Influenza in New Zealand – 2003

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During the 2003 influenza season, 3 470 consultations for influenza-like illness (ILI) were reported from a national sentinel network of 89 general practices. It is estimated that ILI resulting in a visit to a general practitioner affected over 46 116 New Zealanders during the season, compared with an estimated 34 730 in 2002. The national level of ILI in 2003 was relatively low compared with the 1990-2002 period. The highest rates were reported from the Otago and South Canterbury Health Districts. Overall, 99.7% of influenza isolates in 2003 were influenza A and 0.3% were influenza B (2 of B/Sichuan/379/99 and 1 of B/HongKong/330/2001). Influenza A(H3N2) was the dominant subtype with 62.7% as A/Fujian/411/2002 and 36.8% as A/Moscow/10/99 strains.

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 2003, 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).

In 2003, national influenza sentinel surveillance was undertaken from May to September (week 18 to week 40 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 6) 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

Hospitalisations for influenza (ICD-9CM code 487) were extracted from the New Zealand Health Information Service's National Minimum Dataset (NMDS) for the year 2003 (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. Data from December 2003 are provisional at the time of writing.

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.

Results

Sentinel Practices

In 2003, 89 sentinel practices were initially recruited from 22 out of the 24 health districts (two health districts did not participate in 2003). All PHSs began reporting by the end of April 2003. Some practices did not report every week. The average number of practices participating per week was 85, with an average patient roll of 281 228.

Disease burden

From May to October 2003, a total of 3 470 sentinel consultations for influenza-like illness were reported. This gives an average national weekly consultation rate of 56.6 per 100 000 patient population. This rate is higher than the average weekly rate for 2002 of 43.2 per 100 000 but lower than the 2001 rate of 62.8 per 100 000.

Applying these rates to the New Zealand population, it is estimated that ILI resulting in a visit to a general practitioner affected over 46 116 New Zealanders during the influenza season. This total compares with an estimated 34 730 affected in 2002.

Figure 1 compares the weekly consultation rates for influenza-like illness in 2003 with 2002 and 2001. Influenza consultation activity remained at the baseline level from week 18 to 24, and then increased rapidly to a peak at the start of July. The highest consultation rate was reported during week 27 (27 June - 04 July) with 184.7 per 100 000 patient population. This is the same week that had the highest consultation rate in 2002 with 96.3 per 100 000, but is a week later than the highest consultation rate in 2001 with 140.3 per 100 000. Consultation activity then gradually declined, remaining at a moderate level until week 30, and dropping below the baseline in week 33.

Figure 1: Weekly consultation rates for influenza-like illness in New Zealand, 2001, 2002 and 2003

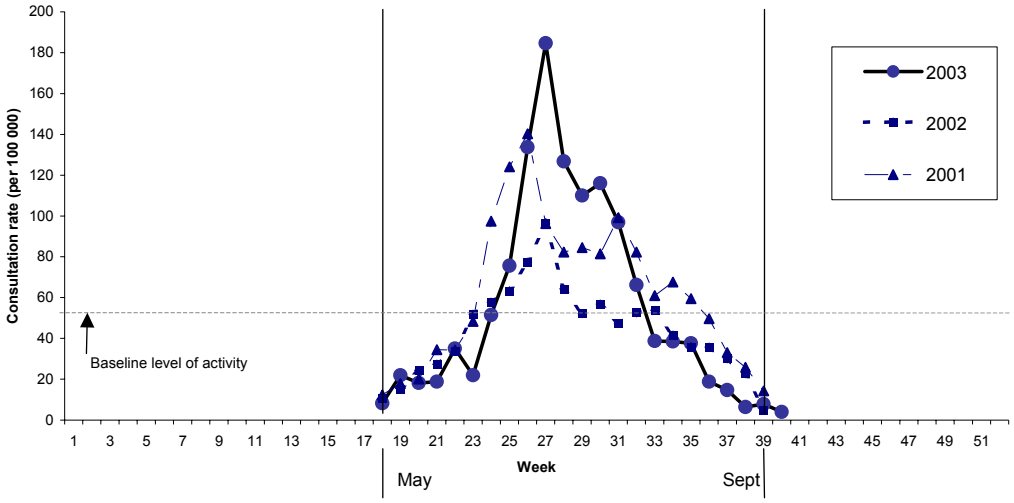


Figure 2: Total influenza isolates by surveillance type and week specimen taken, 2003

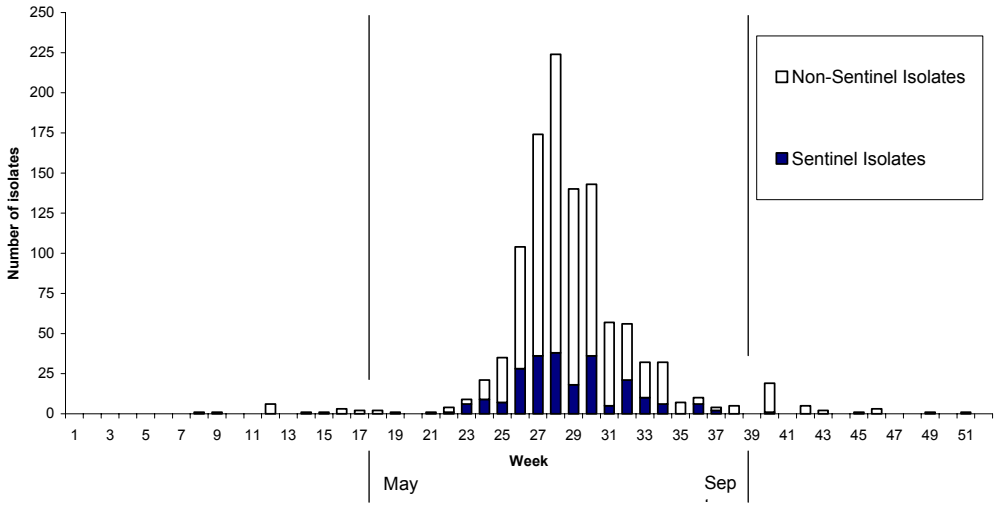
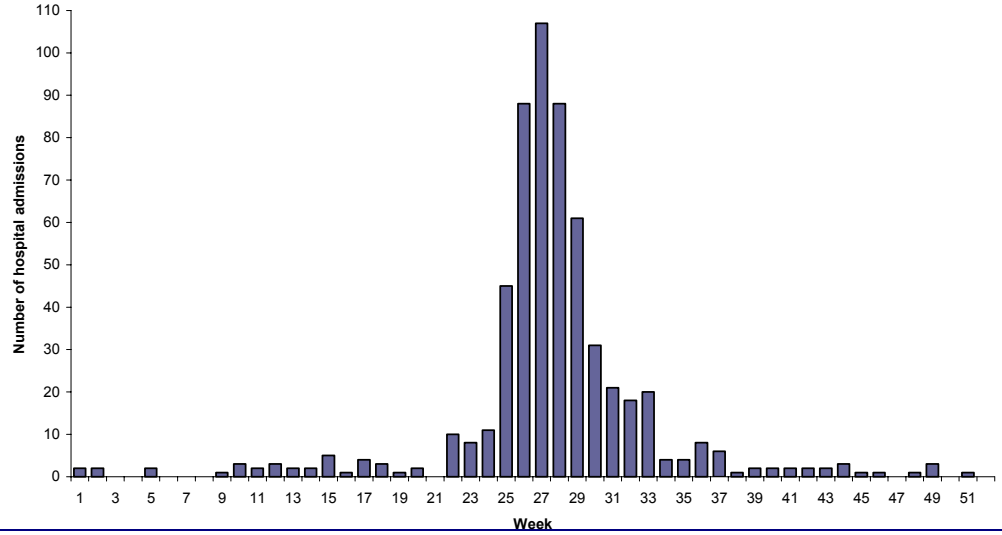


Figure 3: Influenza hospitalisation by week admitted, 2003



A total of 1 108 influenza isolates were identified in 2003, higher than the 702 isolates in 2002 and 654 in 2001. Of the 2003 isolates, 230 came from sentinel practice surveillance during May to September. This is lower than 241 sentinel isolates identified in 2002 and 313 in 2001. There were 878 non-sentinel isolates identified in 2003 compared to 461 in 2002 and 341 in 2001.

Figure 2 shows influenza virus isolations each week throughout 2003. The highest number of sentinel isolates (38) came from specimens taken in week 28, a week later than the peak in consultation rates. Non-sentinel influenza isolates were identified as early as February, however the vast majority (832, 95%) were from specimens taken during May to September. This is similar to the activity seen in 2002. Most sentinel isolates (82%) came from the first half of the sentinel period (weeks 23 to 32). Non-sentinel isolates predominated from week 26 until the latter part of the season.

In 2003, there were a total of 586 hospital admissions for influenza. This compares with 484 admissions in 2002 and 379 in 2001. Figure 3 shows these admissions by week, 92% (539) of which occurred during May to September. The highest number of admissions (303) occurred in July. Hospital admissions peaked in week 27, corresponding with 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 2003 (square brackets denotes a health district that did not participate in sentinel surveillance). The health district reporting the highest rate was Otago (155.3 per 100 000 patient population), followed by South Canterbury (99.2 per 100 000), South Auckland (86.1 per 100 000), Taranaki (82.8 per 100 000), Eastern Bay of Plenty (76.9 per 100 000), Hutt (66.0 per 100 000), and Tauranga (56.8 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, and Otago. Influenza A was seen throughout the country, with a single B seen in Central Auckland. As in 2002 isolates were not identified in two health districts, and swabs for sentinel surveillance were not taken in two health districts. The national isolation rate for 2003, illustrated in Figure 6 was 31.9% (230 isolates from 721 swabs received), which is higher than the 2002 rate of 25.0% (963 swabs), and the 2001 rate of 31.6% (989 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 - see Figure 6 (Note: Canterbury has been allocated an isolation rate of 100% with more isolates reported than swabs received).

Figure 4: Sentinel average weekly consultation rate for influenza-like illness by health district, 2003

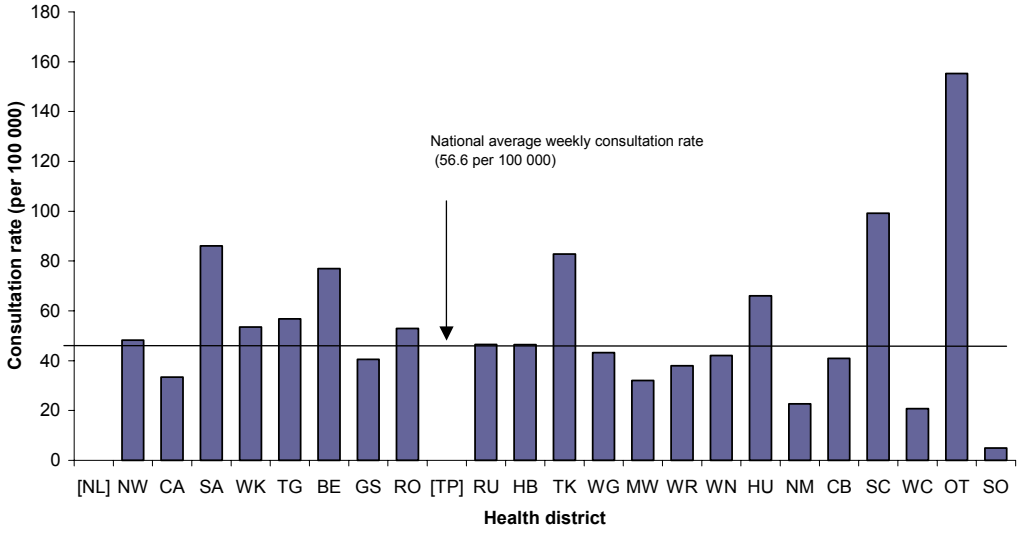


Figure 5: Cumulative laboratory confirmed influenza isolates from sentinel surveillance by health district, May-September 2003

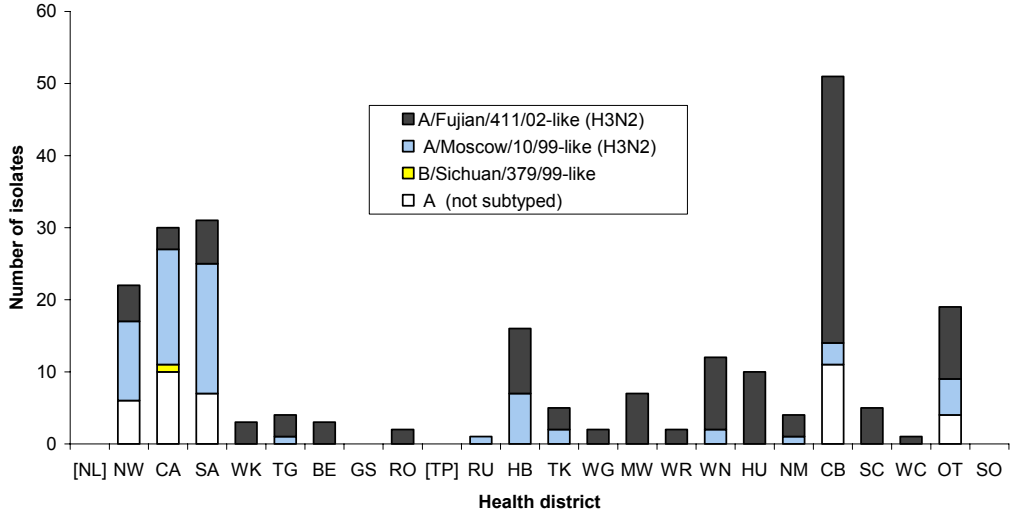


Figure 6: Sentinel swabs, sent, received and tested positive for influenza virus by health district, 2003

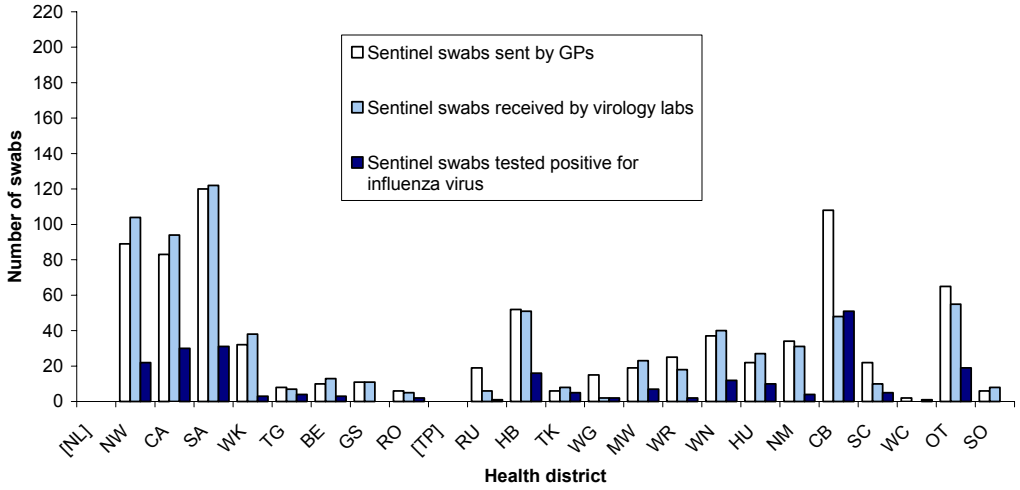


Table 1: Isolation rate by Health District, 2003

Health District	Isolation Rate[1]	Isolation Rate[2]
Northland [NL]		
North West Auckland [NW]	21	25
Central Auckland [CA]	32	36
South Auckland [SA]	25	26
Waikato [WK]	8	9
Tauranga [TG]	57	50
Eastern Bay of Plenty [BE]	23	30
Gisborne [GS]	0	0
Rotorua [RO]	40	33
Taupo [TP]	-	-
Ruapehu [RU]	17	5
Hawkes Bay [HB]	31	31
Taranaki [TK]	63	83
Wanganui [WG]	100	13
Manawatu [MW]	30	37
Wairarapa [WR]	11	8
Wellington [WN]	30	32
Hutt [HU]	37	46
Nelson-Marlborough [NM]	13	12
Canterbury [CB]	100	47
South Canterbury [SC]	50	23
West Coast [WC]	-	50
Otago [OT]	35	29
Southland [SO]	0	0

1 Isolation Rate (%) = Number of positive swabs (influenza isolates)/Number of swabs received *100
2 Isolation Rate (%) = Number of positive swabs (influenza isolates)/Number of swabs sent *100

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 9.1% 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.

The highest consultation rate for influenza-like illness was in pre-schoolers, with an average weekly consultation rate of 122.3 per 100 000 patient population, followed by infants with a consultation rate of 112.6 per 100 000. Children aged 5-19 years had the rate of 71.2 per 100 000. Adults aged 20-34 years had rate of 69.5 per100 000, and adults aged 35-49 years had a slightly lower rate of 49.9 per 100 000. Elderly people (aged 65 years and over) had a rate of 19.6 per 100 000, and adults aged 50-64 years had the lowest rate of 11.1 per 100 000.

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

Figure 7: Sentinel average weekly consultation rate for influenza-like illness by age group, 2003

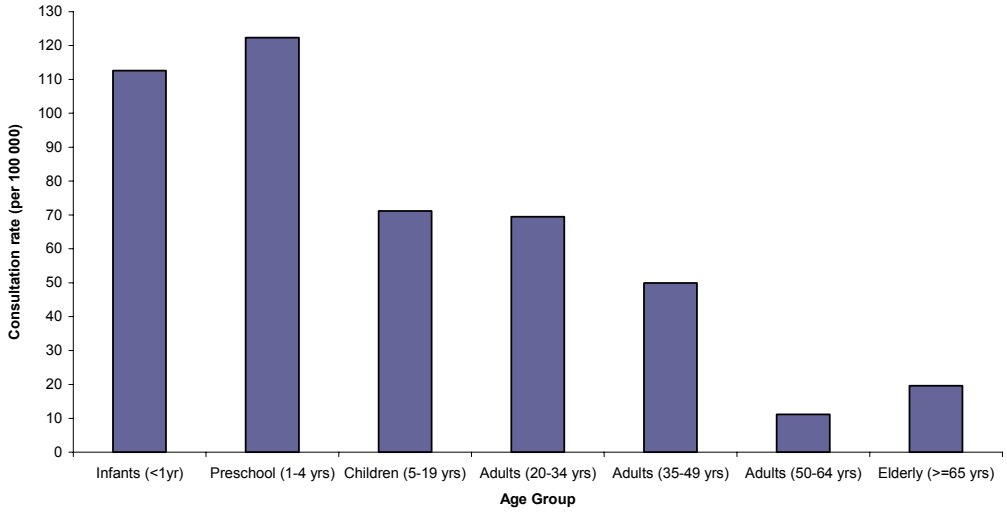


Figure 8: Percentage of sentinel consultations for influenza-like illness and hospitalisations by age group, 2003

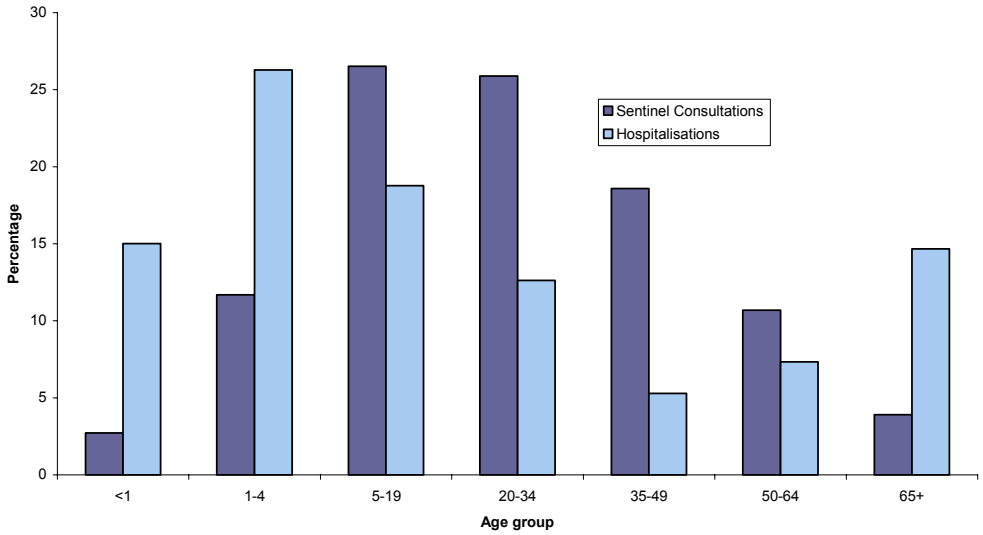
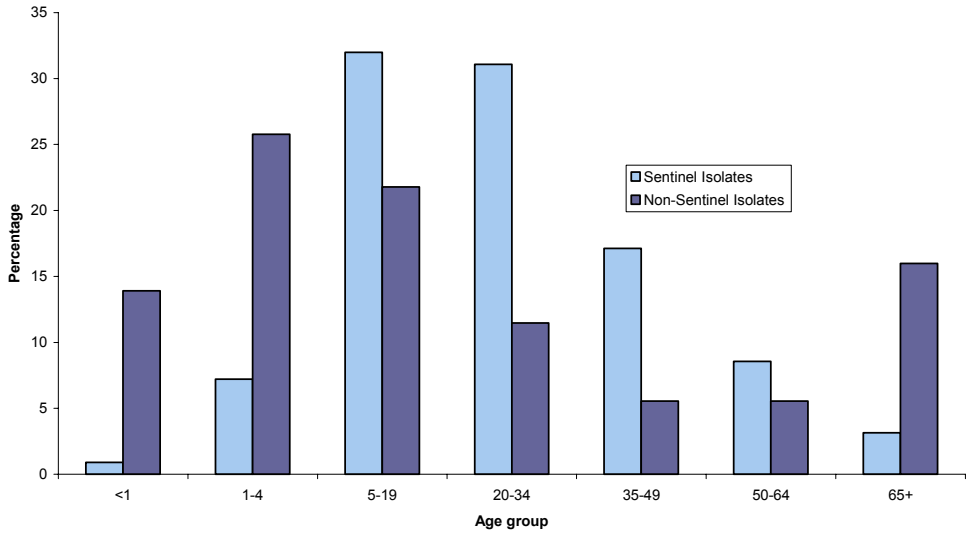


Figure 9: Percentage of sentinel and non-sentinel influenza isolates by age group, 2003



Virus strain characterisation and 2004 vaccine formulation

2003

Figure 10 shows influenza virus isolations by type and subtype for each week throughout 2003, and the total percentage contribution of each.

The majority of influenza isolates (1105 or 99.7% of all isolates) were characterised as influenza A. There were only three influenza B isolates identified in 2003, which represents 0.3% of typed and subtyped isolates. Influenza B made up 32% of all isolates in 2002, and 35% in 2001.

As shown in Figure 11, the general pattern of influenza A isolations was a relatively rapid rise in activity, peaking in week 28 (early July), and the majority of A isolates occurred in the mid-season. This was largely made up of A(H3N2), which was the predominant strain of influenza isolates in 2003 overall, and the most frequently isolated subtype or type from weeks 23 to 35. There were 911 A(H3N2) isolates identified in 2003, which represents 99.6% of typed and subtyped isolates (915) and 82.2% of all influenza isolates (1 108). Influenza A(H1N1) only represented a very small proportion of isolates in 2003 – 0.1% (1) of typed and subtyped isolates and 0.01% of all isolates. In contrast to influenza A, influenza B activity was very sporadic with one isolate in week 8, 40, and 46.

1990-2003

Figure 12 shows the number and percentage of typed and subtyped (not total) influenza isolates from 1990 to 2003. There are three noticeable changes in terms of predominant patterns:

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, 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.[3] 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, in 2002 A(H3N2) had predominated with 68% of typed/subtyped isolates, and 100% in 2003. A(H3N2) distribution pattern in 2003 was very similar to that in 1996 with 99% of typed/subtyped isolates as A(H3N2).

Influenza B

It is well documented that influenza B predominates or co-dominates every second year. In New Zealand, influenza B predominated or co-dominated in 1991, 1993, 1995, 1997, 1999, 2001 and 2002. When influenza B was not the predominant or co-dominant strain, it consisted of a small proportion during 1990 to 1999: 16% in 1990, 11% in 1992, 1% in 1994, 1% in 1996, 1% in 1998. However, in 2000, even though influenza B was not the predominant or co-dominant strain, it consisted of 31% of typed/subtyped isolates. In 2001 (38%) and 2002 (32%), influenza B has been the co-predominant strain consecutively, which is another unusual feature. However in 2003, there were only three influenza B isolations.

Figure 10: Total influenza isolates by type and week specimen taken, 2003

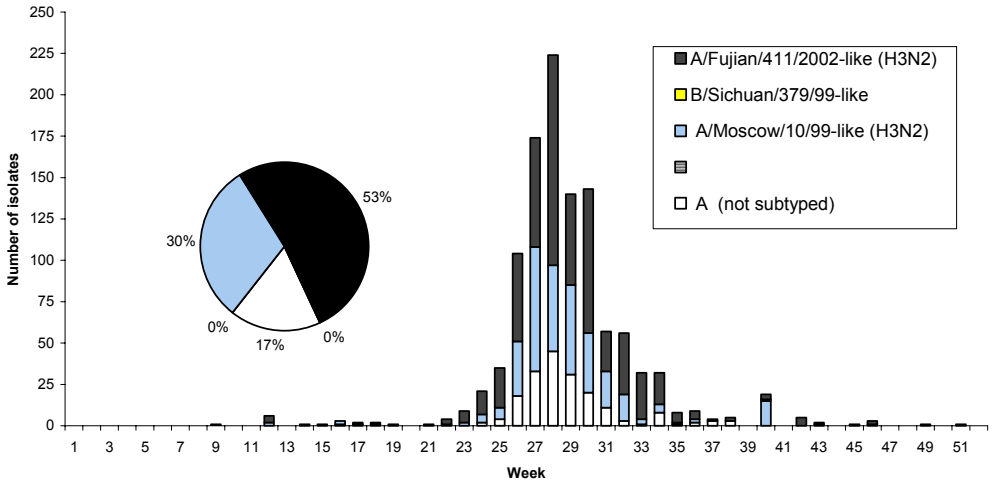


Figure 11: Total influenza virus isolates by type and week specimen taken, 2003

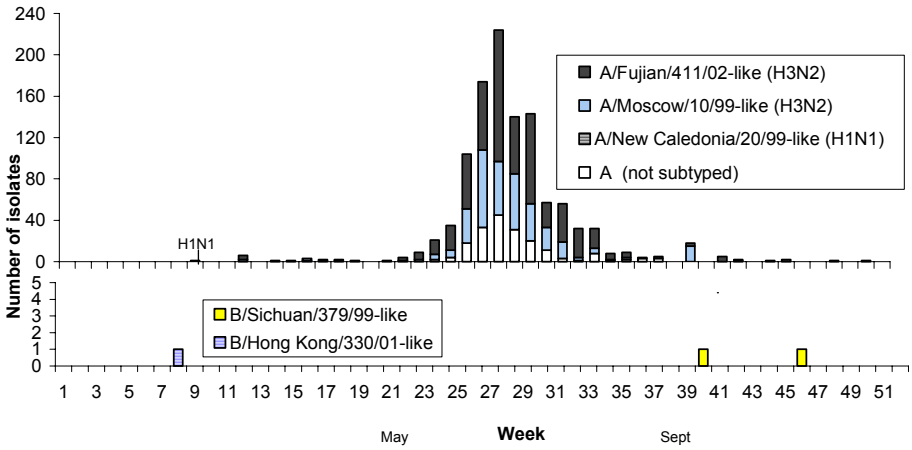
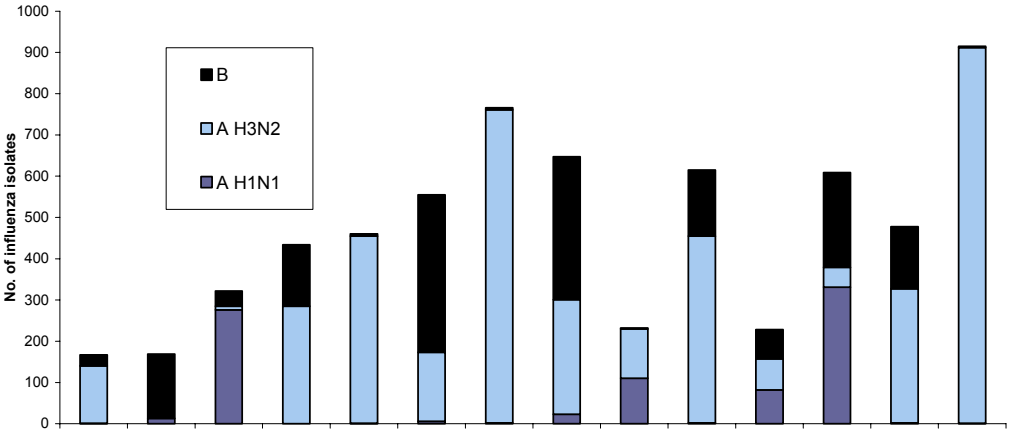


Figure 12: Influenza isolates by type, 1990-2003



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

Southern Hemisphere Trends

In October 2003, the Australian Influenza Vaccine Committee (AIVC), with a New Zealand representative, met to decide on the composition of the influenza vaccine for the 2004 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 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 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 2003, 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 2004 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. The last major change in this subtype was in 1997 with emergence of the A/Sydney/5/97 strain whilst the updating to an A/Moscow10/99 strain in 2000 was seen as a more minor change. In the 2003 winter in New Zealand and Australia, influenza A(H3N2) was by far the predominant subtype.

The Australian WHO Collaborating Centre showed that most A(H3N2) isolates from the Southern Hemisphere including New Zealand started to drift from A/Moscow/10/99-like viruses to A/Fujian/411/2002-like viruses. For example, earlier this year, most of New Zealand and Australia isolates were A/Moscow/10/99-like strains. However, during the major outbreaks of influenza in New Zealand (June-August) and Australia (August-September), many isolates were subtyped as A/Fujian/411/2002-like viruses. Based on

the southern hemisphere and global data, the WHO Consultative Group recommended an A/Fujian/411/2002-like virus as the A(H3N2) vaccine component for 2004:

- The majority of recent isolates were similar to A/Fujian/411/2002.
- 2003 vaccines containing A/Panama/2007/99 antigens stimulated anti-HA antibodies which were lower in frequency and titre to A/Fujian/411/2002-like viruses than to the vaccine virus.

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 B/Sichuan/379/99) spread worldwide whereas strains of the previous B/Victoria/2/87-like viruses 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. Earlier human vaccination studies had indicated that a virus of this lineage, B/Shangdong/7/97, induced moderate antibody responses to the alternate lineage, whereas the converse was not true. Based on this, the lack of recent exposure to related viruses and apparent emergence of this lineage, a recent virus of this type (B/Hong Kong/330/2001) was recommended for vaccines for the 2002-3 Northern winter. Europe accepted B/Shangdong/7/97 as a B/Hong Kong/330/2001-like strain whereas the USA accepted B/Hong Kong/330/2001 or B/Hong Kong/1434/2002 as suitable vaccine strains.

The Australian WHO Collaborating Centre showed that many B isolates from the Southern Hemisphere in 2003 including New Zealand were B/Hong Kong/330/2001 lineage viruses. Current vaccines containing influenza B/Hong Kong/330/2001 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/Hong Kong/330/2001-like strain for 2003 as B component.

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 2004 is:

- **A(H1N1)** **an A/New Caledonia/20/99-like strain**
- **A(H3N2)** **an A/Fujian/411/02-like strain**
- **B** **a B/Hong Kong/330/01-like strain**

Discussion

Based on sentinel consultation data using a set of threshold values, influenza activity in 2003 is described as low to moderate. When weekly consultation rates for influenza-like illness from 1992 to 2003 are compared, 2003 has the fourth lowest level of influenza activity, with 2000,1998, and 2002 first, second and third lowest respectively.

It is estimated that influenza-like illness resulting in a visit to a general practitioner affected over 46 116 New Zealanders in 2003 or about 1.2% of the population. The number of cases reported through the sentinel network is likely to be a considerable underestimate of the true number, as many people do not consult a general practitioner when they have an influenza-like illness.

When the overall pattern for sentinel consultation rates, isolations and influenza hospitalisations are compared for 2003 (Figures 1-3), they follow a very similar pattern, peaking in early July to early August and then declining to the baseline level in mid August. In contrast, influenza activity in 2002 peaked in late June to mid August and then declining to the baseline level in late August. Influenza seasonality in 2003 is relatively normal with a peak in July. However, this varies from year to year. For example, in 2000, influenza activity peaked very late in September, nearly at the end of sentinel surveillance period. Therefore, 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 (155.3 per 100 000 patient population).

Influenza infection may have serious consequences, even in otherwise healthy people. Influenza-associated deaths and severe complications among children aged <18 years were reported in United States during the 2003-4 influenza season.[4] In 2003 in New Zealand, there were a total of 586 hospital admissions for influenza, the highest recorded number in the 14 years from 1990 to 2003. There were 878 (79.2% of total isolates) isolations of A(H3N2), the highest influenza isolations from hospitalised patients in 2003, compared with the previous 13 years. As we know, 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 2003 have drifted from A/Moscow/10/99-like strain (36.8%) to A/Fujian/411/2002-like strain (62.7%) and the 2003 vaccine strain (A/Moscow/10/99) may not be able to effectively protect the population against A/Fujian/411/2002-like viruses. This may explain the highest recorded hospital admissions. This type of phenomenon was also observed in 1999 with the second highest hospital admissions (518) when A/Sydney/5/97 drifted to A/Moscow/10/99.

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 2003 season, some health districts had a small number of swabs or no swabs taken at all.

For sentinel surveillance from May to September 2003, 5 virology laboratories tested 721 respiratory specimens for influenza viruses and 230 (31.9%) specimens were positive for influenza viruses. However, influenza isolation rate varies among different health districts (Figure 6 and Table 1). If the isolation rate is defined as number of positive swabs divided by number of swabs received, the variation of the isolation rate ranged from 0-100%. If the isolation rate is defined as number of positive swabs divided by number of swabs sent, the variation was between 0-83%. One of the attributions to this discrepancy could be the inaccuracy of assigning swabs to sentinel or non-sentinel swabs by virology laboratories.

Some health districts had an influenza virus isolation rate lower than the national average of 31.9%. 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.[5] 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), and couriered to the virology laboratory chilled 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 2003. 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. However in 2002, the rate among infants was lower than for older children and adults aged 20-34 years and 35-49 years, but higher than the 50-64 years. 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. The mortality rate is markedly higher in those aged over 65 years (this age group accounted for 94.1% of deaths from influenza recorded for the 1990-98 period),[3] however data on the number of deaths from influenza in 2003 were not yet available.

Looking at the influenza age group data from sentinel surveillance and hospitalisations (Figures 7 and 8), 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.[3]

Comparing age data for positive influenza virus isolates from sentinel and non-sentinel surveillance (Figures 9 and 10), the sentinel system tends to detect less influenza viruses in the under 5's and ≥65 year olds relative to other age groups than its non-sentinel –

laboratory-based, mainly hospital – counterpart. This may reflect a greater reluctance among sentinel GP's to take swabs from very young children and frail elderly. Overall, these data indicate that sentinel and hospital surveillance compliment each other, providing a better description of influenza disease burden for different age groups.

Comparing the predominant strains in New Zealand during the past 13 years (Figure 12). The most striking feature is that influenza A(H3N2) predominated exclusively in 2003 (911, 99.6% of typed/subtyped isolates). This could be explained partly by the fact that influenza A(H3N2) has drifted more towards A/Fujian/411/2002 like virus than A/Moscow/10/99 like virus, the vaccine strain for 2003 in New Zealand. Therefore, the vaccine strain didn't match the circulating strain well enough to protect fully the population against A/Fujian/411/2002 like virus. A similar pattern was observed in 1996 and 1994.

From 2001 till 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. 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.[4]

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 [4,5]. 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.[6] 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.[11] A national approach to promotion, coupled with local initiatives, has been a key to lifting coverage to 65% amongst those at greatest risk, people 65 year and older. Quality coverage data are essential for the continuing development of this programme, while continuing surveillance ensures the provision of effective vaccines to reduce the burden of influenza in New Zealand.

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.[7] 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.[9] 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.[10] 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

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.

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