Influenza in New Zealand – 2004

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During the 2004 influenza season, 3 277 consultations for influenza-like illness (ILI) were reported from a national sentinel network of 86 general practices. It is estimated that ILI resulting in a visit to a general practitioner affected over 35 186 New Zealanders during the season, compared with an estimated 46 116 in 2003. The national level of ILI in 2004 was relatively low compared with the 1990-2003 period. The highest rates were reported from the Otago and Gisborne Health Districts. Overall, 91.4% of influenza isolates in 2004 were influenza A and 8.6% were influenza B. Among all typed and subtyped isolates, influenza A/Fujian/411/2002 predominated with 47.4% and A/Wellington/1/2004 with 43.4%.

Introduction

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

The purpose of influenza surveillance is:

- to improve knowledge of the incidence and distribution of influenza in the community;
- to assist with early detection of influenza epidemics within the community to help with developing and implementing public health measures; and
- to identify the predominant strains in the community to help plan for an effective influenza vaccine for the subsequent year.[1]

This report summarises results obtained from influenza surveillance in New Zealand for 2004, including some comparisons with previous years. It also includes information on hospital admissions for influenza (obtained from NZHIS) and influenza immunisation coverage data (obtained from Health Benefits Limited).

Methods

General practice sentinel surveillance – consultation and isolate data

The sentinel surveillance system, in its current form, commenced in 1991 as part of the WHO Global Programme for Influenza Surveillance. It is operated nationally by ESR and locally by influenza surveillance co-ordinators in the public health services (PHSs). Normally sentinel surveillance operate from May to September. However, in 2004 due to the late influenza activity it was extended to October with agreement from the Ministry of Health, PHSs, and local virology laboratories.

In 2004, national influenza sentinel surveillance was undertaken from May to October (week 18 to week 44 inclusive). Local surveillance co-ordinators recruited general practices within their region to participate on a voluntary basis. Where possible, the

number of practices recruited was proportional to the size of the population in each health district covered by the PHS (approximately 1:50 000 population).

General practitioners (GPs) were required to record the number of consultations for influenza-like illness each week and the age group (current categories as per Figure 7) of each of these suspected cases on a standardised form.

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

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

Information on the number of consultations and swabs sent from each health district was forwarded to ESR by local co-ordinators each week. Likewise, virology laboratories reported to ESR all influenza viruses identified that week, as well as updated type and strain information, and the total number of swabs received from each health district. This data was collated, analysed and reported on a weekly, monthly and annual basis.

Consultation rates were calculated using the sum of the patient populations, reported by the participating practices, as the denominator. The national level of ILI activity is described using a set of threshold values.[2] A weekly rate below 50 consultations per 100 000 patient population is described as baseline activity. A weekly consultation rate of 50-249 is considered indicative of normal seasonal influenza activity. Within the normal seasonal activity, 50 to 99 is low activity, 100-149 moderate, and 150 to 249 high. A rate of 250-399 indicates higher than expected influenza activity and ≥400 indicates an epidemic level of disease.

Laboratory-based surveillance – year-round isolate data

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

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

Hospitalisations

Hospital admission data for influenza (ICD-10CM code 487) were extracted from the New Zealand Health Information Service's National Minimum Dataset (NMDS) for the year 2004 (by admission date). Influenza-related hospitalisations were conservatively taken to include only those where influenza was the principal diagnosis. Repeat admissions were included, as repeat infections with another influenza A subtype or B virus are possible.

New Zealand Population

Population data for each age group obtained from the Statistics New Zealand 2001 Census of Population and Dwellings were used for calculations and figures.

Immunisation Coverage

In 1997 influenza vaccination was made available free to those ≥65 years of age, and in 1999 free vaccination was extended to risk groups <65 years.[3,4] The data that medical practitioners provide to Health Benefits Limited to claim reimbursement were used to estimate coverage in 2004 among persons ≥65 years of age.

Results

Sentinel Practices

In 2004, 86 sentinel practices were initially recruited from 22 out of the 24 health districts (two health districts did not participate in 2004). All PHSs began reporting by the end of April 2004. Some practices did not report every week. The average number of practices participating per week was 82, with an average patient roll of 348 091.

Disease burden

From May to October 2004, a total of 3 277 sentinel consultations for influenza-like illness were reported. This gives an average national weekly consultation rate of 35.5 per 100 000 patient population. This rate is lower than the average weekly rates for 2003 and 2002 of 56.6 per 100 000 and 43.2 per 100 000 respectively.

Applying these rates to the New Zealand population, it is estimated that ILI resulting in a visit to a general practitioner affected over 35 186 New Zealanders during the influenza season. This total is lower compared with an estimated 46 116 affected in 2003.

Figure 1 compares the weekly consultation rates for influenza-like illness in 2004 with 2003 and 2002. Influenza consultation activity remained at the baseline level from week 18 to 35, and then increased rapidly to a peak at the end of September. The highest consultation rate was reported during week 38 (middle of September) with 127.5 per 100 000 patient population. This is a month later than the peak in 2003 and 2002 during week 27 with a rate of 184.7 per 100 000 and 96.3 per 100 000 respectively. Consultation activity then gradually declined, remaining at a moderate level until week 40, and dropping below the baseline in week 41.

Figure 1: Weekly consultation rates for influenza-like illness in New Zealand, 2002, 2003 and 2004

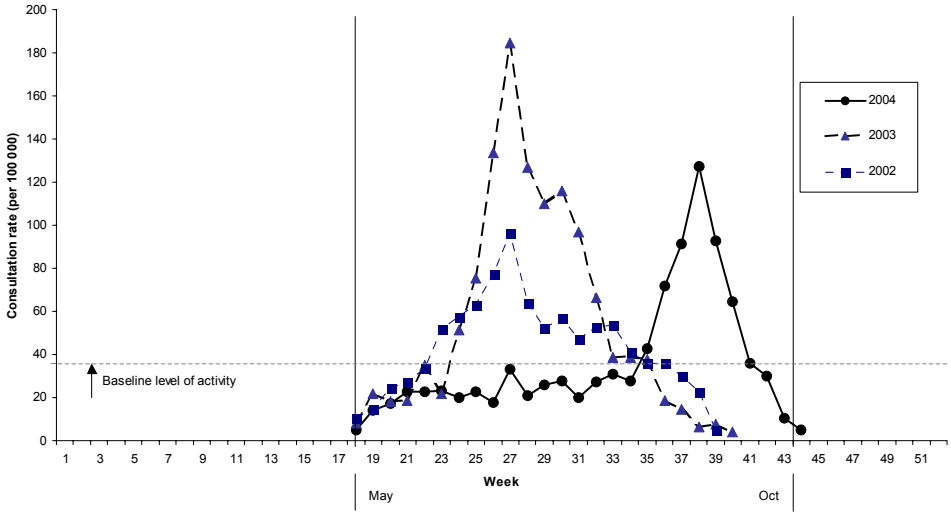


Figure 2: Total influenza isolates by surveillance type and week specimen taken, 2004

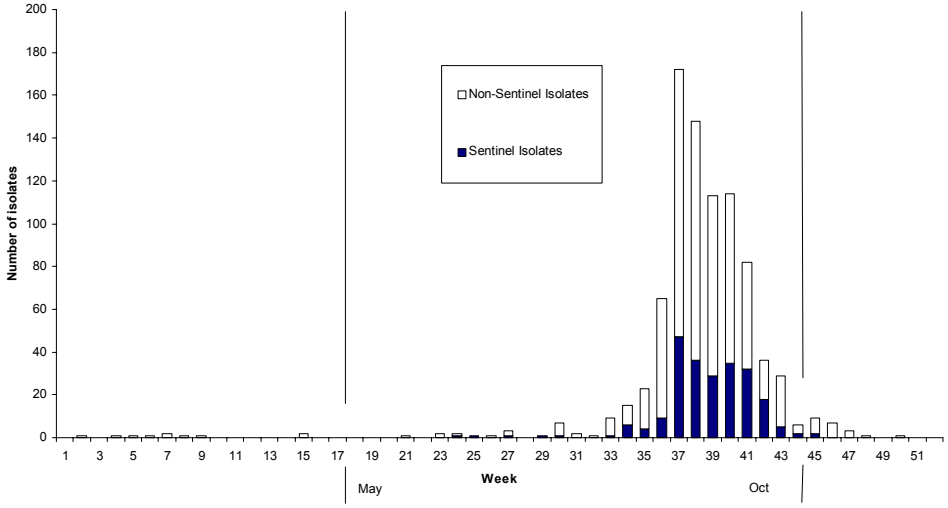
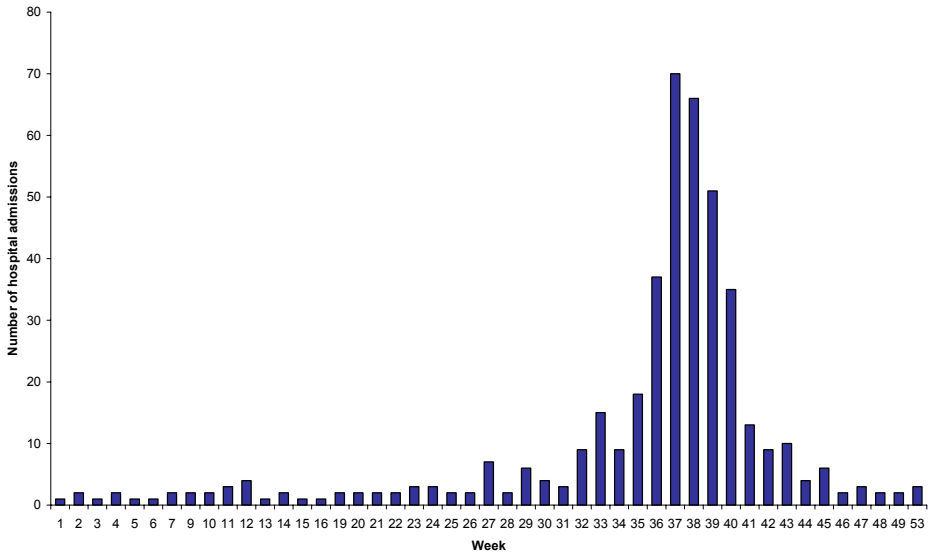


Figure 3: Influenza hospitalisation by week admitted, 2004



A total of 864 influenza isolates were identified in 2004, lower than the 1108 isolates in 2003 but higher than the 702 isolates in 2002. Of the 864 isolates, 231 came from sentinel practice surveillance during May to October. This is similar to 230 sentinel isolates identified in 2003 and 241 isolates in 2002. There were 633 non-sentinel isolates identified in 2004 compared to 878 in 2003 and 461 in 2002.

Figure 2 shows influenza virus isolations each week throughout 2004. The highest number of sentinel isolates (47) came from specimens taken in week 37, a week before the peak in consultation rates. Non-sentinel influenza isolates were identified as early as January, however the vast majority (548, 87%) were from specimens taken during September to October. This is a late activity compared to the activity seen in 2003. Most sentinel and non-sentinel isolates (85%) came from the late half of the sentinel period (weeks 36 to 42).

In 2004, there were a total of 430 hospital admissions for influenza. This compares with 593 admissions in 2003 and 490 in 2002. Figure 3 shows these admissions by week, 89.8% (386) of which occurred during May to October. The highest number of admissions (235) occurred in September. Hospital admissions peaked in week 37, a week prior the peak in consultation rates.

Geographic distribution

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

Figure 4 shows the sentinel average weekly consultation rates for each health district during May to October 2004 (square brackets denotes a health district that did not participate in sentinel surveillance). The health district reporting the highest rate was Otago (122.8 per 100 000 patient population), followed by Gisborne (97.5 per 100 000), Hutt (92.4 per 100 000), Eastern Bay of Plenty (80.6 per 100 000), South Canterbury (76.4 per 100 000), and South Auckland (58.0 per 100 000).

Figure 5 shows the distribution of sentinel influenza isolates based on the health district from which the specimen (swab) was taken. It can be seen that most isolates came from Canterbury, the greater Auckland area, Otago, and Wellington regions. Influenza A was seen throughout the country, with a single AH1N1 seen in Canterbury. Isolates were not identified in four health districts, and swabs for sentinel surveillance were not taken in two health districts. The national isolation rate for 2004, illustrated in Figure 6 was 29.2% (231 isolates from 790 swabs received), which is lower than the 2003 rate of 31.9% (721 swabs), but higher than the 2002 rate of 25.0% (963 swabs).

With regards to influenza isolate geography, it is important to take into account that for some health districts there is a large discrepancy in the reported number of swabs sent by sentinel GPs in that district, and swabs recorded by virology labs as received from that district.

Figure 4: Sentinel average weekly consultation rate for influenza-like illness by health district, 2004

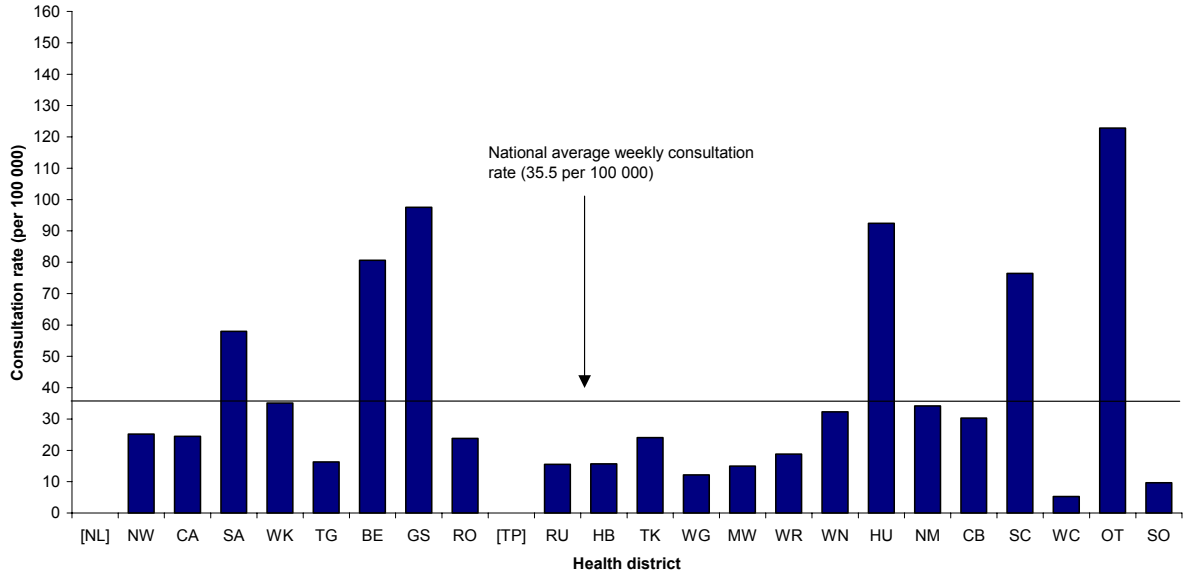


Figure 5: Cumulative laboratory confirmed influenza isolates from sentinel surveillance by health district, May-October 2004

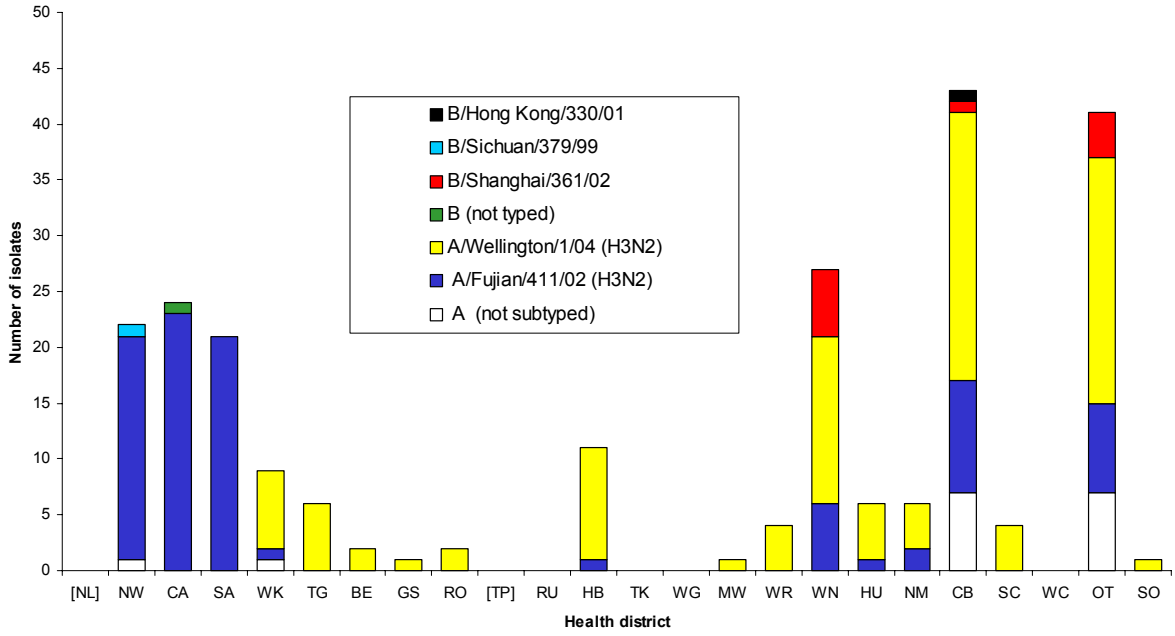
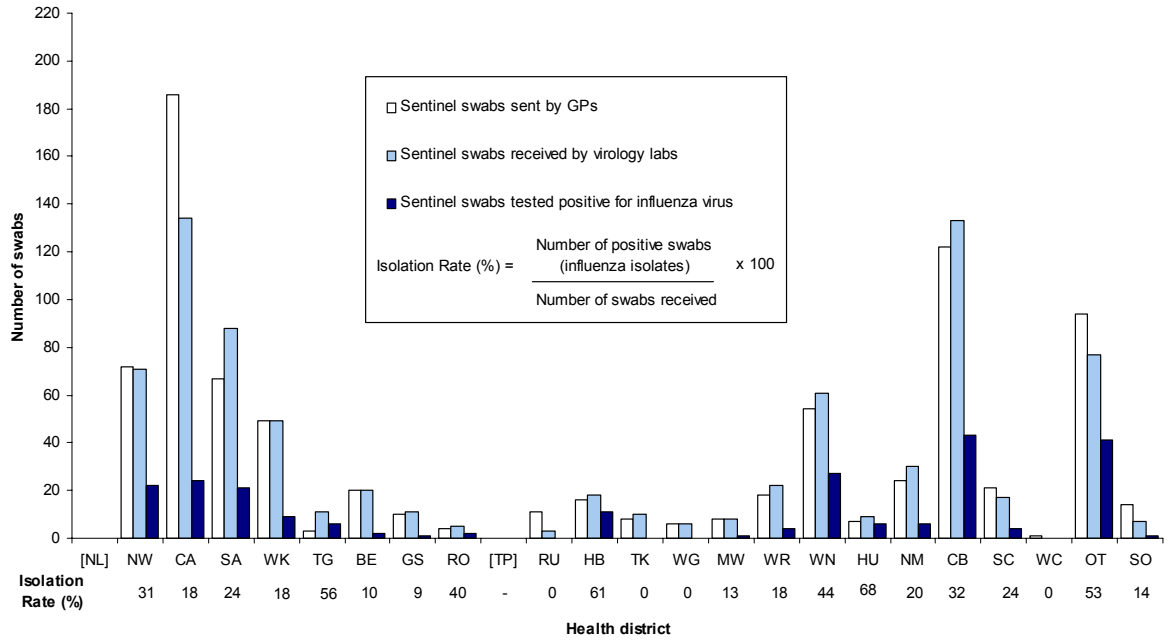
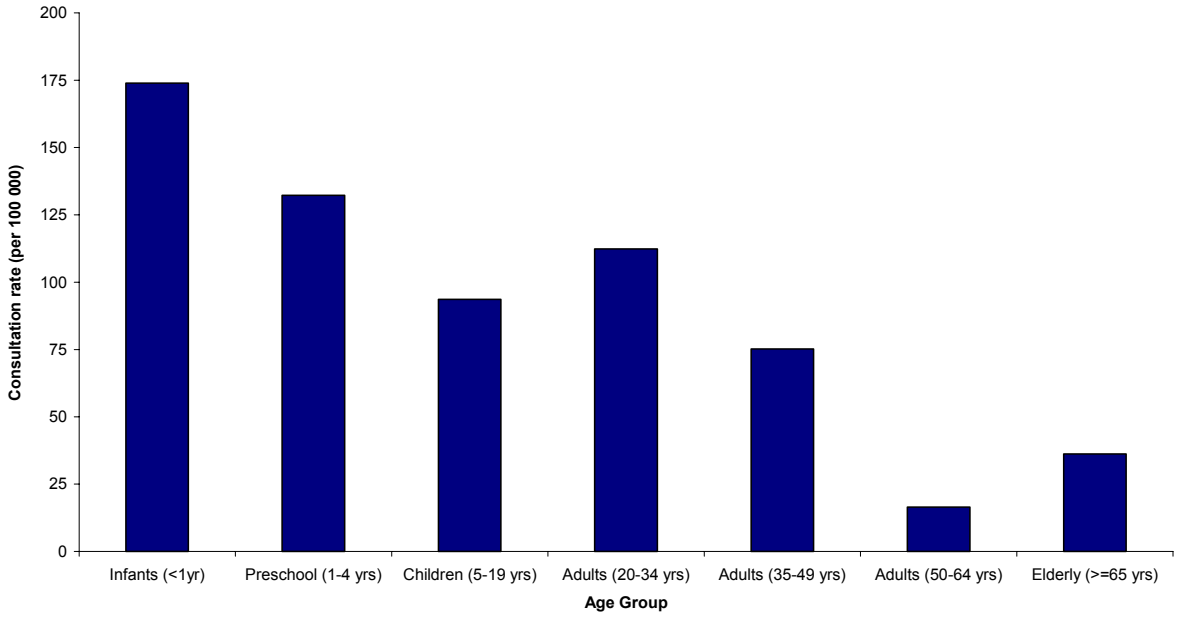


Figure 6: Sentinel swabs, sent, received and tested positive for influenza virus by health district, 2004



Rates of ILI by age group were calculated for each age-band used in the sentinel surveillance system. The denominator for rate calculations was based on the knowledge that the total number of patients from the sentinel practices was 9.3% of the New Zealand population. It was assumed that this practice population collectively had the same age distribution as the New Zealand population. These rates are presented graphically in Figure 7.

Figure 7: Sentinel average weekly consultation rate for influenza-like illness by age group, 2004



The highest consultation rate for influenza-like illness was in pre-schoolers, with an average weekly consultation rate of 173.9 per 100 000 patient population, followed by infants with a consultation rate of 132.3 per 100 000. Children aged 5-19 years had a rate of 93.6 per 100 000. Adults aged 20-34 years had a rate of 112.3 per100 000, and adults aged 35-49 years had a slightly lower rate of 75.2 per 100 000. Elderly people (aged 65 years and over) had a rate of 36.2 per 100 000, and adults aged 50-64 years had the lowest rate of 16.4 per 100 000.

An influenza A outbreak occurred in a rest home in Hutt Valley in the Wellington region in the middle of September 2004. This rest home offers 58 beds. During the outbreak 26 residents became ill. The attack rate was 45%. Four fatal cases occurred and all cases had significant medical problems. Vaccination status for the 26 residents who developed influenza-like illness was as follows: 16 had had flu vaccination (vaccination coverage, 62%), 6 refused vaccinations and 4 with unknown vaccination status. In addition, the rest home has approximately 74 staff members, 17 developed influenza-like illness during the outbreak. The Ministry of Health released the antiviral drug-Tamiflu for prophylaxis for residents within 48 hours of the onset of symptoms. Tamiflu was also provided for unaffected residents and staff. The outbreak appeared to be controlled by these measures. The causative agent was influenza A(H3N2)/Fujian-like strain. These influenza viruses were A/Fujian-low reactors with reduced reactivity (8 fold or greater) against A/Fujian antisera compared with the homologous virus. The vaccine breakthrough could be due to the drifting of A(H3N2) viruses.

Figures 8 and 9 show the percentage of influenza consultations, hospitalisations, and isolates contributed by each age group.

Figure 8: Percentage of sentinel consultations for influenza-like illness and hospitalisations by age group, 2004

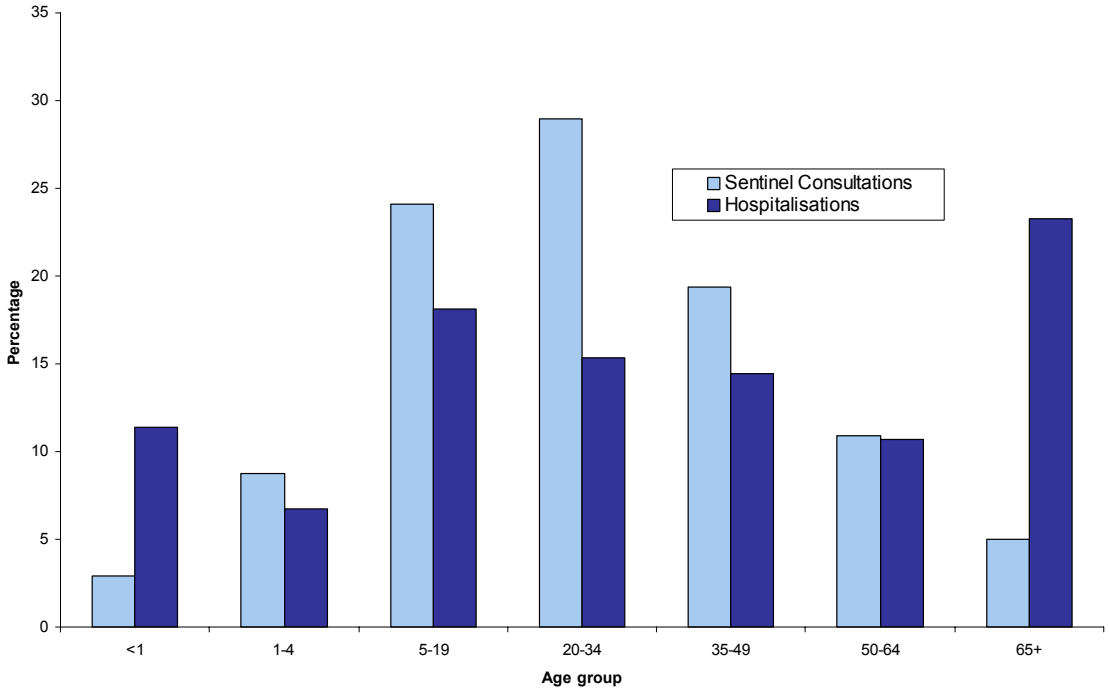
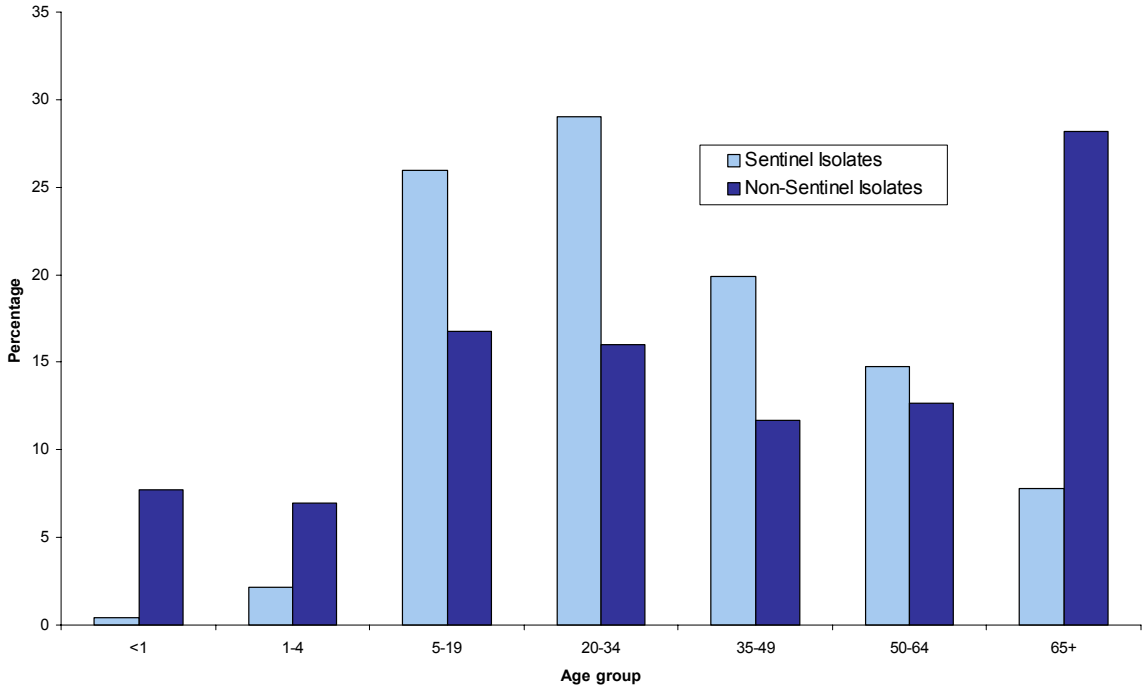


Figure 9: Percentage of sentinel and non-sentinel influenza isolates by age group, 2004



Immunisation Coverage

The uptake of influenza vaccine in New Zealand in 2004 among persons 65 years and over is estimated at 65%. Immunisation coverage for at risk individuals under the age of 65 years is estimated at 33%. The number of doses of influenza vaccine used during the 2004 season was 172 doses per 1000 population.

Virus strain characterisation and 2004 vaccine formulation

2004

Figure 10 shows influenza virus isolations by type and subtype for each week throughout 2004, and the total percentage contribution of each.

The majority of influenza isolates (790/864 or 91.4% of all isolates) were characterised as influenza A. Influenza B made up 8.6% (74/864) of all isolates in contrast to 0.3% in 2003.

As shown in Figure 11, the general pattern of influenza A isolations showed a relatively rapid rise in activity, peaking in week 38 (middle of September), and the majority of A isolates occurred in the late season. This was largely made up of A(H3N2), which was the predominant strain of influenza isolates in 2004 overall, and the most frequently isolated subtype or type from weeks 37 to 47. There were 658 A(H3N2) isolates identified in 2004, which represents 91.3% of typed and subtyped isolates (721) and 76.2% of all influenza isolates (864). For all typed and subtyped isolates 0.1% (1/721) and 0.1% (1/864) of all isolates were influenza A(H1N1). In contrast to influenza A, influenza B co-circulated with A(H3N2) throughout the season, but peaked in week 43, six weeks later than that of A(H3N2). Influenza B represented 8.6 % (62/721) of the typed and subtyped isolates.

Figure 10: Total influenza isolates by type and week specimen taken, 2004

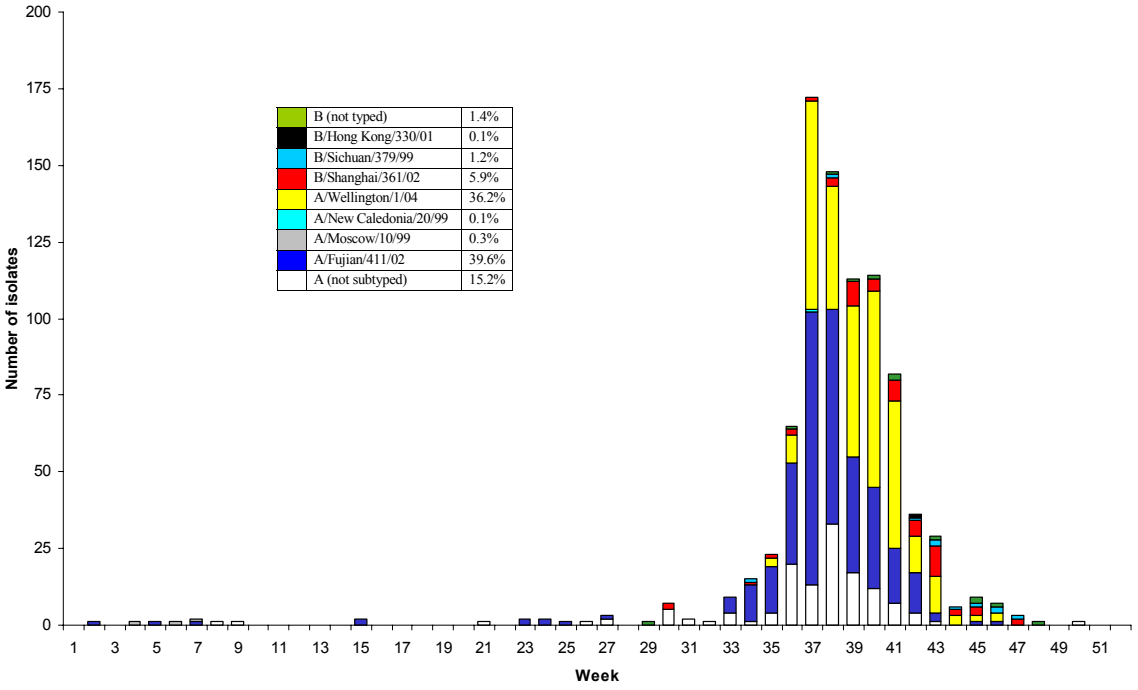
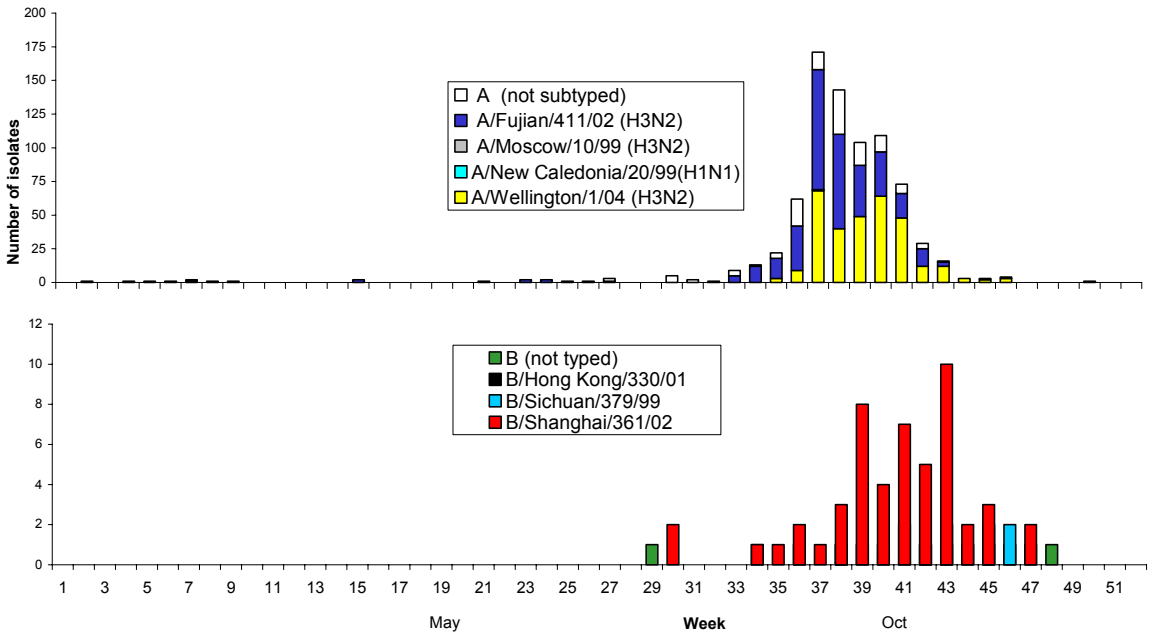


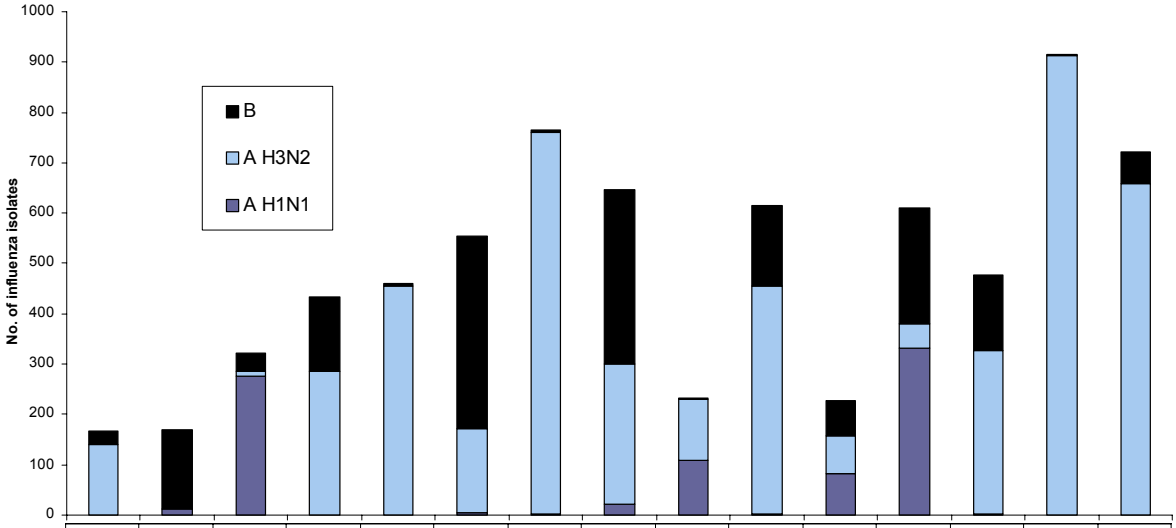
Figure 11: Total influenza virus isolates by type and week specimen taken, 2004



Changes in Isolates 1990-2004

Figure 12 shows the number and percentage of typed and subtyped (not total) influenza isolates from 1990 to 2004. There are three noticeable changes in terms of predominant patterns:

Figure 12: Influenza isolates by type, 1990-2004



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
B	16%	92%	11%	34%	1%	69%	1%	53%	1%	26%	31%	38%	32%	0%	9%
A H3N2	83%	0%	3%	66%	99%	30%	99%	43%	52%	74%	33%	8%	67%	100%	91%
A H1N1	1%	8%	86%	0%	0%	1%	0%	4%	47%	0%	36%	54%	0%	0%	0%

Influenza A(H1N1)

During 1990 to 1999, influenza A(H1N1) predominated or co-dominated only in 1992 (86% of typed/subtyped isolates) and 1998 (47% of typed/subtyped isolates). However in 2001 and 2000, influenza A(H1N1) predominated consecutively, which is an unusual feature. There were 82 A(H1N1) isolates in 2000 (36% of typed/subtyped isolates) and 331 in 2001 (54% of typed/subtyped isolates). This is in contrast to 2003 and 2004, when only one A(H1N1) was isolated.

Influenza A(H3N2)

Influenza A(H3N2) viruses have often been associated with more severe disease and with excess pneumonia and influenza mortality. For example, the highest peak of deaths at 94 in 1996 in New Zealand was recorded during an A(H3N2) epidemic.[5] During 1993 to 2000, A(H3N2) had been the predominant or co-dominant strain for each year. In 2001, A(H3N2) constituted only 8% of typed/subtyped isolates. However, A(H3N2) had predominated with 68% of typed/subtyped isolates in 2002, 100% in 2003, and 91% in 2004. A(H3N2) distribution pattern in 2004 was very similar to that in 1994, 1996, and 2003 with over 90% of typed/subtyped isolates as A(H3N2).

Influenza B

It is well documented that influenza B predominates or co-dominates every second year in southern hemisphere. In New Zealand, influenza B predominated or co-dominated in 1991, 1993, 1995, 1997, 1999 and 2001. However, this pattern has changed since 2001.

Influenza B has been the co-predominant strain consecutively in 2001 and 2002, while very low influenza B activity was observed in 2003 and 2004. In 2003, there were only three (0.3%) influenza B isolations but this has increased to 9% (64) in 2004 similar to what was seen in 1992 (11%, 37).

Southern Hemisphere Trends

In October 2004, the Australian Influenza Vaccine Committee (AIVC), with a New Zealand representative, met to decide on the composition of the influenza vaccine for the 2005 winter season for New Zealand, Australia and South Africa. During these discussions, the following trends were noted:

Influenza A(H1N1)

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

During the 2001-2003 season, it was found that genetic reassortant influenza viruses with H1N2 antigens were circulating and were the predominant H1 viruses in certain areas such as UK but not New Zealand. The haemagglutinin of these viruses was derived from the A/New Caledonia lineage whereas the neuraminidase (and the other 6 genes of the viruses) were derived from the contemporary A(H3N2) human strains.

The Australian WHO Collaborating Centre showed that most A(H1N1) isolates from the Southern Hemisphere in 2004, including New Zealand, were A/New Caledonia/20/99. Based on the southern hemisphere and global data, the WHO Consultative Group concluded that there was no need to change the vaccine strain from an A/New Caledonia/20/99-like virus. Two factors still remain true for the recommendation of A/New Caledonia/20/99-like virus for the year 2005 vaccine formulation:

- Increasing incidence of viruses of this type, and
- The demonstration that, in humans, vaccines containing viruses of this lineage induce similar antibody responses against both the homologous virus and A/Bayern-like strains whereas the converse was not true.

Influenza A(H3N2)

Influenza A(H3N2) has been frequently associated with severe disease and excess mortality in high-risk groups. This subtype has also shown the greatest tendency for antigenic drift as illustrated by the frequency of vaccine formulation changes recommended by the WHO and the AIVC. In the 2004 winter in New Zealand and Australia, influenza A(H3N2) was by far the predominant subtype.

The WHO Collaborating Centre for Influenza in Melbourne has analysed 464 A(H3N2) isolates from 13 countries since January 2004. These viruses made up the majority (74.7%) of all viruses analysed at the Centre. An increasing proportion (41%) of viruses had reduced reactivity (8 fold or greater) with the A/Fujian/411/2002 antisera compared with that with the homologous virus. The drifting of influenza A(H3N2) virus was also observed in New Zealand in 2004. The ESR national influenza reference laboratory also

detected that a significant percentage (73.9%, 122/165) of A(H3N2) viruses were A/Fujian virus-low reactors. As a result, A/Wellington/1/2004 was recommended by WHO and the Australia Influenza Vaccine Committee to be the H3 component of the influenza vaccine for southern hemisphere in 2005. A/Wellington/1/2004 was isolated in ESR from a 57 year old New Zealander who developed influenza-like illness soon after his return from Guangzhou, a southern Chinese city.

Influenza B

Two distinct lines of influenza B have been observed during recent years. This dates back to 1990 when the B/Panama/45/90 variant of influenza B arose whilst strains of the previous B/Victoria /2/87-like viruses continued to circulate in Asia. This strain and its further variants (most recently representative strain-B/Sichuan/379/99) spread worldwide including New Zealand whereas strains of the previous B/Victoria/2/87-like viruses (most recently representative strain-B/HongKong/330/2001) continued to circulate in Asia and subsequently underwent independent evolution as an antigenically distinct lineage. For reasons not understood these remained geographically restricted to Asia until 2001.

In May-June 2001 some isolates of the B/Victoria lineage were found in Hawaii, but not in other non-Asian countries. Further spread of viruses of this lineage then commenced in the 2001-2002 Northern winter and they progressively became prominent in some countries, particularly in North America. Before 2002, all influenza B isolates from New Zealand belonged to the B/Sichuan/379/99 lineage. In 2002, they were replaced almost exclusively by B/HongKong/330/2001-like virus. In 2003, three influenza B viruses were isolated (two B/Sichuan/379/99-like and one B/Hong Kong/330/01-like virus). In 2004, almost all except one influenza B isolates from New Zealand belong to B/Sichuan/379/99 lineage viruses. They have undergone genetic shift and were antigenically closer to B/Shanghai/361/2002-like strain.

The Australian WHO Collaborating Centre showed that the majority of B isolates from the Southern Hemisphere in 2004, including New Zealand, were B/Shanghai/361/2002 lineage viruses. Current vaccines containing influenza B/ Shanghai/361/2002 antigen induced anti-HA antibodies to recently isolated viruses, which were of similar titre and frequency to those against the vaccine virus. Based on the southern hemisphere and global data, the WHO consultation group concluded that vaccines containing a B/ Shanghai/361/2002 -like strain as B component for 2005.

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

The recommended influenza vaccine formulation for New Zealand in 2005 is:

- **A(H1N1)** **an A/New Caledonia/20/1999-like strain**
- **A(H3N2)** **an A/Wellington/1/2004-like strain**
- **B** **a B/Shanghai/361/2002-like strain**

Discussion

Based on sentinel consultation data using a set of threshold values, influenza activity in 2004 is described as moderate. When weekly consultation rates for influenza-like illness from 1992 to 2004 are compared, 2004 has the fifth lowest level of influenza activity, with 2000, 1998, 2002, and 2001 the first, second, third, and fourth lowest respectively.

It is estimated that influenza-like illness resulting in a visit to a general practitioner affected over 35 186 New Zealanders in 2004 or about 0.9% of the population. The number of cases reported through the sentinel network is likely to be a considerable underestimate of the true number, as many people do not consult a general practitioner when they have an influenza-like illness.

Influenza activity in 2004, like in 2000, had an unusual late peak from the middle of September to early October, whereas normal influenza activity peaks in June-July each year. When the overall pattern for sentinel consultation rates, isolations and influenza hospitalisations are compared for 2004 (Figures 1-3), they follow a very similar pattern, peaking in mid September to early October and then declining to the baseline level in mid October. The robustness of the sentinel influenza surveillance has been validated externally by another system, GPSURV.[6] The sentinel surveillance operates in May-September. In 2004, the sentinel surveillance operation had to be extended for an additional month in October. Due to the variability of influenza activity from year to year, there is a need for sentinel surveillance to extend beyond the current May to September period, ideally to year-round surveillance.

Consultation rates varied greatly among health districts. The use of a common case definition for the purposes of surveillance should minimise regional differences in the criteria for diagnosis of influenza. However, in health districts where only a single practice or a small number of practices participate, consultation rates are more likely to be subject to variations in individual diagnostic practices. The health district reporting the highest rate was Otago (122.8 per 100 000 patient population).

In 2004 in New Zealand, there was a total of 430 hospital admissions for influenza, the fifth highest recorded number in the 15 years from 1990 to 2004. For A(H3N2), there were 457 (72.2%, 457/633 of total non-sentinel isolates) isolations. A further 201 A(H3N2) isolates were from sentinel surveillance. Influenza A(H3N2) predominated exclusively in 2004 (658, 91.3% of typed/subtyped isolates). This is the third highest A(H3N2) isolation in the last 15 years. Influenza A(H3N2) has been more frequently associated with severe disease and excess mortality in high-risk groups. The majority of New Zealand A(H3N2) isolates in 2004 have drifted from A/Fujian/411/2002-like (47.4%) to A/Wellington/1/2004-like strain (43.4%). Therefore, the vaccine strain (A/Fujian/411/2002-like virus) did not match the circulating strain well enough to protect the population fully against A/Wellington/1/2004-like virus. This may partly explain the high numbers of hospital admissions. The drifting of influenza A(H3N2) viruses may also contribute to cases of vaccine breakthrough or failure anecdotally reported in Wellington, Waikato and Otago regions. The influenza sentinel surveillance could be improved in the future by recording the influenza vaccination history in the specimen request form, so that vaccination breakthrough or failure could be systematically surveyed. In addition, it is important to further characterise the viruses isolated from the vaccine breakthrough or failure cases.

One of the strengths of the sentinel surveillance system in New Zealand is the combination of disease surveillance (influenza-like illness) and strain surveillance (virological identification). A definitive diagnosis of influenza requires laboratory confirmation, since clinical diagnosis on the basis of clinical symptoms is not highly specific. Consequently, an important part of the sentinel system is for GPs to take throat and/or nose swabs from patients presenting with an influenza-like illness on Monday, Tuesday and Wednesday of each week. During the 2004 season, some health districts had a small number of swabs or no swabs taken at all which influences the reported rates in those health districts.

For sentinel surveillance from May to October 2004, 5 virology laboratories tested 790 respiratory specimens for influenza viruses and 231(29.2%) specimens were positive for influenza viruses. However, the influenza isolation rate varies among different health districts (Figure 6). Some health districts had an influenza virus isolation rate lower than the national average of 29.2%. Many factors could contribute to low isolation rates, including sampling techniques. Sampling of the respiratory tract for clinical viral isolation should maximise the harvest of virally infected columnar epithelial cells. Ideally, nasopharyneal washes or aspirates would be the best specimens since they contain a higher cellular content than nasopharyneal swabs.[6] By comparison, throat swabs or throat washings are of limited use in the diagnosis of influenza since the majority of cells captured by this technique are squamous epithelia. However, a combined nose (i.e. nasophrayngeal) and throat swab can be a useful specimen for influenza virus isolation and it is selected for influenza surveillance because of its convenience. Nasopharyngeal swabs should be cotton-, rayon- or dacron-tipped, plastic-coated swabs. The swab should be inserted deeply into the nasopharynx, rotated vigorously to collect columnar epithelia cells, removed, replaced into viral transport medium (VTM), chilled and couriered to the virology laboratory without delay.

Pre-schoolers (1-4 years) and infants (<1 year) were most likely to be seen by a general practitioner for an influenza-like illness in 2004. The higher consultation rate for this age group is probably due, in part, to children under five being most likely to be seen by a general practitioner when they are suffering from an influenza-like illness. Those aged 50-64 years reported the lowest consultation rate followed by those aged over 65 years. This may be due to relatively higher vaccination rates among these groups. However, the mortality rate is markedly higher in those aged over 65 years. For example, this age group accounted for 94.1% of deaths from influenza recorded for the 1990-98 period,[5] The data on the number of deaths from influenza in 2004 were not yet available.

Looking at the influenza age group data from sentinel surveillance and hospitalisations (Figures 7 - 11), it is interesting to note that there were more hospital admissions for under 5 year olds and ≥ 65 year olds relative to other age groups when compared to the pattern seen for sentinel consultations. Possible explanations include a greater severity of illness in the very young and elderly populations leading to higher hospitalisation rates, and/or less specific symptoms in these groups increasing the difficulty of making a clinical diagnosis in general practice.[5]

Comparing age data for positive influenza virus isolates from sentinel and non-sentinel surveillance (Figures 10 and 11), the sentinel system tends to detect less influenza viruses in the under 5's relative to other age groups but comparable to its non-sentinel – laboratory-based, mainly hospital – counterpart for the ≥65 year olds. This may reflect a greater reluctance among sentinel GP's to take swabs from very young children. Overall,

these data indicate that sentinel and hospital surveillance complement each other, providing a better description of influenza disease burden for different age groups.

From 2001 until now, 5 virology laboratories have been using the ESR-designed electronic virus input form for data entry for influenza. This first generation of virus input form requires the virology staff to retrieve the necessary demographic data from their hospital information system, manually enter it on the virus input form and then send it to ESR. This system inevitably creates data entry errors and it is time consuming. Advances in information technology could be used to streamline the process of sending the data between hospital and ESR systems e.g. using the Health-Link system.

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

As the impact of influenza can be reduced by annual immunisation, this information is particularly important in raising awareness of the disease amongst health professionals and the public, and planning vaccine formulation and delivery. Influenza vaccines are recommended for persons at risk of developing complications following infection because of their age or because of some underlying chronic condition, and are available free each year.[7]

In 1997, New Zealand introduced free influenza vaccination to all New Zealanders aged 65 years and older, and set a target of 75% coverage for the year 2000. In 1999 free vaccination was extended to include those under 65 years with certain chronic medical condition. [7,8] In late 1999, with coverage of the 65 and over group at 55%, it was obvious that the national target was not going to be met. A new promotion group, the National Influenza Immunisation Strategy Group (NIISG) was established in 2000 with the purpose of improving coverage through public and healthcare provider education. The Group is comprised of members from the Ministry of Health, District Health Boards, the Royal NZ College of GPs, the College of Practice Nurses, the Immunisation Advisory Centre, Communications, and the pharmaceutical company which supplies the free vaccine. It is well documented that health professional enthusiasm and support for immunisation is the single most important predictor of a patient being immunised against influenza.[8] For this reason, significant activities of NIISG have been in the area of healthcare professional education. The "Influenza Kit" and ""Education Manual" were specifically developed for this purpose. Other education resources include pamphlets, radio and television advertising, healthcare professional education sessions and developing close links with the National Influenza Pandemic Planning Committee. Media evaluation is in place and research has been initiated into attitudes to immunisation in primary health providers and those 65 years and older.[9] A national approach to promotion, coupled with local initiatives, has been a key to lifting coverage to 65% amongst those at greatest risk, people 65 year and older. Quality coverage data are essential for the continuing development of

this programme, while continuing surveillance ensures the provision of effective vaccines to reduce the burden of influenza in New Zealand.

The influenza sentinel surveillance system is possibly the only ongoing syndromic surveillance system in New Zealand. Most other surveillance systems are based on collecting data on diagnosed disease. Syndromic surveillance is increasingly being developed as an approach to detecting new emerging pathogens that may initially present as non-specific infectious diseases.[10] It is also being promoted as a strategy to improve the early detection of bioterrorism attacks.[8] Improving influenza surveillance is also a key strategy for improving New Zealand's preparedness for pandemic influenza.[11] The action plan derived from the pandemic influenza exercise became the framework for New Zealand's response to severe acute respiratory syndrome (SARS) in 2003 and highly pathogenic avian influenza (H5N1) in 2004. The influenza surveillance system could be readily adapted to increase its sensitivity for detecting cases of H5N1 infection in humans.[12] There is a good case for reviewing New Zealand's existing influenza surveillance system and considering extensions to it.

Recommendations

1. That the sentinel influenza surveillance system be reviewed using standard surveillance system criteria and benchmarked against international best practice. This review should include consideration of:
   - The case definition for ILI
   - The methods of specimen collection from cases
   - Extending the system to operate all year
   - Greater use of electronic approaches to data collection and dissemination
   - Improvement of recording of swabs sent and received so isolation rates can be calculated with greater accuracy
   - Incorporation of the influenza vaccination history in the specimen request form in the 2005 surveillance program

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

Acknowledgements

We would like to thank the general practitioners and their staff, the local surveillance coordinators, regional virology laboratories, and medical officers of health involved in influenza surveillance for their time and cooperation. We would also like to acknowledge the Virology Laboratory at ESR for the provision of laboratory data, Trev Margolin, Hui Chen for their assistance in the running of the electronic flu database, and Graham MacBride-Stewart for peer review. A special thanks to Rebecca Kay for providing influenza hospitalisation data for 2004, Lance Jennings for providing influenza immunization coverage data for 2004, and to Annette Nesdale for providing details on the influenza outbreak in a Hutt Valley rest home.

References

1 Report of the WHO/GEIG Informal Consultation on the Standardization and Improvement of Influenza Surveillance, Monaco, September 1991.

2 Dedman DJ, Joseph CA, Zambon M, et al. Influenza surveillance in England and Wales: October 1996 to June 1997. CDR Rev 1997; 13: R212-9.

3 Influenza vaccine. [Circular letter] to health professionals. Wellington: Ministry of Health, 1996.

4 Jennings LC, Baker S. Government policy change in 1997 was essential for the implementation of an influenza vaccination strategy for New Zealand. In: Osterhaus ADME, et al, editors. Options for the control of influenza IV. Proceedings of the Fourth International Conference on Options for the Control of Influenza; 2000 Sep 23-28; Hersonissos, Greece. Amsterdam: Elsevier, 2001.

5 Jennings L, Huang QS, Baker M, et al. Influenza surveillance and immunisation in New Zealand, 1990-1999. NZ Public Health Report 2001; 8: 9-12.

6 Jones N, Marshall R. Evaluation of an electronic general-practitioner-based syndromic surveillance system-Auckland, New Zealand, 2000-2001. MMWR 2004; 53:173-178.

7 Centers for Disease Control. "Update: influenza-associated deaths reported among children aged <18 years-United States, 2003-4 influenza season. MMWR 52 (53):1286-1288.

8 Zambon M. Chapter 22: Laboratory Diagnosis of Influenza. In: Nicholson KG, Webster RG, Hay AJ, eds. Textbook of Influenza. London: Blackwell Science Ltd, 1998.

9 Weir R, Brunton C, Jennings LC. Attitudes to influenza immunisation amongst General practitioners, Practice nurses and those 65 years and older. Abstracts, New Zealand Immunisation Conference, Christchurch, September 2002.

10 Hampson AW. Vaccination of the older adult: the Australian experience. Vaccine 1999; 17: S63-S66.

11 Rana A, Hajjeh D, Relman P, et al. Surveillance for unexplained deaths and critical illnesses due to possibly infectious causes, United States, 1995–1998. Emerg Infect Dis 2002; 8: 145-53.

12 Outbreaks of avian influenza A (H5N1) in Asia and interim recommendations for evaluation and reporting of suspected cases—United States, 2004. MMWR Morb Mortal Wkly Rep. 2004; 53:97-100.