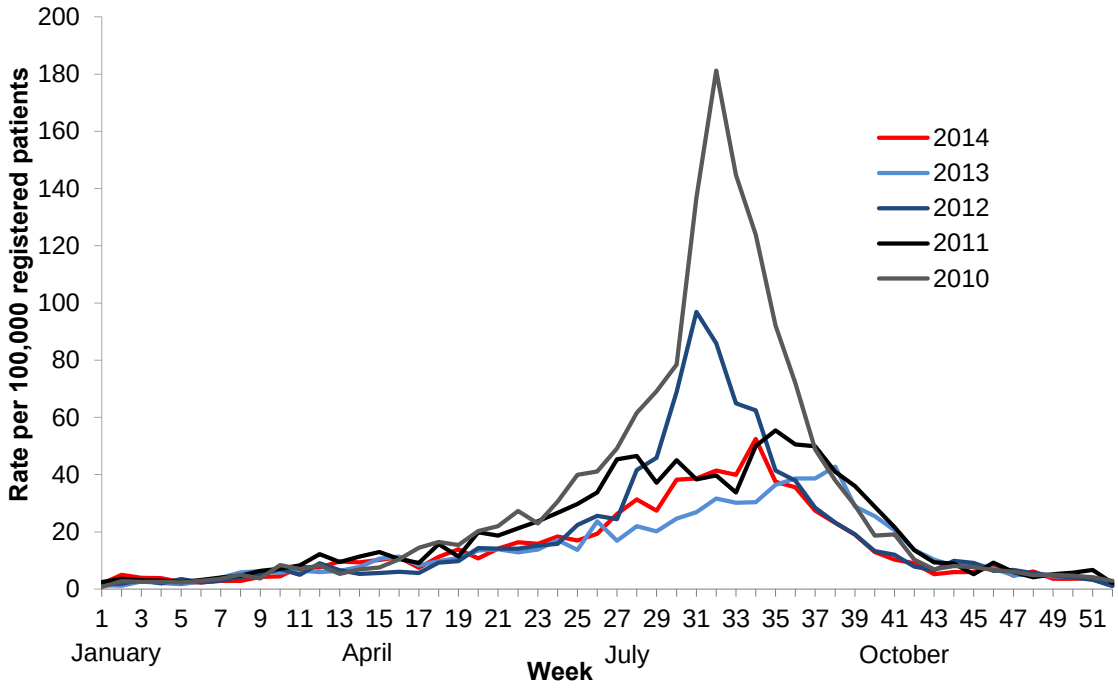
Figure 16. Temporal distribution of the number and proportion of non-influenza viruses from ILI specimens by type and week, 28 April to 28 September 2014



HealthStat GP-based surveillance

Figure 17 shows the weekly rate of ILI consultations per 100,000 general practice patients collected by HealthStat sentinel GPs from 2010 to 2014. The ILI rate in 2014 was similar to the yearly level between 2010 and 2013.

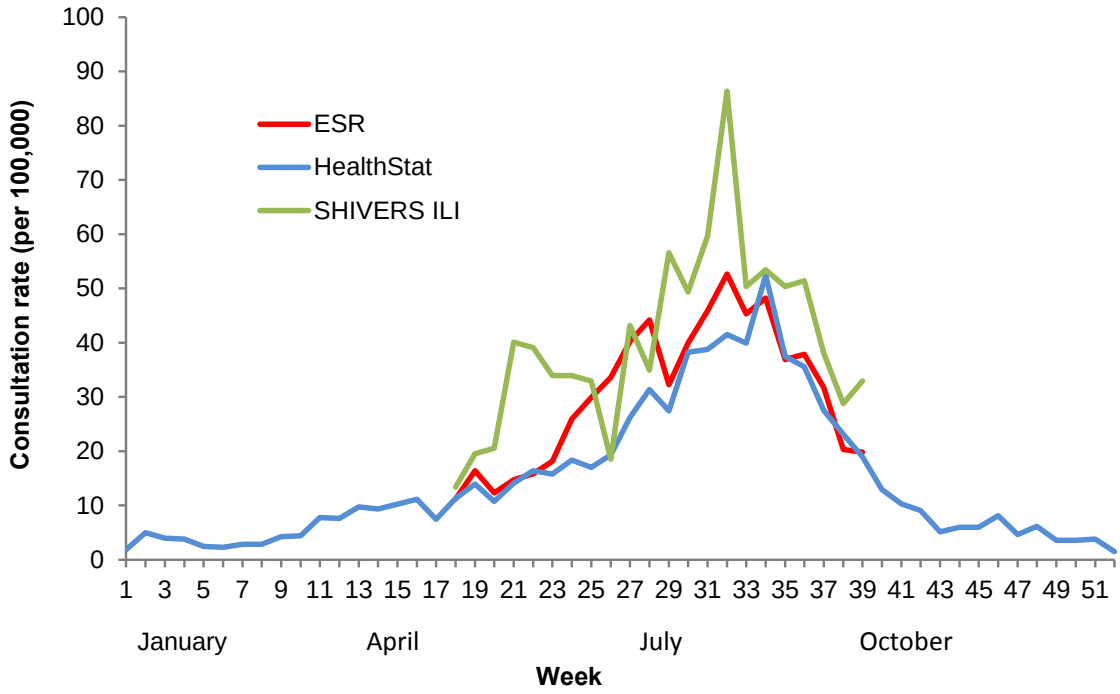
Figure 17. HealthStat ILI consultation rates by week from 2010–2014



Data source: From responding practices of original HealthStat GP practice panel.

Overall, the trend of the 2014 HealthStat data was similar to ESR's sentinel GP surveillance (Figure 18). SHIVERS ILI surveillance is generally slightly ESR's sentinel GP surveillance peaked in week 32 (52.7 per 100,000) and the HealthStat data peaked in week 34 (52.4 per 100,000).

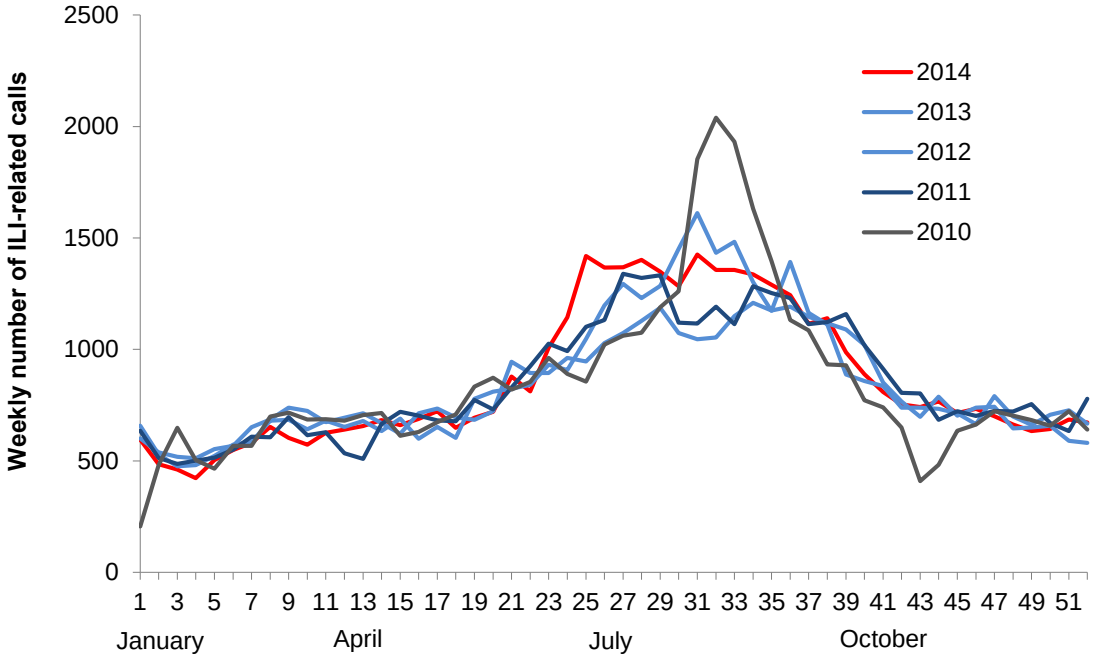
Figure 18. ESR, HealthStat and SHIVERS sentinel ILI consultation rates, 2014



Healthline

Figure 19 shows the weekly number of calls to Healthline for ILI from 2010 to 2014. The number of calls in 2014 was similar to the number in 2013, and similar to the yearly average between 2010 and 2012. In 2014, Healthline calls peaked in week 31, with 1426 ILI-related calls.

Figure 19. Weekly numbers of ILI related calls to Healthline in 2010–2014



Data source: Healthline New Zealand.

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SHIVERS hospital-based surveillance for severe acute respiratory infections

From 30 December 2013 to 29 December 2014, there were 140,145 acute admissions to ADHB and CMDHB hospitals. A total of 6515 (4.6%) patients with suspected respiratory infections were assessed in these hospitals. Of these, 2858 (43.9%) patients met the SARI case definition. Among these SARI patients, 2109 (76.5%) had laboratory PCR testing for influenza. Of these, 428 (20.3%) had an influenza virus detected.

Of the 6515 assessed patients, 3657 (56.1%) did not meet the SARI case definition. A total of 1295 (41.7%) of these non-SARI cases were also tested for influenza viruses. Among the tested non-SARI cases, 119 (9.2%) had influenza viruses detected.

The temporal distribution of SARI influenza cases (cases that met the SARI definition, and were positive for influenza) and non-influenza SARI cases in 2014 is shown in Figure 20.

Figure 20. Weekly SARI and influenza incidence, 2014

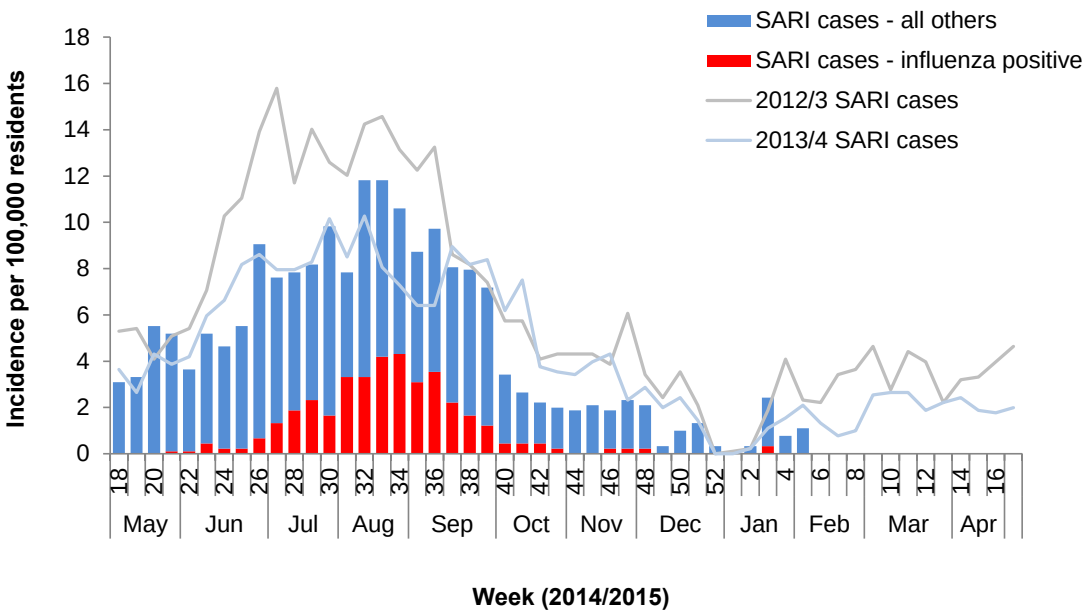


Table 6 shows the demographic features of the acute admission patients, SARI cases, and SARI-associated influenza cases in 2014. Of the 6515 (4.6%) cases with suspected respiratory infections, 2858 (43.9%) met the SARI case definition, resulting in 20.4 SARI cases per 1000 acute hospitalisations. This was lower than the 27.5 per 1000 hospitalisations during the same period in 2013. Among all SARI cases, 1938 (67.8%) were residents of ADHB and CMDHB, giving a cumulative SARI incidence of 214 per 100,000 population. This was higher than the 163.8 cases per 100,000 population during 2013. Of the 428 positive influenza cases, 353 were residents of ADHB and CMDHB, which gives a cumulative influenza incidence of 39 per 100,000 population. This is higher than the 22.6 per 100,000 population recorded in 2013.

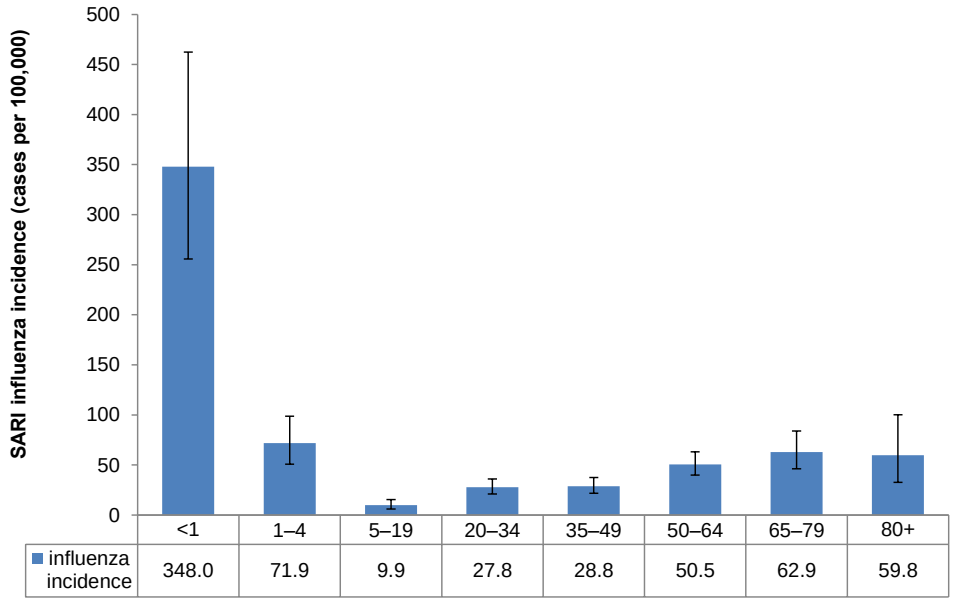
Table 6. Demographic characteristics of SARI cases, 2014

Characteristics	All acute admissions	SARI & influenza cases among all hospital patients			SARI & influenza cases among ADHB & CMDHB residents	
		SARI Cases	Cases per 1000 hospitalisations	Influenza positive (%*)	SARI incidence rate per 100,000	Influenza incidence rate per 100,000 (95%CI)
Overall	**140,145**	**2858**	**20.4**	**428 (20.3)**	**214.0**	**39.0 (35.0, 43.3)**
Age group (years)						
<1	5299	646	121.9	56 (10.5)	3598.4	348.0 (255.8, 462.5)
1–4	10,320	495	48.0	44 (12.8)	626.0	71.9 (50.9, 98.6)
5–19	16,342	187	11.4	26 (19.1)	61.2	9.9 (5.9, 15.4)
20–34	26,513	189	7.1	67 (41.6)	73.4	27.8 (21.1, 36.0)
35–49	22,022	228	10.4	63 (34.2)	95.3	28.8 (21.7, 37.5)
50–64	23,791	358	15.0	95 (32.5)	184.0	50.5 (39.8, 63.2)
65–79	21,765	363	16.7	54 (19.7)	344.8	62.9 (46.1, 83.9)
>80	14,093	237	16.8	17 (11.8)	593.3	59.8 (32.7, 100.2)
Unknown	0	155		6 (15.4)		
Ethnicity						
Māori	18,547	536	28.9	77 (18.5)	381.0	63.3 (48.7, 81.0)
Pacific peoples	28,892	1092	37.8	162 (19.0)	587.7	94.9 (79.4, 112.6)
Asians	21,162	237	11.2	41 (24.4)	75.6	16.2 (11.2, 22.6)
European and others	70,452	834	11.8	142 (22.5)	128.2	27.3 (22.7, 32.5)
Unknown	1060	159	150.0	6 (14.6)		
Hospitals						
ADHB	77,247	1190	15.4	169 (21.3)	167.5	34.6 (29.3, 40.6)
CMDHB	62,898	1668	26.5	259 (19.7)	257.2	43.0 (37.3, 49.4)
Sex						
Female	73,716	1347	18.3	240 (22.9)	210.9	44.1 (38.2, 50.5)
Male	66,429	1356	20.4	182 (17.8)	217.3	33.6 (28.4, 39.5)
Unknown	0	155		6 (15.4)	0.0	0.0 (0.0, 26464.8)
NZ Dep						
1		230		48 (27.7)	86.3	24.1 (17.4, 32.5)
2		219		38 (23.8)	89.9	17.4 (11.6, 25.0)
3		361		59 (21.8)	160.1	35.0 (26.1, 46.1)
4		354		49 (19.1)	147.3	23.5 (16.7, 32.2)
5		1377		211 (19.7)	409.7	70.6 (60.6, 81.9)

*Calculated as a percentage of SARI cases tested for influenza viruses. (This may differ from the percentage of SARI samples tested for influenza viruses).

The cumulative SARI-associated influenza incidence by age group for 2014 is shown in Figure 21. The highest rate of SARI-associated influenza hospitalisation was recorded in infants aged <1 year (348 per 100,000) followed by older people (62.9 per 100,000 for ages 65–79 years, and 59.8 per 100,000 for the 80 years and over age group). However, differences were only statistically significant between <1 year age group compared to all other age groups.

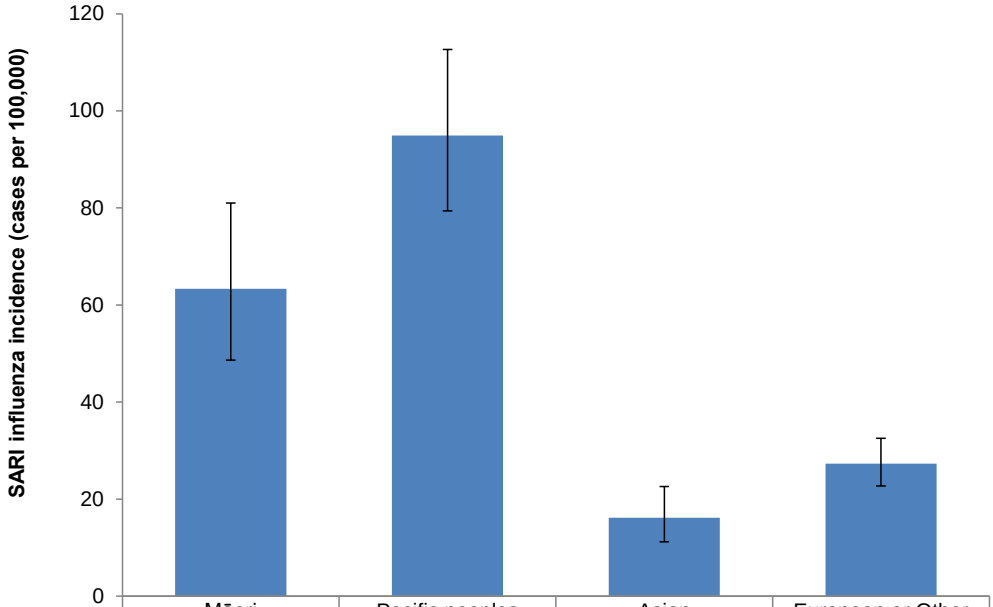
Figure 21. Cumulative SARI-associated influenza hospitalisation incidence by age group, 2014



	<1	1–4	5–19	20–34	35–49	50–64	65–79	80+
influenza incidence	348.0	71.9	9.9	27.8	28.8	50.5	62.9	59.8

The cumulative SARI-associated influenza incidence by ethnic group for 2014 is shown in Figure 22. The Pacific peoples ethnic group had the highest hospitalisation rate. This was followed by Māori, European or Other and Asian ethnic groups. However, differences were only statistically significant between the Asian and European or Other ethnic groups compared to Pacific peoples and Māori ethnic group. This trend is similar to the SARI 2012/13 and 2013/2014 results.

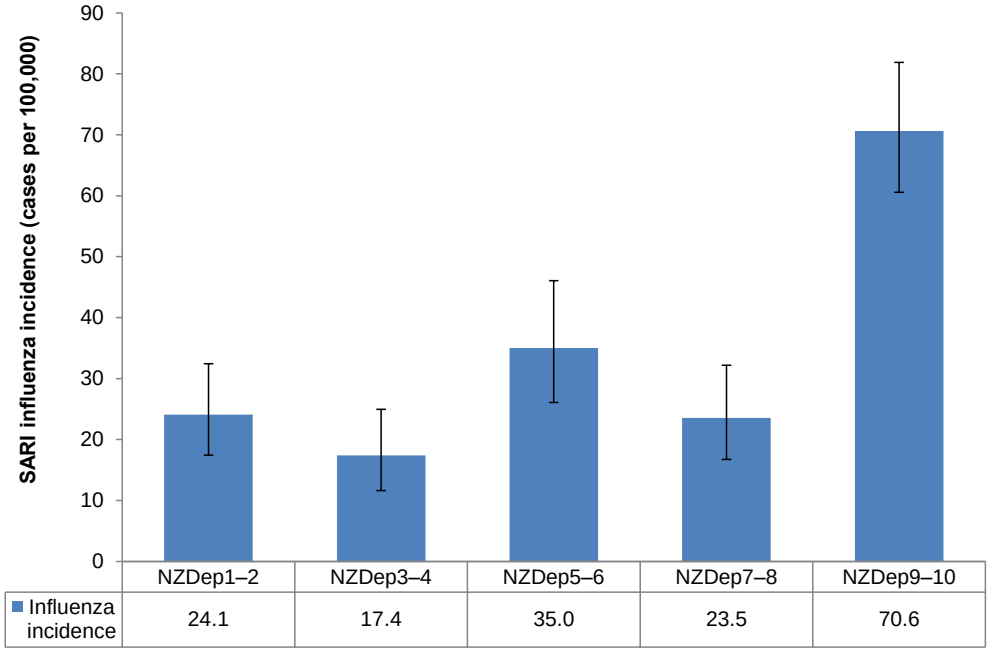
Figure 22. SARI-associated influenza hospitalisation incidence by ethnic group, 2014



	Māori	Pacific peoples	Asian	European or Other
Influenza incidence	63.3	94.9	16.2	27.3

Rates of influenza incidence among SARI cases by deprivation index (NZDep) are shown in Figure 23. Cases in the most deprived quintile (NZDep9–10) have the highest rate. Differences were only statistically significant between NZDep 9–10 compared to all other quintiles.

Figure 23. SARI-associated influenza hospitalisation incidence by NZDep, 2014



	NZDep1–2	NZDep3–4	NZDep5–6	NZDep7–8	NZDep9–10
Influenza incidence	24.1	17.4	35.0	23.5	70.6

Severe hospital outcomes

A measure of the severity of an acute hospitalisation is an admission to an ICU, or death recorded while in hospital.

During 2014, a total of 1239 people were admitted to an ICU from all causes. Of them, 145 met the SARI case definition (Table 7). This gave the proportion of SARI cases among total ICU admissions as 11.7%. The proportion of SARI ICU cases among total SARI cases was 5.1% (145/2858). A total of 26 (19%, 26/137) of the tested SARI ICU cases were positive for influenza viruses, and the influenza incidence rate among SARI cases who were admitted to ICU was two per 100,000 (95% CI: 1.2, 3.1).

The incidence rate for SARI cases admitted to ICU was two to four times higher among Māori and Pacific peoples than among other ethnic groups, and concentrated among young cases.

During 2014, a total of 1103 hospital deaths were recorded. Of these, 17 met the SARI case definition. This gave the proportion of SARI deaths among total hospital deaths as 1.5%. The proportion of SARI deaths among total SARI cases was 0.6% (17/2858). Four (44.4%, 4/9) of the SARI cases who died were positive for influenza virus: two were from ADHB and two were from CMDHB. The influenza incidence rate among SARI cases who died was 0.4 per 100,000 (95% CI: 0.1.1.1).

Table 7. Demographic characteristics of SARI cases admitted to ICU, 2014

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[1] (%)	SARI ICU cases	SARI ICU incidence (per 100,000)	Influenza cases	Influenza incidence (per 100,000) (CI)
Overall	**1239**	**2858**	**145**	**117.0**	**5.1**	**26 (19.0)**	**106**	**10.0**	**18**	**2.0 (1.2, 3.1)**
Age group (years)										
<1	194	646	60	309.3	9.3	4 (6.8)	45	311.0	3	22.2 (4.6, 64.9)
1 to 4	118	495	35	296.6	7.1	3 (9.7)	25	41.6	2	3.8 (0.5, 13.7)
5 to 19	137	187	20	146.0	10.7	7 (38.9)	12	4.7	4	2.1 (0.6, 5.3)
20 to 34	154	189	6	39.0	3.2	3 (50.0)	4	1.4	2	1.0 (0.1, 3.5)
35 to 49	169	228	9	53.3	3.9	5 (62.5)	7	3.7	4	2.1 (0.6, 5.4)
50 to 64	218	358	6	27.5	1.7	1 (16.7)	6	1.3	1	0.7 (0.0, 3.7)
65 to 79	213	363	8	37.6	2.2	3 (37.5)	6	6.8	2	2.7 (0.3, 9.9)
80 and over	36	237	1	27.8	0.4	0 (0.0)	1	4.3	0	0.0 (0.0, 15.7)
Unknown	0	155	0		0.0		0		0	0.0 (0.0, 26464.8)
Ethnicity										
Māori	293	536	43	146.8	8.0	4 (10.0)	28	24.1	3	3.0 (0.6, 8.8)
Pacific peoples	340	1092	51	150.0	4.7	9 (18.0)	43	28.3	6	4.3 (1.6, 9.5)
Asians	121	237	10	82.6	4.2	3 (33.3)	9	3.3	3	1.4 (0.3, 4.2)
European and others	471	834	41	87.0	4.9	10 (26.3)	26	5.2	6	1.3 (0.5, 2.9)
Unknown	14	159	0	0.0	0.0		0	0.0	0	0.0 (0.0, 26464.8)
Hospitals										
ADHB	434	1190	91	209.7	7.6	17 (20.2)	54	10.3	9	2.1 (0.9, 3.9)
CMDHB	805	1668	54	67.1	3.2	9 (17.0)	52	9.8	9	1.9 (0.9, 3.6)
Sex										
Female	520	1347	57	109.6	4.2	11 (20.0)	46	8.0	7	1.5 (0.6, 3.1)
Male	719	1356	88	122.4	6.5	15 (18.3)	60	12.3	11	2.5 (1.2, 4.5)
Unknown	0	155	0		0.0		0		0	0.0 (0.0, 26464.8)
NZDep										
1		230	14		6.1	5 (38.5)	9	3.9	3	1.7 (0.3, 4.9)
2		219	10		4.6	1 (10.0)	5	2.4	0	0.0 (0.0, 2.2)
3		361	22		6.1	6 (30.0)	13	8.9	5	3.4 (1.1, 8.0)
4		354	24		6.8	2 (10.0)	16	8.5	1	0.6 (0.0, 3.4)
5		1377	61		4.4	10 (16.7)	52	20.5	8	3.2 (1.4, 6.3)

Influenza viruses

In 2014, 2249 specimens from SARI patients were tested and 453 (20.1%) were positive for influenza viruses, including 408 for influenza A and 45 for influenza B viruses (Table 8).

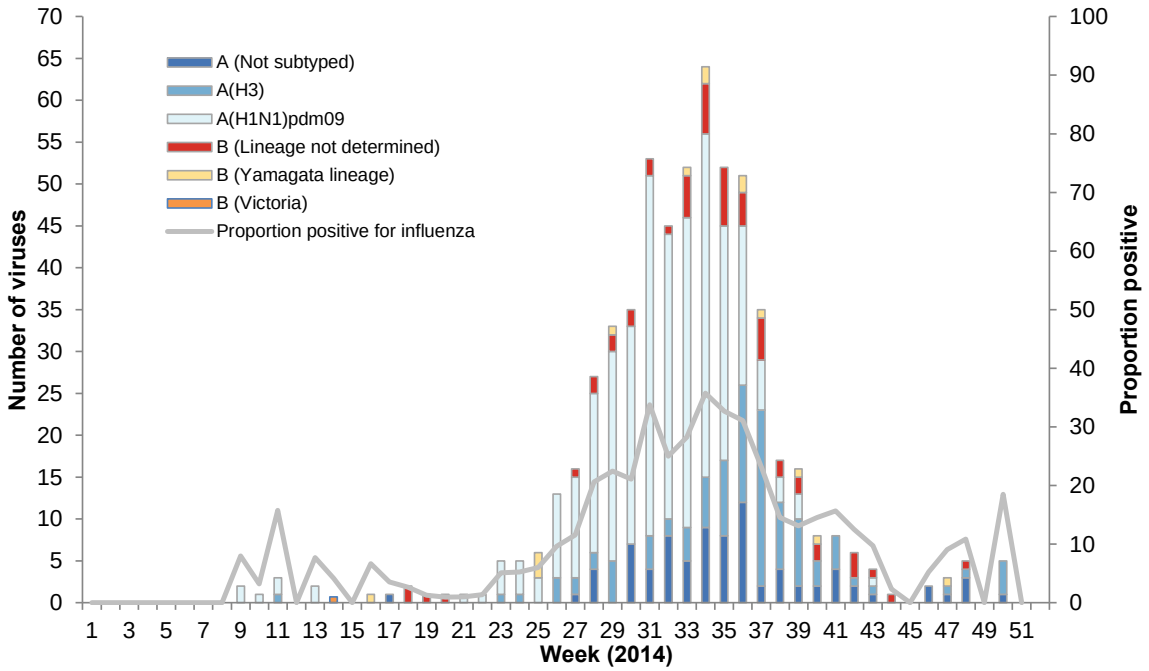
Table 8. Influenza viruses among SARI cases, 2014

Influenza viruses	SARI		
	Cases	ICU	Deaths
No. of specimens tested	2249	153	10
No. of positive specimens (%)[1]	453 (20.1)	31 (20.3)	5 (50.0)
Influenza A	408	30	5
A (not subtyped)	68	4	0
A (H1N1)pdm09	257	23	5
A(H1N1)pdm09 by PCR	225	19	5
A/California/7/2009 (H1N1) - like	32	4	0
A(H3N2)	83	3	0
A(H3N2) by PCR	79	3	0
A/Texas/50/2012 (H3N2) - like	4	0	0
Influenza B	45	1	0
B (lineage not determined)	40	1	0
B/Yamagata lineage	5	0	0
B/Yamagata lineage by PCR	1	0	0
B/Massachusetts/2/2012 - like	4	0	0
B/Victoria lineage	0	0	0
B/Victoria lineage by PCR	0	0	0
B/Brisbane/60/2008 - like	0	0	0
Influenza and non-influenza co-detection (% of positives)	46 (10.2)	1 (3.2)	0 (0.0)

[1]Number of specimens positive for at least one of the listed viruses. (Note: A specimen may be positive for more than one virus.)

The temporal distribution of the number and proportion of the influenza viruses from SARI patients is shown in Figure 24. Influenza A(H1N1)pdm09 was the predominant strain from week 23 (ending 8 June) to week 36 (ending 7 September). From week 37 A(H3N2) became the predominant strain. SARI-associated influenza viruses associated with hospital patients peaked in week 34.

Figure 24. Temporal distribution of the number and proportion of influenza viruses from SARI specimens by type and week, 2014



Non-influenza respiratory viruses

In addition to testing for influenza viruses, specimens from the SARI surveillance were also tested for the presence of seven non-influenza viruses. In 2014, 1151 SARI specimens were tested for non-influenza respiratory viruses. Of these, 562 (48.8%) were positive. Details are given in Table 9.

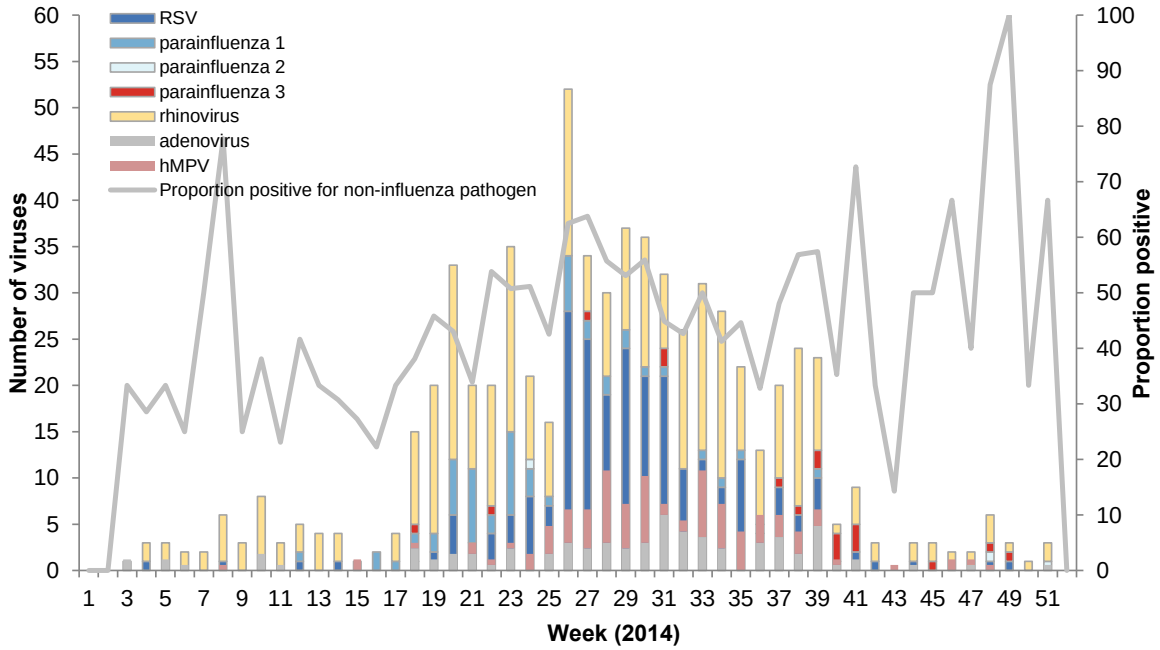
Table 9. Non-influenza respiratory viruses among SARI cases, 2014

Non-influenza respiratory viruses	SARI		
	Cases	ICU	Deaths
No. of specimens tested	1151	45	5
No. of positive specimens (%)[1]	562 (48.8)	21 (46.7)	2 (40.0)
Respiratory syncytial virus (RSV)	203	7	0
Parainfluenza 1 (PIV1)	41	3	0
Parainfluenza 2 (PIV2)	3	0	0
Parainfluenza 3 (PIV3)	16	1	1
Rhinovirus (RV)	207	5	1
Adenovirus (AdV)	75	8	0
Human metapneumovirus (hMPV)	99	2	0
Single virus detection (% of positives)	484 (86.1)	16 (76.2)	2 (100.0)
Multiple virus detection (% of positives)	78 (13.9)	5 (23.8)	0 (0.0)

[1]Number of specimens positive for at least one of the listed viruses. (Note: A specimen may be positive for more than one virus.)

The temporal distribution of the number and proportion of non-influenza respiratory viruses is shown in Figure 25. High RSV activity occurred between weeks 24 and 35. RSV activity peaked in week 26 (ending 29 June), eight weeks earlier than the influenza peak. The proportion of rhinovirus remained approximately constant from May to September.

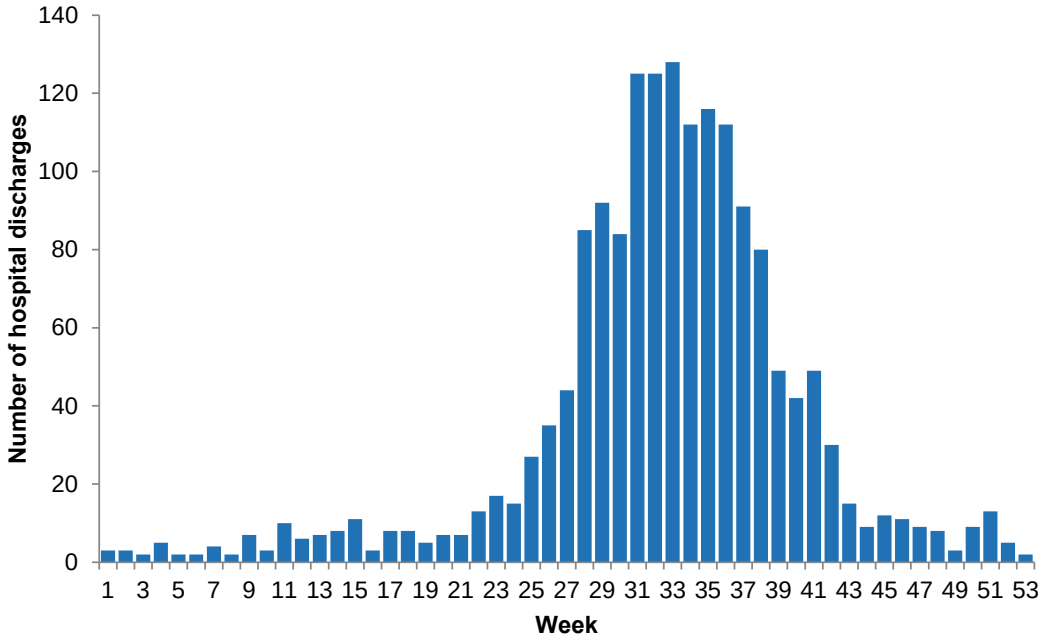
Figure 25. Temporal distribution of the number and proportion of non-influenza viruses from SARI specimens by type and week, 2014



Ministry of Health data on publicly funded hospital discharges

Influenza hospitalisations by week discharged are shown in Figure 26 and indicate that 86.7% (678) of these occurred from weeks 22–44. The highest number of hospitalisations (534) occurred in August (weeks 31–35). Hospitalisations peaked in week 33—the same as non-sentinel virus numbers and national sentinel ILI consultations.

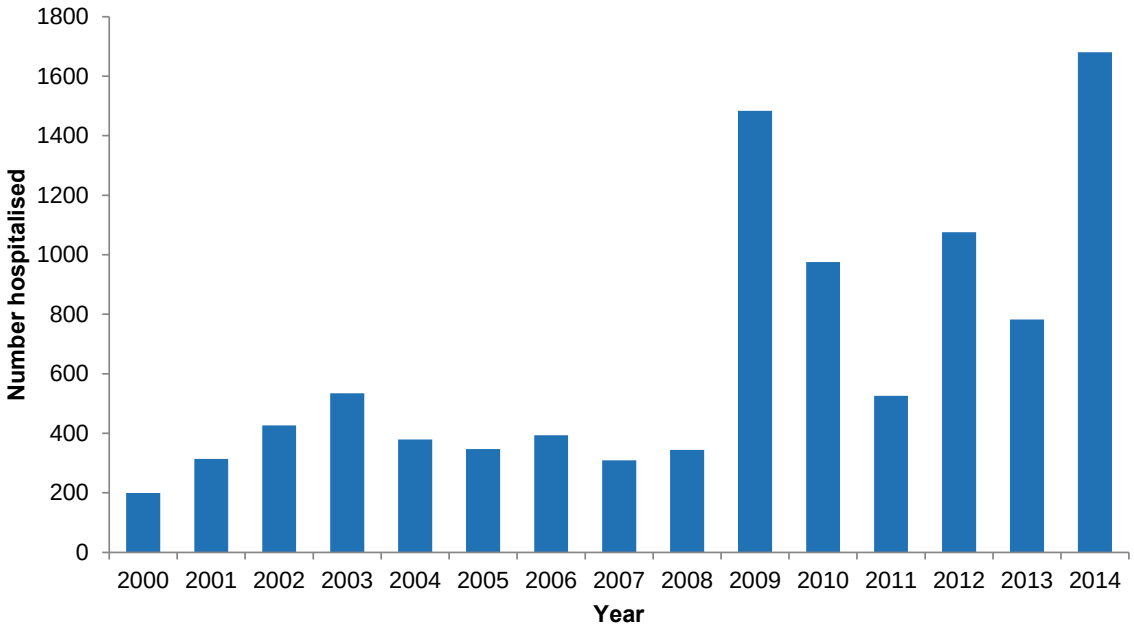
Figure 26. Influenza hospital discharges by week, 2014



Data source: Ministry of Health, NMDS (Hospital Events).

The number of influenza hospitalisations in 2014 ranked the highest during the period from 2000 to 2014 (Figure 27). In 2014, there were 1680 hospitalisations for influenza compared with 782 hospitalisations in 2013 and 1076 in 2012.

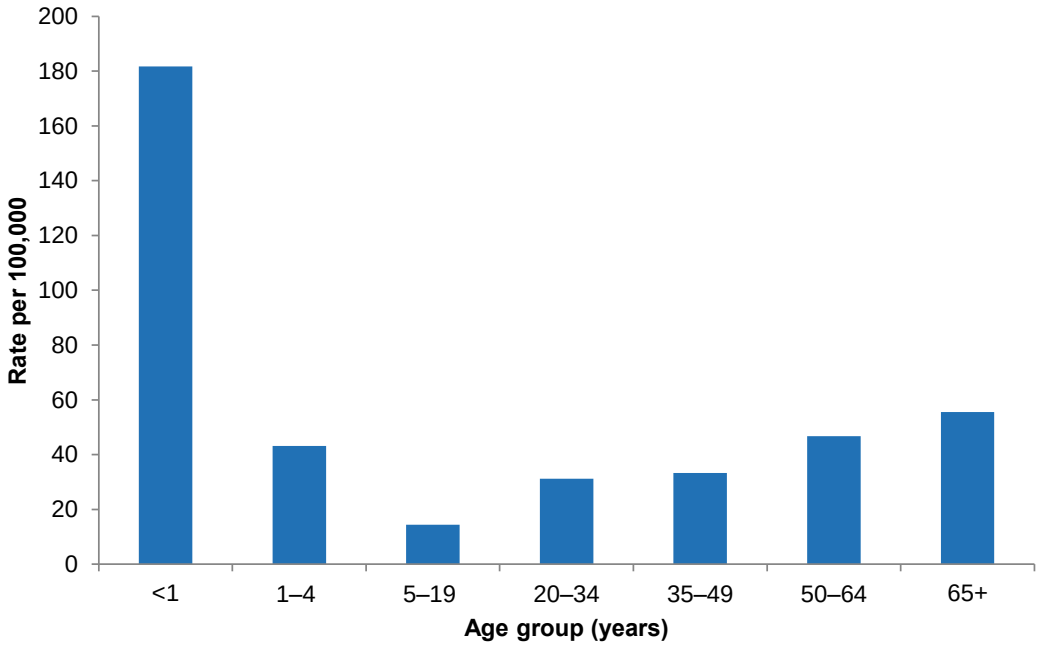
Figure 27. Influenza hospital discharges, 2000–2014



Data source: Ministry of Health, NMDS (Hospital Events).

Figure 28 compares the hospitalisation rates in 2014 by age group. In 2014 by far the highest hospitalisation rates occurred in children aged less than one year (181.7 per 100,000 patient population). This was more than three times the next highest rate of 55.5 per 100,000 for adults aged 65 years and over.

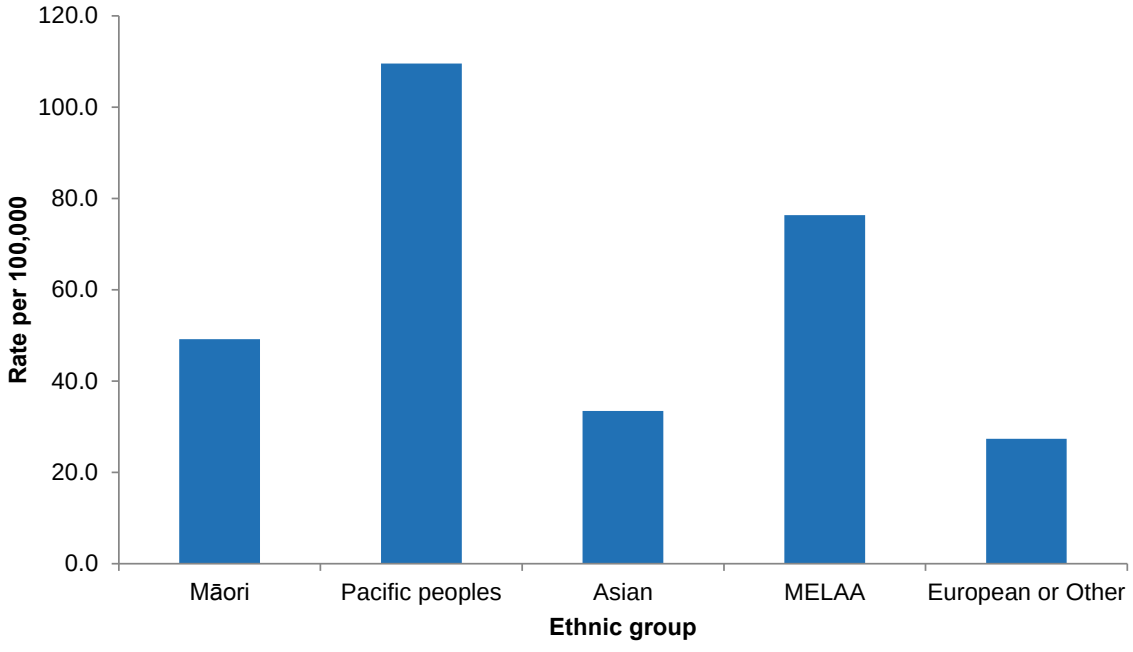
Figure 28. Influenza hospital discharge rates by age group, 2014



Data source: Ministry of Health, NMDS (Hospital Events).

The ethnic distribution of influenza hospitalisations in 2014 is shown in Figure 29. Pacific peoples had the highest hospitalisation rate (109.6 per 100,000), followed by MELAA with 76.4 per 100,000 (38 hospitalised). European or Other ethnic group had the lowest rate of hospitalisations (27.3 per 100,000).

Figure 29. Hospital discharge rates by prioritised ethnic group in 2014

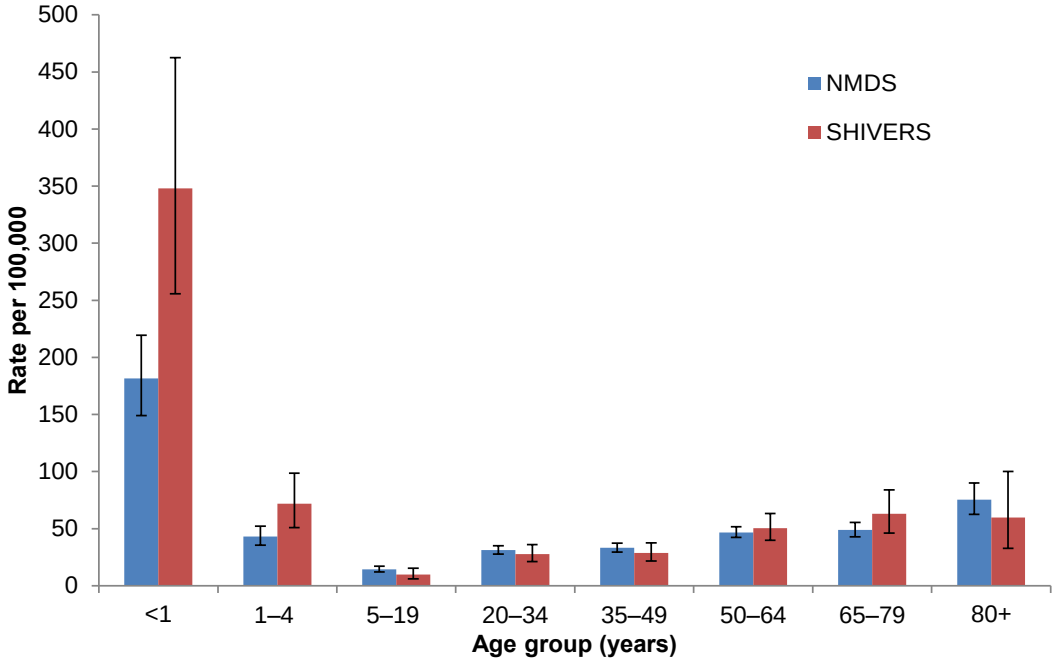


Data source: Ministry of Health, NMDS (Hospital Events).

Comparison of SARI and NMDS hospitalisations

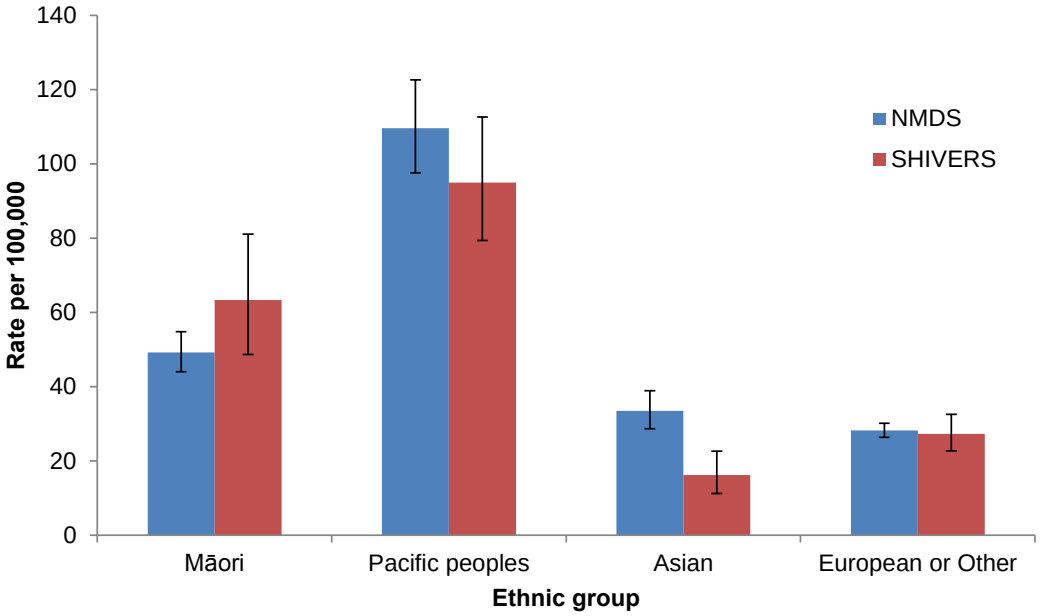
The SARI influenza hospitalisation rates from SHIVERS (ADHB and CMDHB populations) were compared to the NMDS influenza hospitalisation rates for each age group for the same ADHB and CMDHB populations. Both the NMDS and SHIVERS patients recorded the highest influenza hospitalisation rates in the <1 year age group, with rates of 181.7 per 100,000 and 348 per 100,000 respectively. People aged 80 years and over had the next highest rates (75.4 per 100,000) in the NMDS, while the 65–69 years age group had the highest rate of SHIVERS patients (62.9 per 100, 000) (Figure 30). Higher influenza hospitalisation rates from SARI surveillance are likely to be due to the rigorous case ascertainment and more frequent testing of respiratory illness admissions as a result of the SHIVERS research programme.

Figure 30. Age-specific influenza hospitalisation rates from the NMDS and SHIVERS data, during 2014 in ADHB and CMDHB



Pacific peoples recorded the highest influenza confirmed hospitalisation rates for both NMDS and SHIVERS (109.6 per 100,000 and 94.9 per 100,000 respectively). Māori ethnic group had the second highest rate (49.2 per 100,000 and 63.3 per 100,000 respectively) (Figure 31).

Figure 31. Ethnic-specific influenza hospitalisation rates for NMDS and SHIVERS data, 2014

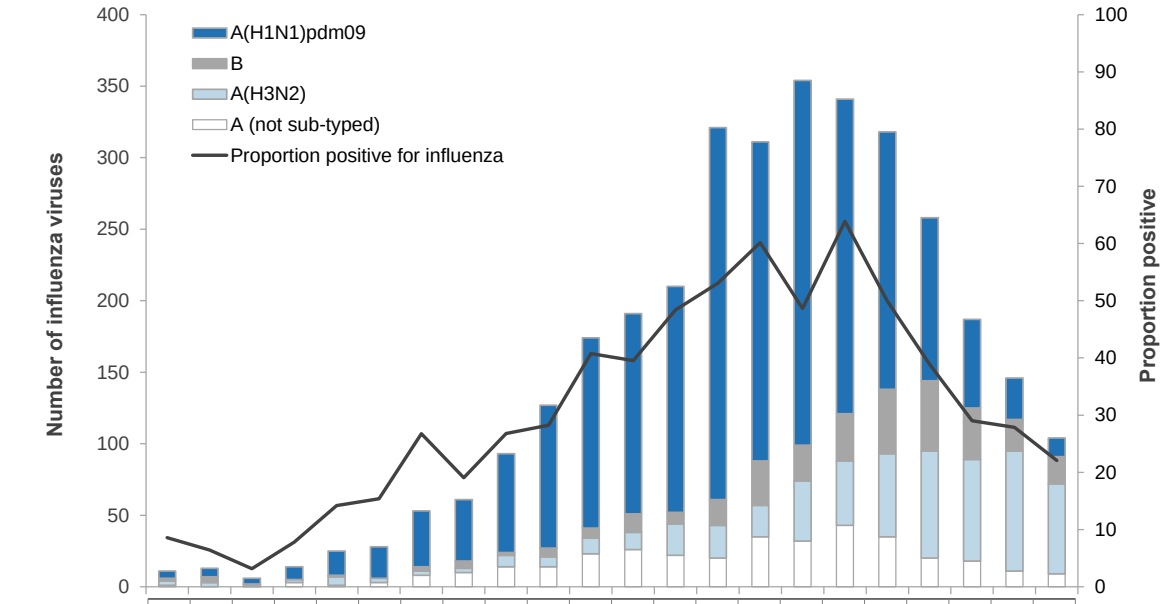


Laboratory-based non-sentinel surveillance—for outpatients and hospital inpatients

For laboratory-based non-sentinel surveillance from January to December 2014, a total of 13,104 specimens were tested. Of these, 3871 (29.5%) specimens tested positive for influenza viruses. This is higher than the 2130 and 2026 viruses identified through non-sentinel surveillance in 2013 and 2012 respectively, but lower than the 4276 viruses identified in 2009.

Figure 32 shows the temporal distribution of influenza viruses reported by type and sub-type each week from non-sentinel surveillance for weeks 18–39. Influenza viruses peaked in week 33 (11–17 August 2014). Influenza A(H1N1)pdm09 peaked in week 31 (260 viruses), B peaked in week 36 (49 viruses) and A(H3N2) peaked in week 38 (84 viruses).

Figure 32. Influenza viruses from non-sentinel surveillance by type and week reported, 2014



	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)	1	0	0	3	1	3	8	10	14	14	23	26	22	20	35	32	43	35	20	18	11	9
A(H3N2)	3	3	0	2	6	3	3	3	8	7	11	12	22	23	22	42	45	58	75	71	84	63
B	2	4	2	0	1	0	3	5	2	6	7	13	8	18	31	25	33	45	49	36	22	19
A(H1N1)pdm09	5	6	4	9	17	22	39	43	69	100	133	140	158	260	223	255	220	180	114	62	29	13

*Data shown from weeks 18–39 only.

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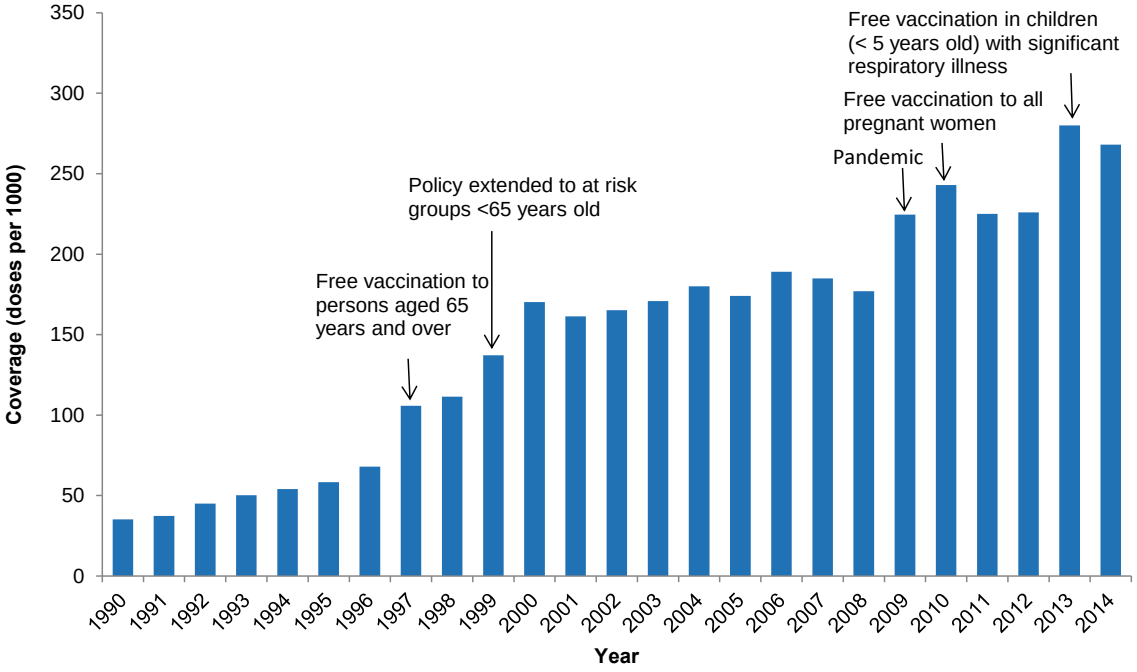
Influenza vaccine coverage in New Zealand in 2014 was lower than the previous peak in 2013 (Figure 33). The coverage rate of influenza vaccine (both publically and privately funded) as estimated by vaccine distribution figures during the 2014 seasonal influenza immunisation programme was 268 doses per 1000 population, 4% lower than the 280 doses per 1000 population administered in 2013.

The coverage rate for people 65 years and older was 67.5%; similar to the coverage rate of 68.4% achieved in 2013 (Immunisation Benefit Claims Data, Sector Services, Ministry of Health). No data is available on privately funded immunisations.

Figure 33. Influenza vaccine coverage[1], 1990–2014



[1] Estimated by vaccine distribution figures.

At least 1,206,773 doses of the seasonal trivalent influenza vaccine were distributed in New Zealand in the 2014 season. Table 10 shows the estimated number of people who received the funded influenza vaccine in seven age groups.

Table 10. Influenza coverage by age group, 2014

Age group (years)	Total vaccines received
<1	1325
1–4	13,243
5–19	39,214
20–34	29,304
35–49	52,815
50–64	120,284
65+	438,851
Total	**695,036**

Data source: Immunisation benefits claims data, Sector Services, Ministry of Health.

VIRUS STRAIN CHARACTERISATION

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VIRUS STRAIN CHARACTERISATION

Circulating viral strains in 2014

A total of 4144 influenza viruses were detected and reported in 2014, with influenza A representing 88.6% (3673/4144) and influenza B 11.4% (471/4144) of all influenza viruses (Table 11). The influenza A(H1N1)pdm09 virus represented 58.3% (2416/4144) of all viruses and 69.3% (2416/3486) of all sub-typed and lineage-typed viruses. Influenza A(H3N2) strain represented 20.3% (842/4144) of all viruses and 24.2% (842/3486) of all typed and sub-typed viruses. The influenza B/Yamagata lineage virus represented 5.3% (220/4144) of all viruses and 6.3% (220/3486) of all sub-typed and lineage-typed viruses. The influenza B/Victoria lineage virus represented 0.2% (8/4144) of all viruses 0.2% (8/3486) of all sub-typed and lineage-typed viruses.

Table 11. Influenza virus identifications by type and sub-type and lineage-typed, 2014

Viruses	All viruses (%)	Sub-typed and lineage-typed (%)
Influenza A (not sub-typed)	**415 (10.0)**	
Influenza A(H1N1)pdm09	**2416 (58.3)**	**2416 (69.3)**
A(H1N1)pdm09 by PCR	1764 (42.6)	1764 (50.6)
A/California/7/2009 (H1N1)-like	652 (15.7)	652 (18.7)
Influenza A(H3N2)	**842 (20.3)**	**842 (24.2)**
A(H3N2) by PCR	670 (16.2)	670 (19.2)
A/Texas/50/2012 (H3N2)-like	172 (4.2)	172 (4.9)
Influenza B (not lineage-typed)	**243 (5.9)**	
B/Yamagata lineage	**220 (5.3)**	**220 (6.3)**
B/Yamagata lineage by PCR	71 (1.7)	71 (2.0)
B/Massachusetts/2/2012	148 (3.6)	148 (4.2)
B/Wisconsin/1/2010-like	1 (0.0)	1 (0.0)
B/Victoria lineage	**8 (0.2)**	**8 (0.2)**
B/Brisbane/60/2008-like	6 (0.1)	6 (0.2)
B/Victoria lineage by PCR	2 (0.0)	2 (0.1)
Total	**4144 (100)**	**3486 (100)**

Figure 34 shows the influenza virus identifications by type and sub-type for each week throughout 2014. A(H1N1)pdm09 was the predominant type until week 37. Then the predominant type was A(H3N2).

Figure 34. Total influenza viruses by type and week specimen taken, 2014

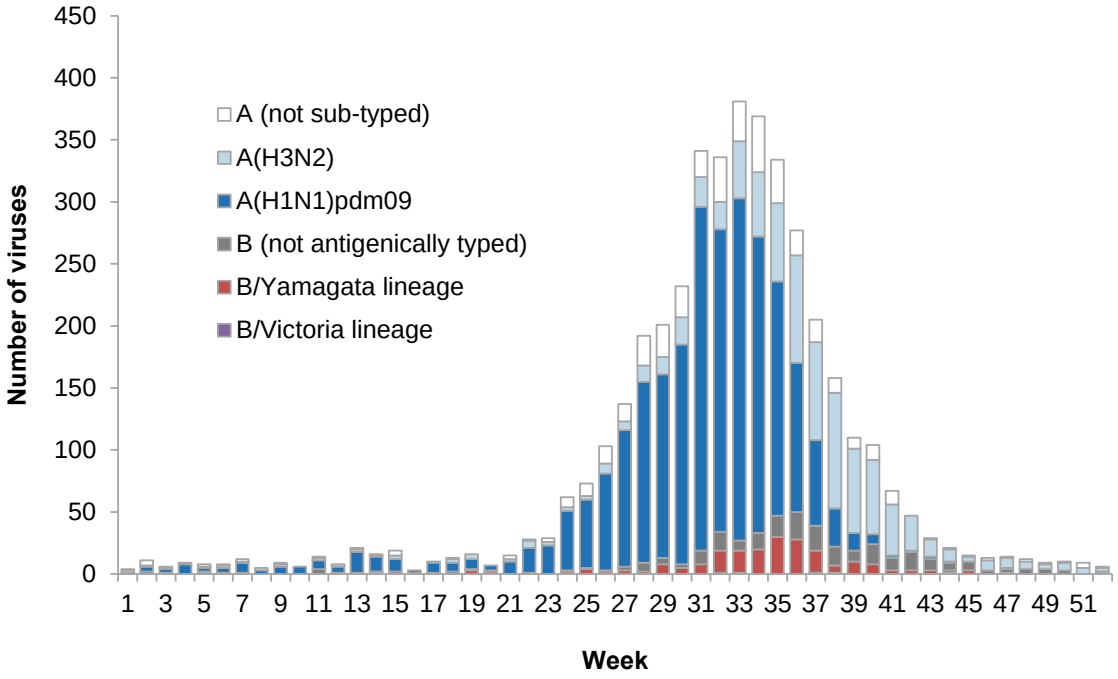


Figure 35 shows the general pattern of influenza virus identifications. Influenza A and B viruses co-circulated throughout the season. The majority of influenza B were B/Yamagata lineage.

Figure 35. Total influenza A and B viruses by week specimen taken, 2014

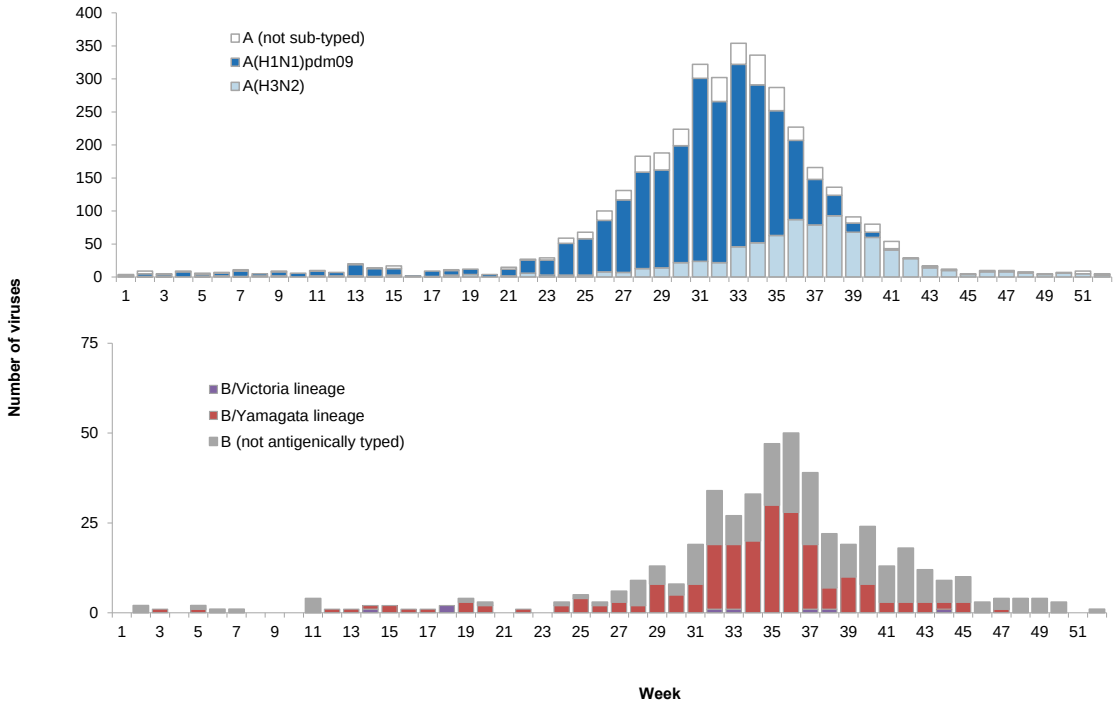
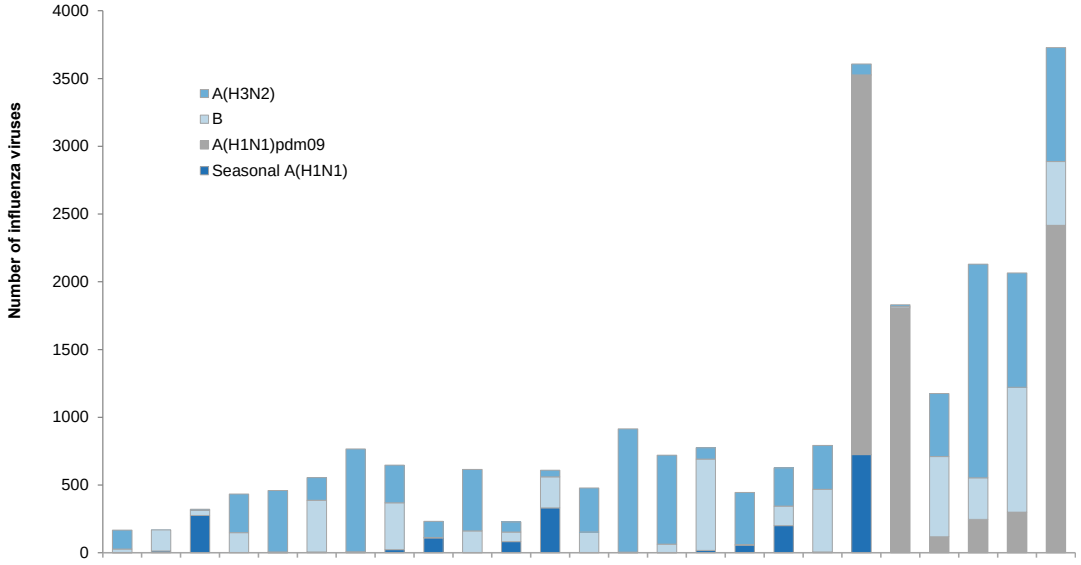


Figure 36 shows the number and percentage of typed and sub-typed (not total) influenza viruses from 1990–2014. Higher yearly numbers of influenza viruses were detected in New Zealand during 2009–2013 than in the previous years. There were two reasons: 1) Since PCR was introduced as a screening assay in NZ virus laboratory network in 2009, more specimens were tested as PCR can cope with a higher volume of testing than viral isolations; 2) SHIVERS SARI and ILI surveillance have been established in New Zealand since 2012, resulting in more influenza testing.

There are noticeable changes in terms of the predominant strains.

- The influenza A(H1N1)pdm09 strain predominated in 2009, 2010 and 2014.
- The 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 A(H1N1) viruses have been detected since 2010.
- The A(H3N2) strain predominated for 12 seasons (1990, 1993, 1994, 1996, 1998, 1999, 2002, 2003, 2004, 2006, 2007 and 2012). During 1990-2008, the highest recorded numbers of influenza hospitalisations occurred in 2003 with the predominant A/Fujian/411/02 (H3N2)-like strain. During 1990–2008, the highest recorded numbers of influenza deaths occurred in 1996, with the predominant A/Wuhan/359/95 (H3N2)-like strain (94 deaths recorded. Of which, 93 occurred in people aged 65 years and older).
- Influenza B strains predominated for seven seasons (1991, 1995, 1997, 2005, 2008, 2011 and 2013). 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 (2002, 2005, 2008 and 2011). Since 2012, B/Yamagata lineage has been the predominant lineage over B/Victoria lineage.

Figure 36. Influenza viruses by type/sub-type, 1990–2014



	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
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	40.9	22.6
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	44.6	12.6
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	14.5	64.8
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	0.0	0.0

Influenza A(H1N1)pdm09

In 2014, 652 representative influenza A(H1N1)pdm09 isolates were antigenically sub-typed. The results from the NIC and WHOCC-Melbourne indicated that most of the currently circulating influenza A(H1N1)pdm09 viruses were antigenically closely related to the vaccine strain A/California/7/2009 (H1N1). Genetically, most of the A(H1N1)pdm09 viruses fell into groups 6B and 6C (CDC designation, Appendix A). However, it appears that these genetic changes have not resulted in significant antigenic changes.

Influenza A(H3N2)

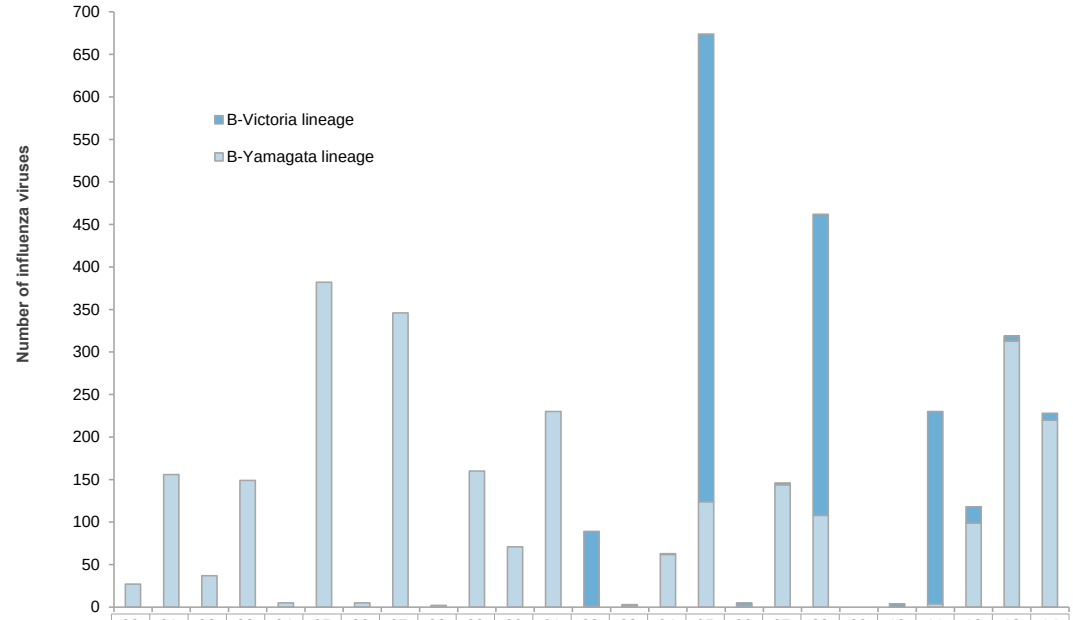
In 2014, 172 representative seasonal influenza A(H3N2) isolates were antigenically sub-typed. The results indicated that most of the New Zealand isolates, as well as isolates from Australia and other countries, had antigenically drifted from the vaccine strain A/Texas/50/2012 (H3N2)-like viruses to A/Switzerland/9715293/2013-like viruses. Genetically, most of the A(H3N2) viruses fell into group 3C.3a (CDC designations, Appendix B).

Influenza B

In 2014, 148 representative seasonal influenza B/Yamagata lineage isolates (B/Massachusetts/2/2012-like, the current vaccine strain) and two B/Victoria lineage isolates (B/Brisbane/60/2008-like) were antigenically typed. The results indicated that the B/Yamagata isolates from New Zealand, as well as isolates from Australia and other countries, had antigenically drifted from B/Massachusetts/2/2012-like viruses to B/Phuket/3073/2013-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 groups one and three respectively (CDC designations, Appendices C and D).

Figure 37 shows the number and percentage of all antigenically typed B viruses from 1990 to 2014. Since the introduction of the B/Victoria lineage viruses into New Zealand in 2002, this strain has predominated over the B/Yamagata lineage viruses in three yearly cycles (2002, 2005, 2008, and 2011). However, this pattern did not continue in 2014.

Figure 37. Influenza B antigenic types, 1990–2014



	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
B/Victoria lineage (%)	0	0	0	0	0	0	0	0	0	0	0	0	99	33	2	82	60	1	77	0	100	98	16	2	4
B/Yamagata lineage (%)	100	100	100	100	100	100	100	100	100	100	100	100	1	67	98	18	40	99	23	0	0	2	84	98	96

Oseltamivir resistance monitoring

In 2014, 998 influenza viruses were tested for resistance to oseltamivir and 996 for resistance to zanamivir by a phenotypic assay (fluorometric neuraminidase inhibition). All viruses except two were found to be sensitive to oseltamivir (Table 12) and all viruses were sensitive to zanamivir (Table 13).

In 2014, two A(H1N1)pdm09 viruses were resistant to oseltamivir. The first was detected from a 35 year old male from Auckland who was hospitalised. The results of the phenotypic assay indicated that the virus had highly reduced sensitivity to oseltamivir with an IC50 value of 146 nM, 365 times higher than the median (0.4 nM). The second oseltamivir-resistant virus was detected in a 72 year old male from Auckland who consulted a general practice with influenza-like illness. The results indicated that the virus had reduced sensitivity to oseltamivir with an IC50 value of 14.3 nM, 36 times higher than the median.

Table 12. Antiviral susceptibility to oseltamivir for influenza viruses in New Zealand, 2006–2014

Influenza type/sub-type	2006	2007	2008	2009	2010	2011**	2012**	2013	2014
Influenza B									
Number of isolates tested	1	132	306	-	1	244	117	316	167
Mean IC50 (nM)	42.3	37.5	26.5	-	13.1	30.6	13.4	14.3	27.4
Median IC50 (nM)	42.3	34.1	23.5	-	13.1	29.0	11.3	13.2	20.9
Standard Deviation (nM)	-	22.5	16.9	-	-	14.9	8.5	8.1	18.5
Minimum IC50* (nM)	42.3	0.9	0.2	-	13.1	4.1	3.5	0.1	2.9
Maximum IC50 (nM)	42.3	97.4	87.8	-	13.1	182.7	64.9	51.1	111.7
Influenza A(H3N2)									
Number of isolates tested	189	45	120	-	1	224	355	321	164
Mean IC50 (nM)	0.7	0.4	0.3	-	0.2	0.4	0.4	0.3	0.5
Median IC50 (nM)	0.7	0.3	0.3		0.2	0.4	0.4	0.3	0.4
Standard Deviation (nM)	0.3	0.3	0.2	-	-	0.2	0.2	0.2	0.4
Minimum IC50 (nM)	0.1	0.1	0.0	-	0.2	0.1	0.0	0.1	0.2
Maximum IC50 (nM)	1.4	1.1	1.1	-	0.2	1.5	1.4	0.9	3.3
Seasonal influenza A(H1N1)									
Number of isolates tested	18	136	4	25	-	-	-	-	-
Mean IC50 (nM)	1.3	0.8	767.7	1385.3	-	-	-	-	-
Median IC50 (nM)	0.9	0.7	657.2	707.5	-	-	-	-	-
Standard Deviation (nM)	0.9	0.6	287.3	1995.5	-	-	-	-	-
Minimum IC50 (nM)	0.2	0.1	572.5	305.2	-	-	-	-	-
Maximum IC50 (nM)	3.0	2.7	1184.0	7912.0	-	-	-	-	-
Influenza A(H1N1)pdm09									
Number of isolates tested	-	-	-	483	334	29	93.0	75	667
Mean IC50 (nM)	-	-	-	0.4	0.7	0.5	0.3	0.4	0.9
Median IC50 (nM)	-	-	-	0.3	0.6	0.5	0.3	0.3	0.4
Standard Deviation (nM)	-	-	-	0.2	0.4	0.3	0.2	0.2	6.1
Minimum IC50 (nM)	-	-	-	0.1	0.0	0.2	0.1	0.1	0.1
Maximum IC50 (nM)	-	-	-	1.4	2.0	1.3	316.2	1.4	146.2

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

** Mean and standard deviation calculated for 2011 and 2012 and 2014 includes six outliers deemed to be resistant to oseltamivir (having IC50 values >10-fold higher than the overall median for a given sub-type recorded for all years). Six outliers were excluded in mean and standard deviation calculations: two influenza B viruses in 2011; two pandemic influenza A(H1N1)pdm09 viruses in 2012 and two pandemic influenza A(H1N1)pdm09 viruses in 2014

Table 13. Antiviral susceptibility to zanamivir for influenza viruses, 2013–2014

Influenza type/sub-type	2013	2014
Influenza B		
Number of isolates tested	314	168
Mean IC50 (nM)	1.3	1.4
Median IC50 (nM)	1.2	1.1
Standard Deviation (nM)	0.8	0.9
Minimum IC50* (nM)	0.0	0.4
Maximum IC50 (nM)	5.6	5.3
Influenza A(H3N2)		
Number of isolates tested	324	157
Mean IC50 (nM)	0.3	0.4
Median IC50 (nM)	0.3	0.4
Standard Deviation (nM)	0.2	0.3
Minimum IC50 (nM)	0.1	0.2
Maximum IC50 (nM)	1.4	2.5
Influenza A(H1N1)pdm09		
Number of isolates tested	72	671
Mean IC50 (nM)	0.2	0.3
Median IC50 (nM)	0.2	0.3
Standard Deviation (nM)	0.2	0.2
Minimum IC50 (nM)	0.0	0.1
Maximum IC50 (nM)	1.1	1.6

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

SOUTHERN HEMISPHERE VACCINE STRAIN RECOMMENDATIONS

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SOUTHERN HEMISPHERE VACCINE STRAIN RECOMMENDATIONS

In October 2014, the Australian Influenza Vaccine Committee (AIVC), which includes a New Zealand representative, met to decide on the composition of the influenza vaccine for the 2015 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 2014 influenza season, along with most other southern hemisphere countries, indicated that the current circulating influenza A(H1N1)pdm09 viruses are antigenically similar to the vaccine strain A/California/7/2009 (H1N1). Current vaccines containing A/California/7/2009 antigen elicited antibodies in humans that reacted well to the recent influenza A(H1N1)pdm09 isolates.

Based on southern hemisphere and global data, the WHO Consultative Group and the AIVC recommended that the 2015 vaccines contain an 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 sub-type 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 majority of influenza A(H3N2) viruses from New Zealand and other southern hemisphere countries were antigenically distinguishable from the previous vaccine A/Texas/50/2012-like strain and more closely related to A/Switzerland/9715293/2013-like strain. Current vaccines containing A/Texas/50/2012 antigens elicited antibodies in humans that reacted less well to A(H3N2) clade 3C.3a viruses. Based on all of the epidemiological, antigenic, genetic and serological data, the WHO Consultative Group recommended that the H3 component of the vaccines should be an A/Switzerland/9715293/2013-like strain. AIVC accepted this recommendation.

Influenza B

Two distinct lines of influenza B have co-circulated in many countries during recent years. During 1980s, B/Yamagata/16/88 lineage and its further variants (the most recent representative strain being B/Massachusetts/2/2012-like strain) spread worldwide. During the same periodB/Victoria/2/87 lineage viruses continued to circulate in Asia and subsequently underwent independent evolution as an antigenically distinct lineage, with 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 and B/Yamagata-like strains continued to be isolated worldwide in 2014. 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 had drifted antigenically from the B/Massachusetts/2/2012-like strain (clade 2) to B/Phuket/3073/2013-like strain (clade 3). Current vaccines containing B/Massachusetts/2/2012 antigens elicited antibodies in humans that reacted well to

B/Yamagata/16/88 lineage clade 2 viruses; however, less well to the clade 3 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 recommended vaccines containing B/Phuket/3073/2013-like strain as the B component of the influenza vaccine for the southern hemisphere for 2015.

In summary, the AIVC agreed to adopt the recommendations of the WHO Consultative Group as shown.

The recommended influenza vaccine formulation for New Zealand in 2015 is:

A(H1N1)	**an A/California/7/2009 (H1N1)pdm-like virus***
A(H3N2)	**an A/Switzerland/9715293/2013 (H3N2)-like virus**
B	**a B/Phuket/3073/2013-like virus (belonging to B/Yamagata lineage)**

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

DISCUSSION

DISCUSSION

Sentinel GP-based influenza surveillance, a syndromic surveillance system, is an effective tool for monitoring the disease in the community. It has operated continuously in New Zealand since its establishment in 1989 [3, 7]. Sentinel influenza surveillance is a relatively stable system that monitors disease trends in the community year by year. Active syndromic surveillance systems are increasingly being used to detect emerging and re-emerging pathogens [8] [9]. Influenza surveillance is also a key strategy for improving New Zealand's preparedness for an influenza pandemic [10]. 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 2014 was at a low level. Comparing data for the past 18 years (1997–2014), the weekly consultation rate peak and cumulative consultation rate for ILI in 2014 were the third lowest during this period. It is estimated that ILI resulting in a visit to a GP affected more than 29,768 New Zealanders in 2014; about 0.7% of the population. The number of cases reported through the sentinel network, however, is likely to considerably under-estimate 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 diagnosis criteria. Yet in DHBs where 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 produce much greater fluctuations in ILI consultation rates.

Virological surveillance for outpatients and hospital inpatients (referred to as non-sentinel surveillance) complements sentinel surveillance. Non-sentinel surveillance provides useful information for 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 as no denominator information is provided.

The emergence of the influenza A(H1N1)pdm09 virus in 2009 highlighted that the world was ill-prepared to respond to a severe influenza pandemic or to any similar global event. It emphasised the need for a surveillance system to better define those most at risk of SARI resulting from influenza [11] [12, 13].

Therefore, in October 2011, led by the Institute of Environmental Science and Research, a multi-agency and multi-disciplinary project "Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance" (SHIVERS) was established for a five-year period (2012–2016) as a result of funding received from The United States' Centers for Disease Control (CDC). This collaboration involves ESR, Auckland and Counties Manukau DHBs, the University of Auckland, the University of Otago, the WHOCC at St Jude Children's Hospital in Memphis and the CDC. The overarching aim of SHIVERS is to comprehensively investigate the disease burden, epidemiology, aetiology, risk factors, immunology, and the effectiveness of vaccination and other prevention strategies for influenza and other respiratory diseases of public health importance. The hospital-based surveillance for SARI has been established since 2012 and sentinel GP-based surveillance for influenza-like illness has also been established since 2013.

Rates of influenza-associated general practice consultations and hospitalisations from the SHIVERS study are markedly different by age group. Influenza-associated hospitalisation rates are highest in the very young (0–4 years) and older people (≥65 years). Influenza-associated general practice consultation rates, however, show the opposite pattern, with a higher rate in preschoolers,

school-aged children and adults, but a lower rate in infants (<1 year) and older people (≥65 years). The differences in hospitalisation and GP consultation rates by age are well documented [14, 15] and are likely to result from multiple influences including differences in host immune response, virus pathogenesis, clinical severity and health-seeking behaviour among different age groups and their parents/caregivers.

A preliminary analysis of influenza rates by ethnic group, found that Māori and Pacific peoples experienced the highest rates of influenza-associated hospitalisations but the lowest rates of general practice consultations, while the Asian ethnic group showed the opposite trend. When NZDep was considered, the most deprived populations (NZDep 9–10) were found to have the highest rates of influenza-associated hospitalisations but the lowest rates of influenza-associated GP consultations. Higher hospitalisation rates from seasonal and pandemic influenza have been reported in indigenous groups in New Zealand, as well as the United States and Australia [16, 17]. However, it is unclear why. It remains unclear if Māori and Pacific peoples had the highest rates of influenza-associated hospitalisations in New Zealand but the lowest rates of influenza-associated GP consultations as a result of genetic susceptibility, differences in baseline health status and co-morbidities, or a host of possible contributory factors such as NZDep and less access to healthcare, unfavourable environmental conditions, different perception on health and healthy life-style, poorer health-seeking patterns and poorer health literacy. Further research is required to understand the independent and synergistic effects of these factors.

High numbers (1680) of people hospitalised with respiratory illness tested positive for infection with influenza viruses in the winter flu season in 2014, higher than that of 2009 when the A(H1N1)pdm09 pandemic virus first circulated (1484). The numbers of patients admitted to ICU with severe acute respiratory illness and influenza infections in 2014 almost doubled compared to 2013. One possible explanation is that for the first time after its absence for three years, A(H1N1)pdm09 viruses became the predominant strain for most of the winter season in 2014. During its absence, different population subgroups may exhibit different rates of waning immunity (ie young adults aged 20–49 years) or no immunity (ie children aged 0–3 years) against this virus. This may have built more susceptible population to A(H1N1)pdm09 infection for certain age groups. A serosurvey conducted in Canada in 2013 showed that seroprotective antibody to A(H1N1)pdm09 was high among school-aged children and elderly; however, seroprotection was lower among very young children and adults between 20–69 years [18]. The SARI surveillance data in 2014 showed higher influenza hospitalization rates in people aged 0–4, 20–34, 35–49 years compared with the previous two years for the same age groups. The low level of pre-existing antibody toward A(H1N1)pdm09 in certain age groups may explain such a demographic shift in increased disease burden in these age groups. Another possible explanation for the high numbers of influenza hospitalisation in 2014 is that more influenza related testing were performed. Although ADHB and CMDHB used the SARI surveillance protocol with standardised testing algorithm and case ascertainment scheme, many other DHBs ordered influenza related testing based on clinical purposes which may not be as standardised and uniformed as using SARI surveillance protocol. This could result in higher volume of testing ordered. Additionally, some small hospital laboratories started to offer influenza related testing which would also contribute to more influenza confirmation. In 2014, about 13,104 specimens were tested from non-sentinel surveillance mainly for outpatients and inpatients. This figure was higher than 7,956 in 2013 and 8,725 in 2012.

One strength 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 diagnosis on the basis of clinical symptoms is not specific. 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 September 2014, four virology laboratories tested 733 respiratory specimens for influenza viruses: 273 (37.2%) specimens were positive. The influenza detection rate varied among DHBs, with a range from 21.7%–85.7%. Such variation may be due to sampling techniques that may contribute to low detection rates. Appropriate sampling of the respiratory tract for viral isolation should maximise the harvest of virally infected, columnar epithelial cells, which would then improve the influenza detection rate [19].

There are three sentinel general practice-based (or GP-based) systems for influenza-like illness surveillance: ESR's sentinel GP-based surveillance, HealthStat sentinel general practice based surveillance and SHIVERS' sentinel general practice based surveillance. Overall, these systems detected similar trends and peaks regarding influenza activity. Thus, it would be efficient and effective to develop one national sentinel general practice-based ILI surveillance in a long-term and sustainable way by combining strengths from the three systems into one system.

The emergence 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. By contrast, all influenza A(H1N1)pdm09 viruses tested in 2009, 2010, 2011 and 2013 were sensitive to oseltamivir. However, two oseltamivir resistant influenza A(H1N1)pdm09 viruses were detected in 2014 and another two in 2012. 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 to provide timely surveillance information, to assist clinicians in choosing antiviral agents for their patients and for public health officials making decisions on stockpiling antiviral agents during a pandemic or epidemic. Timely surveillance information also encourages clinicians to test patients for influenza virus infection to select appropriate antiviral medications.

Because the impact of influenza on people and health systems can be reduced by yearly immunisation, information about 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. A national approach to promotion, coupled with local initiatives, has been key to reaching vaccination coverage of 67.5% for people aged 65 years and older in 2014. However, this is still below the target of 75.0%.

Influenza vaccines are recommended for people at risk of developing complications following infection because of their age or because of underlying chronic conditions [20]. In 1997, New Zealand introduced a programme of free influenza vaccinations to all New Zealanders aged 65 years and older. In 1999, the free vaccination programme was extended to include those aged under 65 who had specified chronic medical conditions [21]. In 2010, the free vaccination was extended to all pregnant women [21]. In 2013, the free vaccination was again extended to children aged less than five who had significant respiratory illness [22]. Quality coverage data is essential for evaluating the effectiveness of influenza vaccines. Therefore, it is crucial that influenza vaccination information from multiple sources is included on the national immunisation register. Progress in this area in the coming years would help us to assess vaccine effectiveness more accurately.

In summary, we have described the national influenza surveillance data collected in 2014 in terms of community disease burden, circulating viral strains, hospitalisations, mortality, and immunisation coverage. The national sentinel GP-based surveillance recorded influenza activity at a low level in the community. SHIVERS hospital-based SARI surveillance and GP-based ILI surveillance showed contrasting sociodemographic patterns. The influenza vaccination coverage reached 67.5% in 2014 in people aged 65 years and older. This report demonstrates that an integrated virological and epidemiological surveillance system for influenza is essential for monitoring the disease burden, identifying circulating strains, guiding effective vaccination and planning for a potential pandemic.

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APPENDIX

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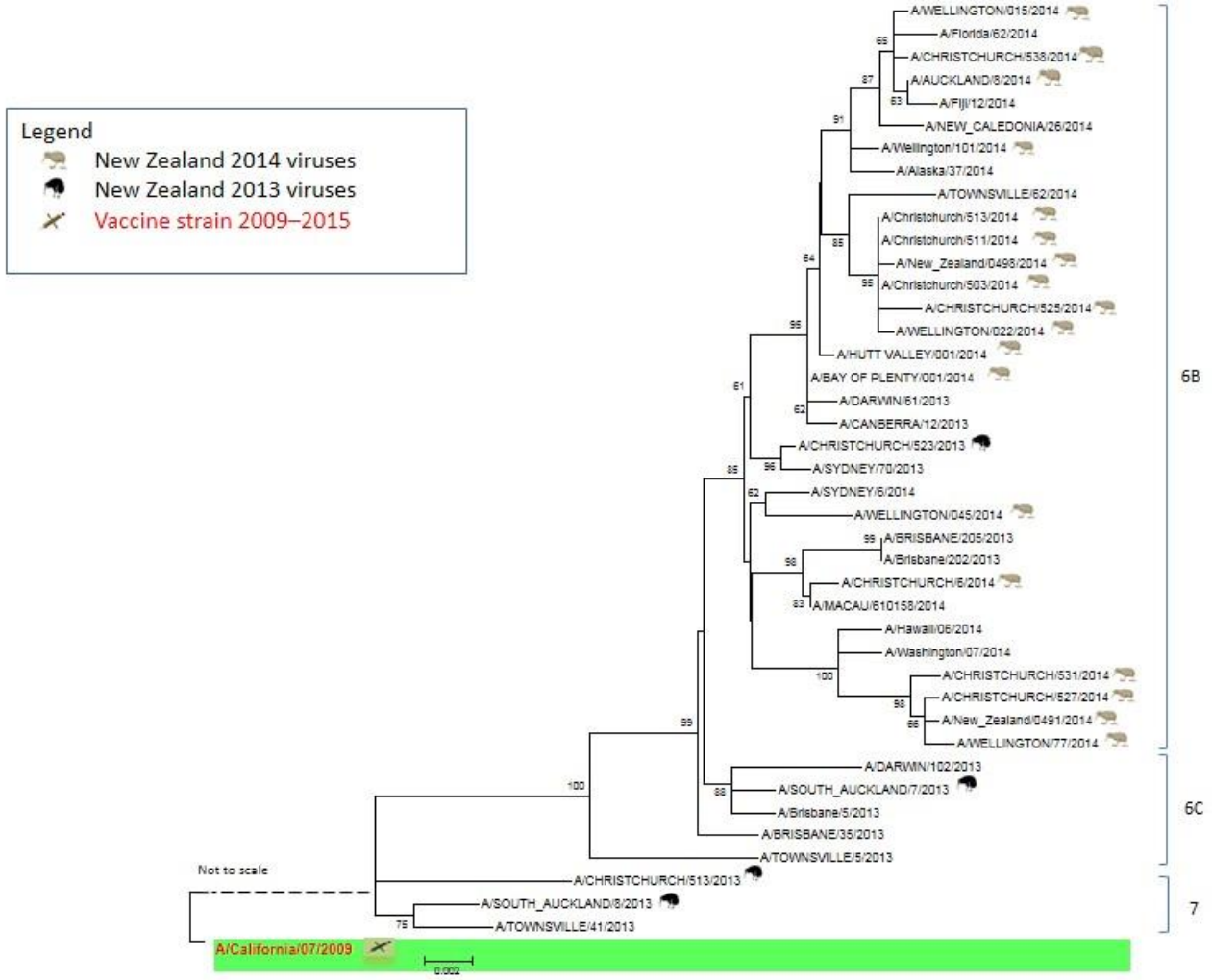
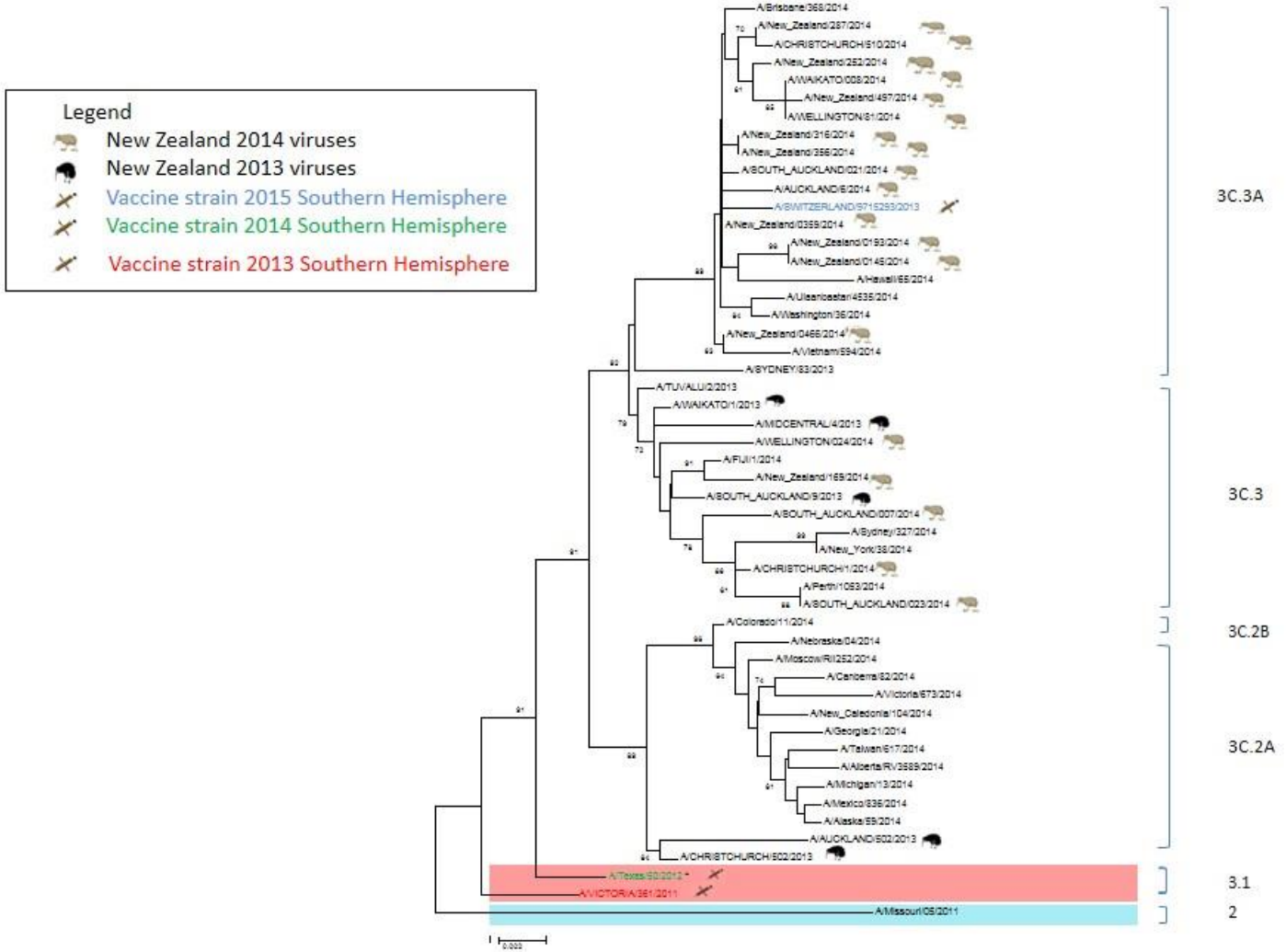
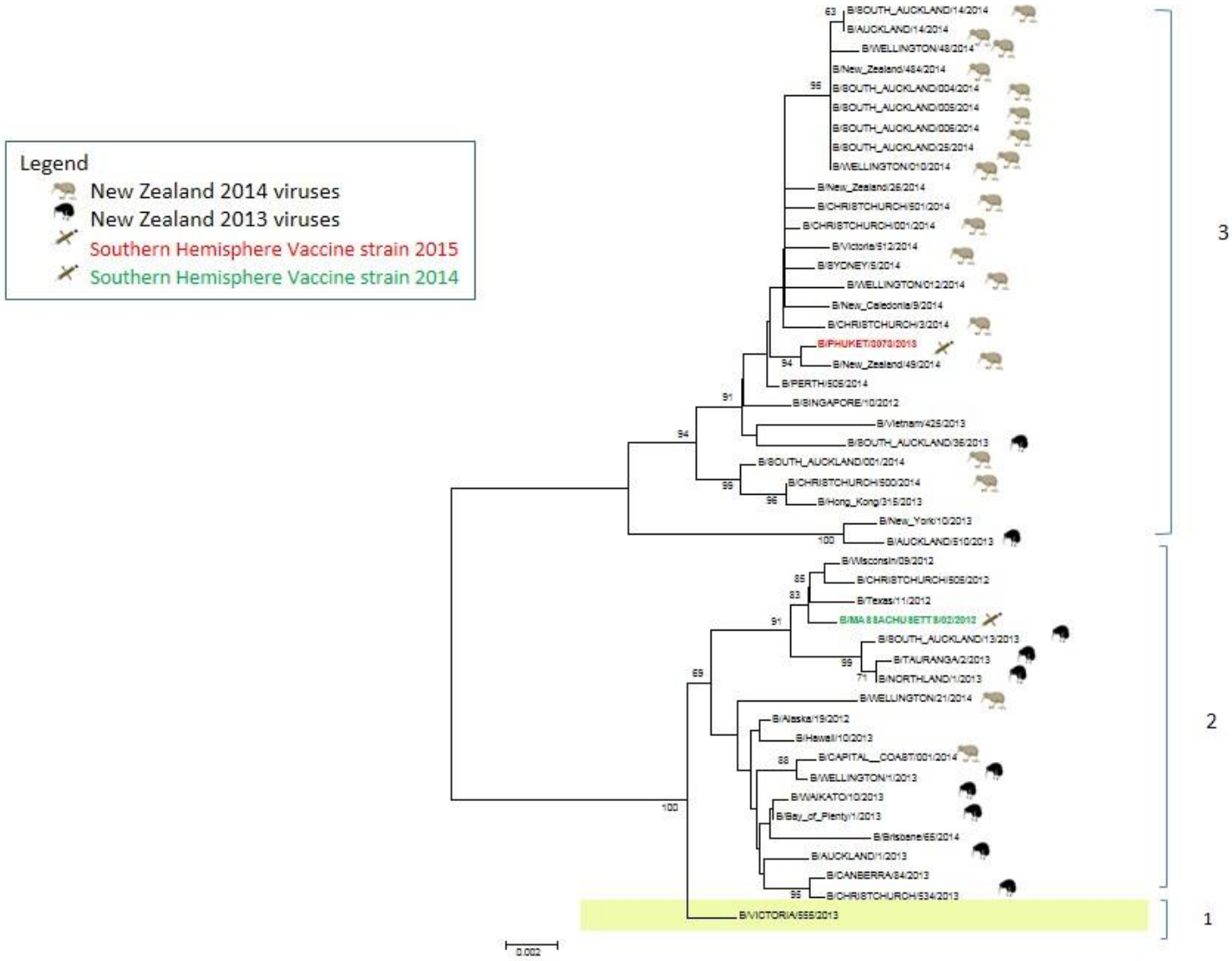
Appendix A. Phylogenetic relationships among influenza A (H1N1) haemagglutinin genes



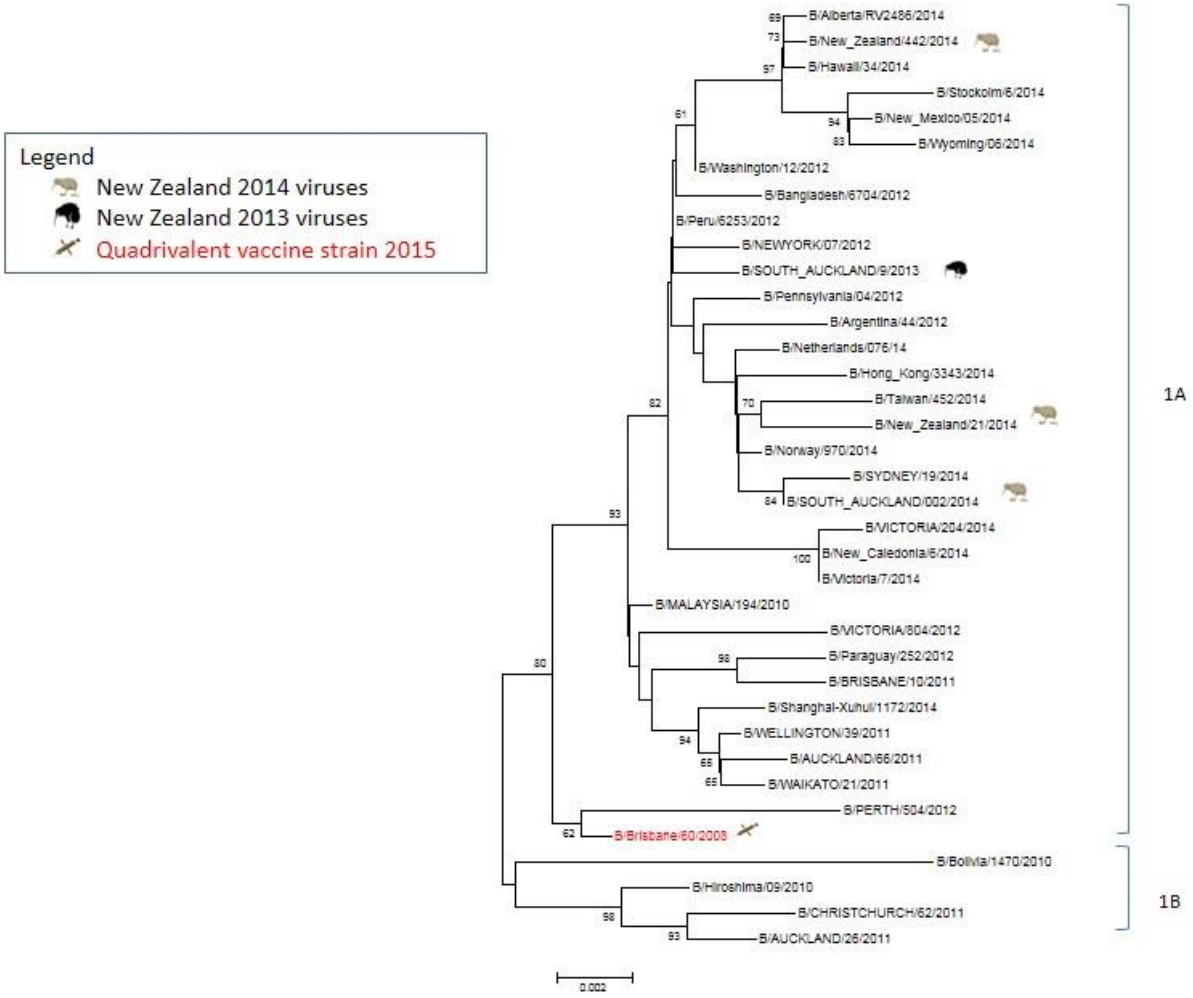
Appendix B. Phylogenetic relationships among influenza A(H3N2) haemagglutinin genes



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



Appendix D. Phylogenetic relationships among influenza B/Victoria haemagglutinin genes



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