

Annual report of the National Influenza Surveillance Scheme, 2003

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Abstract

Surveillance of influenza in Australia is based on laboratory isolation of influenza viruses, sentinel general-practitioner practices for influenza-like illness, and absenteeism data from a major national employer. In 2003, the peak in influenza activity was in August which was later than in 2002. In 2003, 3,604 laboratory-confirmed cases of influenza were notified to the National Notifiable Diseases Surveillance System, which was marginally lower than for the previous year. Ninety-four per cent of the circulating viruses were influenza A. This was the highest proportion in the last five years. Nine hundred and thirty-five isolates were antigenically analysed: 928 were A(H3), two were A(H1) strains and five were influenza B viruses. The majority (98%) of the A(H3) subtypes were A/Fujian/411/2002(H3N2)-like and have shown a significant antigenic drift. The 2003 Australian influenza vaccine contained A/Panama/2007/99, which induced 2–4-fold lower antibody response against the drifted strain. An A/Fujian/411/2002(H3N2)-like virus has been incorporated in the Australian influenza vaccine for 2004. In 2003, the influenza vaccine was given to 77 per cent of Australians aged over 65 years; the same up take as in 2002. *Commun Dis Intell* 2004;28:160–168.

Keywords: influenza, surveillance, vaccine, general practice, influenza-like illness

Introduction

Influenza is an acute self-limiting viral disease of the upper respiratory tract. The health and economic impact of influenza largely arises from related complications such as lower respiratory tract infections and exacerbation of cardiopulmonary and other chronic diseases. These complications result in excess hospitalisation and mortality.

Influenza infections are seasonal in temperate climates (June to September in the Southern Hemisphere and December to April in the Northern Hemisphere), but may occur throughout the year in tropical regions. The seasonal activity of influenza virus varies from year to year with some years marked by larger epidemics with higher morbidity and mortality. In Australia in 2002, influenza and pneumonia were the underlying causes of 3,084 deaths.¹ Although the infection affects all age groups, those aged 0–4 years or 65 years and over, or those with chronic medical problems have higher rates of morbidity and mortality.

The potential for an epidemic of influenza is dependent on the susceptibility of the population and the ability of the viruses to evolve. There are three types of influenza viruses, A, B and C. Influenza virus types are further subtyped by the antigenic properties of two surface glycoproteins: haemagglutinin (H) and neuraminidase (N). Fifteen H and nine N subtypes have been identified for influenza A, and of these, three H (H1, H2, H3) and two N (N1 and N2) have been found in humans, while all subtypes have been found in aquatic birds. Only one H and one N have been identified for influenza B viruses. Influenza virus A and B are the cause of widespread annual epidemics as these viruses evolve by mutation of genes encoding the H and N. This gradual change or 'antigenic drift', is responsible for the emergence of variant strains of viruses able to evade the immunity conferred by previous infection or vaccination.

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Influenza virus A is also known to cause pandemics (worldwide epidemics) at irregular intervals, either by direct introduction of new haemagglutinin subtypes into the human population from animals or birds, or by genetic reassortment between an avian or animal influenza virus and a human influenza virus. This latter process is called 'genetic shift' and results in a new influenza virus. Unlike the seasonal epidemics of influenza, where attack rates depend on age, reflecting immunity conferred from previous infection, in pandemic influenza all age groups are equally susceptible. Last century the emergence of new strains of influenza A caused pandemic influenza with a global impact on morbidity and mortality rates: A(H1N1) in 1918; A(H2N2) in 1957; and A(H3N2) in 1968.

An effective national surveillance system is an essential component for the control of seasonal epidemics and the preparedness for possible pandemics. Virological and epidemiological monitoring are important components of influenza surveillance. The main objectives of virological and epidemiological surveillance of influenza are:

- (i) early detection of epidemics to enable the implementation of public health measures such as the vaccination of high risk groups, outbreak control campaigns and provision of clinical services;
- (ii) characterisation of the nature of the epidemic;
- (iii) isolation and antigenic characterisation of circulating influenza viruses to assist in the formulation of the following season's vaccine and to provide new vaccine strains; and
- (iv) evaluation of the impact of the epidemic and associated public health measures.

In 2003, the Communicable Diseases Australia website (<http://www.cda.gov.au/index.htm>) published influenza surveillance data fortnightly during the influenza season. This annual influenza report is a summary of the surveillance information gathered by various systems in 2003.

Surveillance methods

Surveillance of influenza in Australia is based on six sets of data:

1. notifications of laboratory-confirmed influenza required by legislation in most state and territories, and nationally notifiable to the National Notifiable Diseases Surveillance System (NNDSS);
2. laboratory diagnosis including virus isolation and serology by laboratories participating in the Laboratory Virology and Serology Reporting Scheme (LabVISE);

3. subtype and strain data of circulating influenza viruses provided by the WHO Collaborating Centre for Reference and Research on Influenza;
4. consultation rates for influenza-like illness diagnosed by sentinel general practitioners;
5. absenteeism data of workers from a national employer; and
6. hospitalisation and mortality data.

National Notifiable Diseases Surveillance System

In all jurisdictions with the exception of the Australian Capital Territory and South Australia, laboratory-confirmed influenza is a notifiable disease under state and territory legislature. In the Australian Capital Territory and South Australia, laboratory reports are also collected and sent to NNDSS although influenza is not a notifiable condition. In this report, data are analysed by the date of onset in order to present disease occurrence during the reporting period, but when this was not available the earliest date from specimen collection date or notification date was used.

Laboratory surveillance

LabVISE is a national scheme of sentinel laboratories that report influenza diagnosis all year round. In 2003, 16 laboratories from all jurisdictions except the Northern Territory contributed to the scheme. Data were reported to LabVISE monthly and were analysed by the specimen collection date.

WHO Collaborating Centre for Reference and Research on Influenza

The WHO Collaborating Centre for Reference and Research on Influenza is part of an international network for the surveillance of influenza viruses. It reports on the subtypes, performs antigenic analysis of influenza viruses isolated throughout the year and classifies them in accordance to the standard nomenclature for influenza viruses. The standard nomenclature is based on type, the place where they were first identified, sequential number, and year of isolation. For example, A/Sydney/5/97 denotes influenza A virus that was first isolated in Sydney and was isolate number 5 for the year in 1997. The main application of strain characterisation is to assess the suitability of the current vaccine (by measuring the degree of antigenic match between circulating strains and the current vaccine) and to determine the composition of vaccine for the following influenza season.

The Centre conducts detailed antigenic analysis on all isolates received from Australian laboratories, and laboratories throughout Oceania and South East Asia, using conventional serological techniques. A geographically and temporally representative sample of isolates, together with any strains demonstrating uncharacteristic reactions during antigenic characterisation are further analysed by genetic sequencing of the viral haemagglutinin antigen and, for a proportion of these, the neuraminidase antigen. Studies are also conducted with panels of pre-and-post vaccination human sera to determine the likely effectiveness of current vaccines against recently circulating viruses to provide data that assist in vaccine formulation decisions. The Centre's data together with that from the WHO Collaborating Centres in Japan, the United Kingdom and the United States of America are reviewed at the World Health Organization (WHO) consultations, which take place twice yearly, to provide recommendations to national and regional authorities regarding vaccine formulation.

Sentinel general practitioner surveillance

Sentinel general practitioner surveillance schemes for influenza monitor the consultation rates for influenza-like illness (ILI). In Australia, there are five such schemes: the Australian Sentinel Practice Research Network (ASPREN) which collects data at a national level, the New South Wales Influenza Surveillance Scheme, the Victorian Influenza Surveillance Scheme, Western Australian sentinel general practices and the Northern Territory Tropical Influenza Surveillance Scheme. ASPREN and the Northern Territory Tropical Influenza Surveillance Scheme report ILI rates throughout the year, while the other sentinel surveillance schemes report from May to October each year.

Sentinel general practices contributing to the ASPREN scheme are mostly located in capital cities and larger regional centres on the east coast of Australia (Map). In 2003, an average of 47 (range 32–62) general practices reported ILI cases on an average of 4,962 (range 2,138–6,587) consultation per week.

The Northern Territory Tropical Influenza Surveillance reported cases of ILI as a rate per 1,000 consultations per week. Throughout the year, eight to 14 centres reported to the surveillance system with an average of 756 (range, 230–1,074) consultations per week.

In 2003, the New South Wales Influenza Surveillance program collected reports from New South Wales practitioners who are part of ASPREN and from five out of 17 Public Health Units (Southern New South Wales, New England, Illawarra, Central Coast, Northern Sydney, Western Sydney and South Eastern Sydney). Thirty-seven (range 17–50) general practitioners reported ILI cases weekly from May to October on an average of 3,933 (range 1,723–5,335) consultations per week.

The Victorian Infectious Diseases Reference Laboratory, the WHO Collaborating Centre for Influenza and the Department of Human Services contributed to the Victorian Influenza Surveillance Scheme. In 2003, the Victorian Influenza Surveillance Scheme also enlisted the Melbourne Locum Service. Overall, 79 general practitioners from metropolitan (20 sites) and rural (21 sites) regions were recruited to report ILI rates per 100 consultations per week, between May and September. These practices reported on average 7,542 (range 5,315–14,376) consultations per fortnight. ILI was reported as a rate per 100 and has been converted to rate per 1,000 consultations in this report to allow comparisons with other sentinel schemes.

In Western Australia, 16 general practices, 12 in the metropolitan area (Perth) and four in rural regions (one each in Kalgoorlie, Busselton, Tom Price and Geraldton) participated in ILI surveillance from May to October. Data were reported as the number of cases of ILI per practice per week. The number of consultations was not recorded and hence the number of practices was used as the denominator.

Map. Geographic distribution of ASPREN sentinel general practice sites, Australia, 2003



Absenteeism surveillance

Australia Post, a major nation-wide employer, provided sick leave absenteeism data collected weekly between March and September 2003. Absenteeism, defined as an absence due to illness for at least three consecutive days, was presented as a rate per 100 employees per week, on an average of 33,246 employees per week.

Hospitalisation data

The Australian Institute of Health and Welfare provide data on hospital separations in public and private hospitals. The number of separations with a primary diagnosis of influenza due to identified influenza viruses (ICD-10AM = J10) and influenza where the virus was not identified (ICD-10AM = J11) are reported. Data for the 2002/03 financial year were not available at the time of writing this report.

Results

The influenza surveillance data presented here are limited and should be interpreted with caution. Laboratory-confirmed influenza represents a small proportion of all influenza cases in the year and consequently the estimation of the circulating strains is based on a small sample. Definitions of ILI varied between sentinel surveillance schemes (Table 1) which makes comparison of ILI among the different schemes difficult.

National Notifiable Diseases Surveillance System

In 2003, 3,604 laboratory-confirmed cases of influenza were reported to NNDSS, which represents a two per cent decrease from the number of notifications in 2002. All jurisdictions reported laboratory-confirmed influenza to NNDSS, although Tasmania reported very few cases due to limited access to laboratory testing for influenza.

Notifications of laboratory-confirmed influenza started to increase in early August and peaked in the last week of August (Figure 1). Compared to 2002, the influenza season started late and was characterised by a rapid rise in cases.

A comparison of notification rates in each jurisdiction (with the exception of the Australian Capital Territory and Tasmania) is shown in Figure 2. The highest notification rates occurred in August in New South Wales (85 cases per 100,000 population), Victoria (89 cases per 100,000 population) and Queensland (131 cases per 100,000 population); and in September in the Northern Territory (629 cases per 100,000 population), South Australia (134 cases per 100,000 population), and Western Australia (185 cases per 100,000 population).

Figure 1. Notifications of laboratory-confirmed influenza to the National Notifiable Diseases Surveillance System, Australia, 2002 and 2003, by week of onset

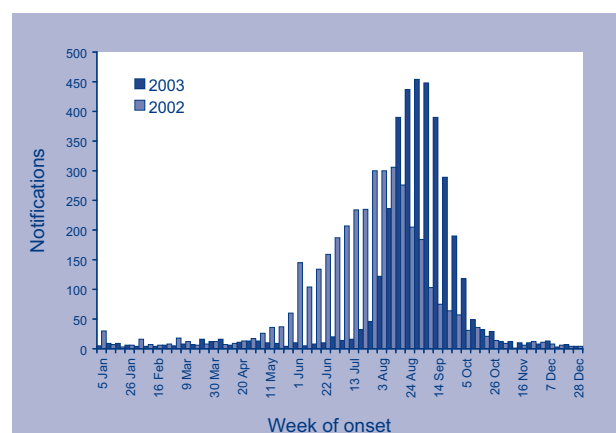


Figure 2. Notification rates of laboratory-confirmed influenza, Australia, 2003, by jurisdiction and month of onset

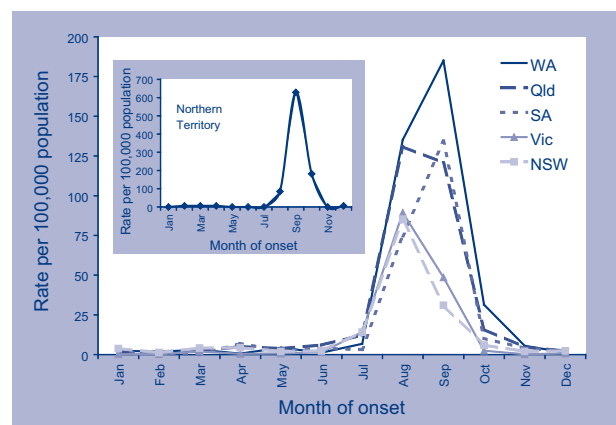


Table 1. Case definitions of influenza-like-illness used in Australian sentinel practice schemes, 2003²

Program	Case definition
Victorian Influenza Surveillance Scheme	Fever, cough, fatigue
Western Australian sentinel general practices	Fever, cough, fatigue
New South Wales state program, Northern Territory and ASPREN	Six of the following nine symptoms with sudden onset (<12 hours previously): cough, rigours or chills, fever, prostration and weakness, myalgia, redness of mucous membranes, influenza in close contacts

National age-specific notification rates are shown in Figure 3. The overall female to male ratio was 0.9:1. The 0–4 year age group had the highest notification rate (135 cases per 100,000 population), representing 48 per cent of all notifications.

Infants under the age of one accounted for 38 per cent of notifications in the 0–4 years age group and had the highest notification rate at 257 cases per 100,000 population (Figure 3 insert). Notification rates among the over 65 years age group were marginally lower in 2003 (16 cases per 100,000 population) compared to 2002 (18 cases per 100,000 population).

Laboratory surveillance

A total of 2,071 laboratory diagnoses of influenza were reported to LabVISE participating laboratories, of which 94 per cent of isolates were influenza A (Figure 4). The overall A to B ratio in 2003 was 16:1. The peak of influenza reports from LabVISE occurred in September, which was a fortnight later than the peak influenza activity observed in the NNDSS surveillance data. This is because LabVISE data were analysed by the date of specimen collection while NNDSS data were analysed by date of onset.

WHO Collaborating Centre for Reference and Research on Influenza

The WHO Collaborating Centre for Reference and Research on Influenza received 935 isolates or clinical specimens that yielded viable influenza viruses (477 less than for 2002) and they were all analysed antigenically. Of these viruses 928 (99.3%) were A(H3) strains with only two A(H1) viruses and five influenza B isolates. Sequence analysis of the variable (HA1) region of the haemagglutinin was undertaken for 61 strains (1 H1; 56 H3; and 4 B) and of the neuraminidase for 41 strains (39 A and 2 B). The majority (98%) of the A(H3) viruses were genetically and antigenically distinguishable from the reference strain A/Moscow/10/99 and the 2003 vaccine strain A/Panama/2007/99 (Table 2, Figure 5), and were similar to the new reference strain A/Fujian/411/2002. The majority of the 19 A/Moscow/10/99-like viruses identified were isolated early in the year (between January and May) whilst the first of the A/Fujian/411/2002-like viruses were isolated in Queensland and Victoria during late June. New Zealand also experienced predominantly A(H3) influenza and a similar change from A/Moscow-like to A/Fujian-like strains was also observed, although a few A/Fujian-like strains were seen there early in the season.

Genetic analysis of the Australian A(H3) isolates demonstrated that the neuraminidase antigen of these viruses remained more closely related to that of strains circulating in the 2003 season than to that of the new reference virus A/Fujian/411/2002 (Figure 6). Of the two A(H1) isolates one was A(H1N1), the other A(H1N2), however both remained antigenically close to the reference and vaccine strain A/New Caledonia/20/99. Of the five influenza B viruses analysed four were antigenically and genetically B/Sichuan/379/99 lineage viruses with one B/Hong Kong/330/2001-like strain (Figure 7).

Figure 3. Notification rates of laboratory-confirmed influenza, Australia, 2003, by age group and sex, and infants aged under four years, by age and sex

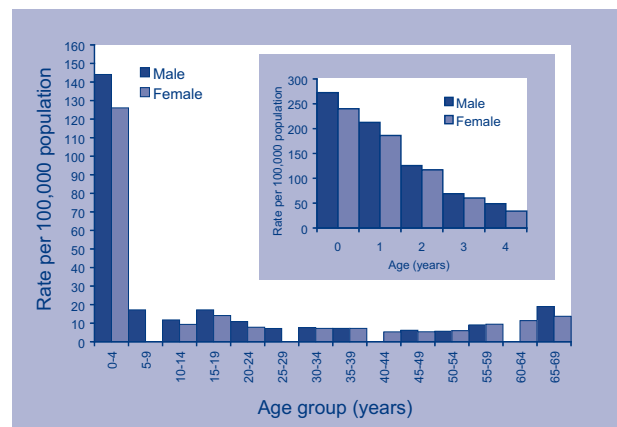


Figure 4. Laboratory reports of influenza diagnoses reported to LabVISE, Australia, 2003, by type and month of specimen collection

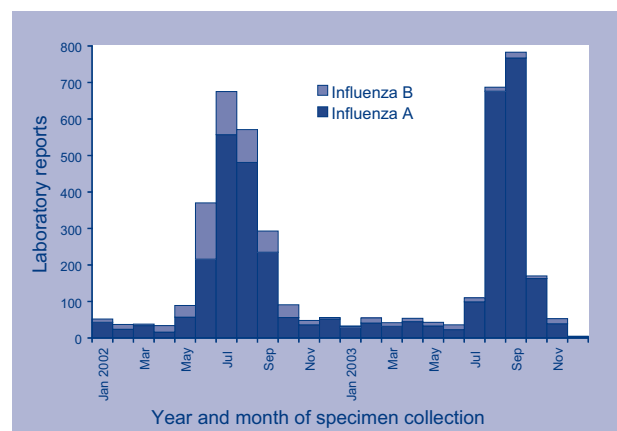


Figure 5. Evolutionary relationships between influenza A(H3) haemagglutinins (HA1 region)

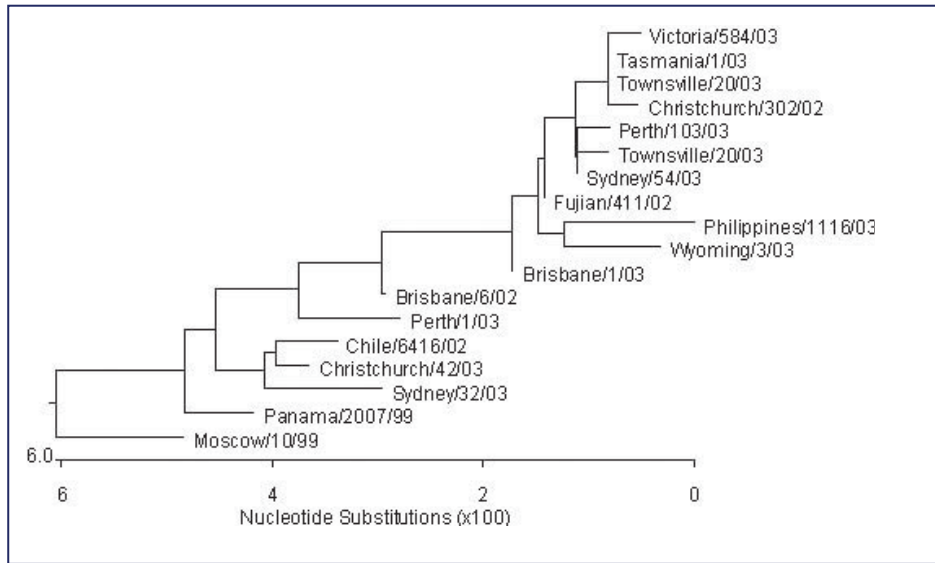


Figure 6. Evolutionary relationships between influenza N2 neuraminidases

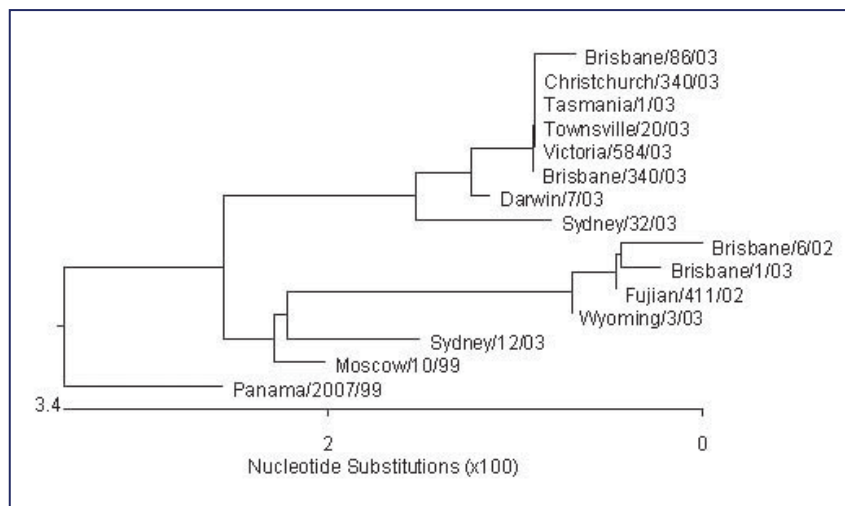
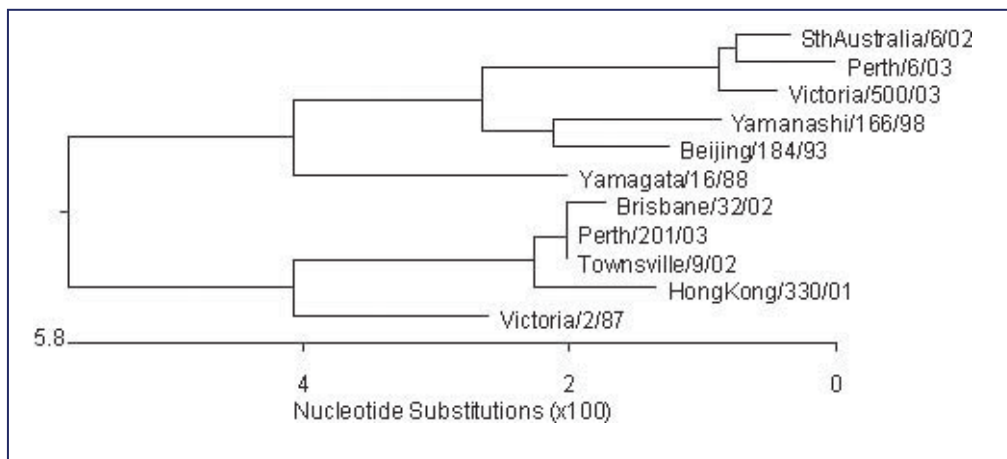


Figure 7. Evolutionary relationships between influenza B haemagglutinins (HA1 region)



Consistent with the antigenic drift in the A(H3) isolates demonstrated by ferret antisera (Table 2), serological studies conducted with pre- and post-vaccination human sera from recipients of vaccine containing the A/Panama/2007/99 strain, showed 2–4-fold lower antibody titres to the recent A/Fujian/411/2002-like strains and a reduction of about 20 per cent in the number of recipients achieving antibody levels in the protective range. While the 2003 vaccine contained a B/Hong Kong/330/2001-like strain, and the majority of the small number of influenza B isolates were B/Sichuan/379/99 lineage strains, similar numbers of younger adults and only slightly reduced numbers of older adults achieved antibody levels in the protective range to the B/Sichuan/379/99-like isolates.

Evidence of the emergence of A/Fujian/411/2002 (H3N2)-like strains was first recognised in the latter part of the 2002/03 Northern Hemisphere winter. As a consequence, WHO deferred its choice of an A(H3N2) vaccine strain at the February 2003 vaccine consultation. However, in the absence of a suitable A/Fujian/411/2002-like vaccine strain by March 2003, Northern Hemisphere vaccines for the 2003/04 winter contained the A/Panama/2007/99 virus as in the preceding winter. During the subsequent six months A/Fujian/411/2002-like strains became the predominant circulating influenza viruses and were responsible for extensive and severe outbreaks in some Northern Hemisphere countries during the 2003/04 winter. An A/Fujian-like virus has now been incorporated into the formulation for the Australian 2004 and the 2004/05 Northern Hemisphere vaccines.

Sentinel general practice surveillance

In 2003, reports of influenza-like illness from ASPREN sites started to increase earlier than in the 2002 season. ILI reports increased first in early March then in late May and peaked in mid-August (Figure 8). The peak ILI rate was 24 cases per 1,000 consultations in 2003 compared to 18 cases per 1,000 consultations in 2002. In contrast to previous years, ILI rates did not return to the base line but remained at seven cases per 1,000 consultations to the end of the year.

The Northern Territory Tropical Influenza Surveillance Scheme data showed two peak ILI rates (Figure 9); one in the first week of April, (21 ILI per 1,000 consultations) and the other in mid-September (36 ILI per 1,000 consultations). In 2002, the highest ILI rate was reported at the end of July with a rate of 39 ILI per 1,000 consultations.

Figure 8. ASPREN consultation rates for influenza-like illness, Australia, 2002 and 2003, by week of report

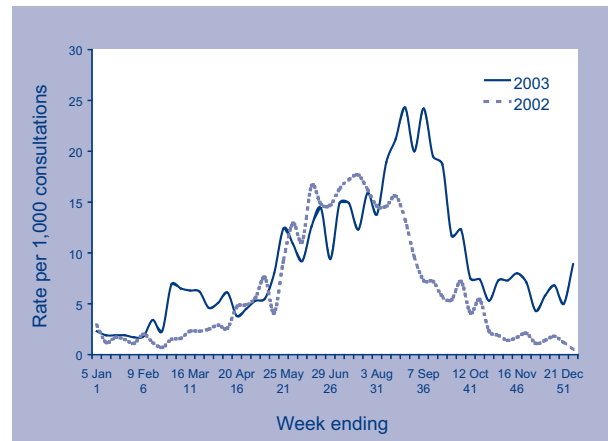


Figure 9. Consultation rates for influenza-like illness, Northern Territory, 2002 and 2003, by week of report

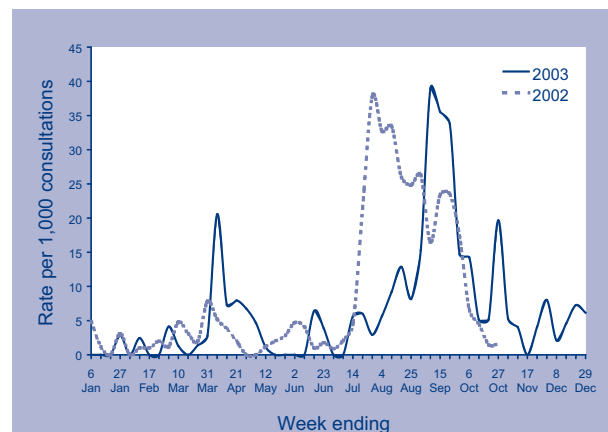


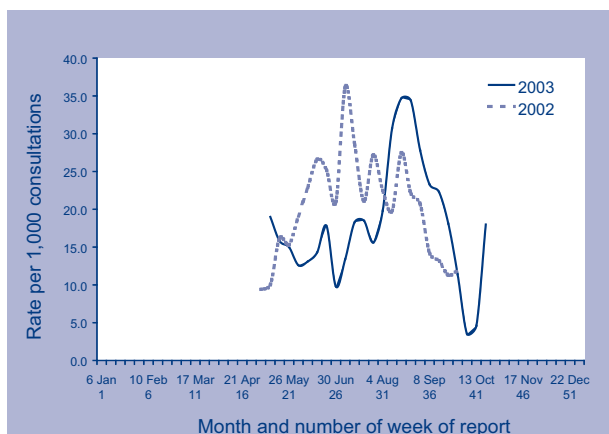
Table 2. Antigenic comparisons of influenza A(H3) viruses isolated by the haemagglutination-inhibition test

Virus antigen	Ferret serum			
	Reciprocal HI titre			
	A/Panama	A/New York	A/Fujian	A/Wyoming
A/Panama/2007/99	1,280	160	40	40
A/New York/55/2001	1,280	1,280	320	640
A/Fujian/411/2002	80	80	1,280	2,560
A/Wyoming/3/2003*	320	80	2,560	2,560

* A/Wyoming is an A/Fujian-like strain that has been approved for vaccine manufacture.

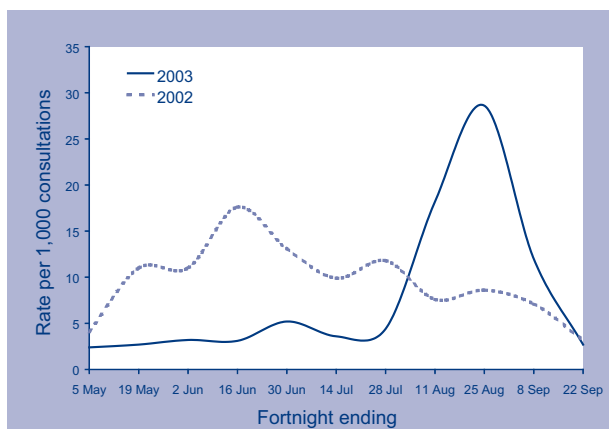
In New South Wales, ILI surveillance ran from May to October 2003. The peak ILI rate (35 ILI per 1,000 consultations) was reported for the weeks ending on 18 and 25 August (Figure 10). The peak ILI rate was similar in magnitude to that of 2002 but occurred one month later.

Figure 10. Consultation rates for influenza-like illness, New South Wales, 2002 and 2003, by week of report



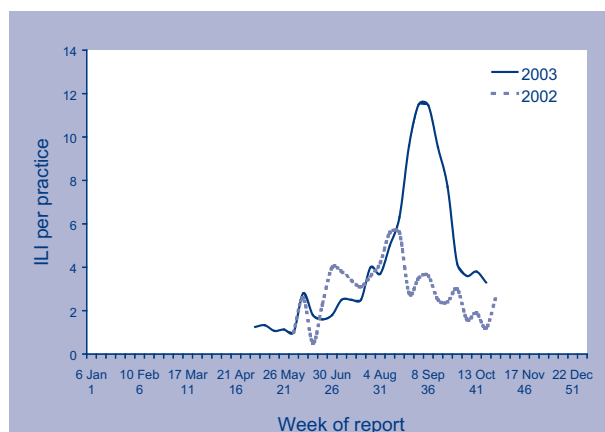
In Victoria, in 2003, ILI rates started to rise in early August and peaked at the end of that month (28 cases per 1,000 consultations). Compared to 2002, the peak ILI rate in 2003 was higher in magnitude (by 63%) and was reached two months later (Figure 11). A separate report on influenza in Victoria is included in this issue of *Communicable Diseases Intelligence* (pp. 175–180).

Figure 11. Consultation rates for influenza-like illness, Victoria, 2002 and 2003, by week of report



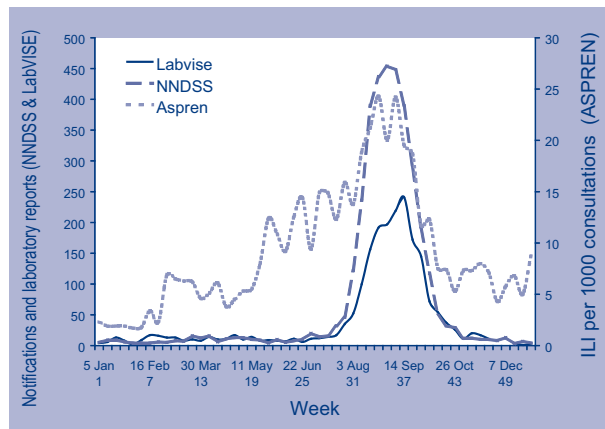
In Western Australia, ILI rates are calculated by number of cases per sentinel general practitioner practice. In 2003, the ILI rate per practice peaked in September at 12 cases per practice per week, more than twice the rate of 3.5 cases per practice reported during the peak period in 2002 (Figure 12). A separate report on influenza in Western Australia in 2003 is included in this issue of *Communicable Diseases Intelligence* (pp. 169–174).

Figure 12. Consultation rates for influenza-like illness, Western Australia, 2002 and 2003, by week of report



All indices of national influenza activity in Australia in 2003 indicated that the influenza season peaked between 17 August and 7 September (Figure 13).

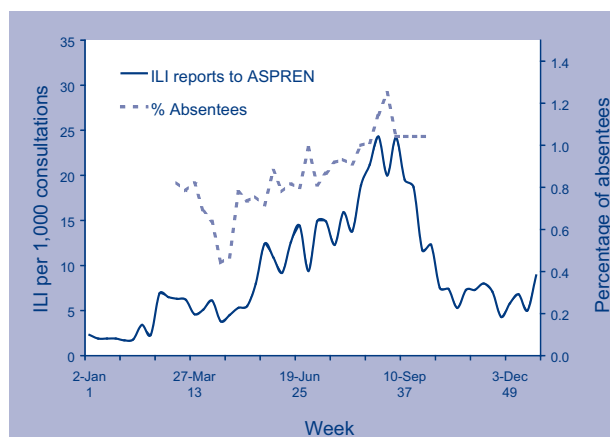
Figure 13. Laboratory reports to LabVISE, notifications to NNDSS and consultation rates in ASPREN of influenza, Australia 2003, by week of report



Absenteeism surveillance

Absenteeism surveillance is a non-specific index of influenza activity. The peak in absenteeism coincided with the peak influenza activity as measured by NNDSS and ASPREN (Figure 14). National absenteeism rates in 2003 peaked during the week ending on 28 August, at 1.3 per cent (n=415): an increase of 46 per cent from the average of 0.9 per cent absentees per week (n=284) during the reporting period.

Figure 14. Rates of absenteeism and consultation rates of influenza-like illness, Australia, 2003, by week of report



Discussion

According to most indices of influenza activity, the 2003 influenza season in Australia started later than the 2002 season. Influenza A was the predominant virus type diagnosed throughout the season with an A to B ratio of 16:1, the highest recorded over the last five years. The ratio of influenza A isolates submitted to the WHO Centre for antigenic analysis was even considerably higher (190:1). In the past, roughly equal levels of influenza A and B have been seen in every second year, interspersed with predominantly influenza A years.

In 2003, ILI rates started to increase five months before an increase in laboratory-confirmed influenza notifications. ILI reports may have been influenced by heightened attention to respiratory symptoms following the emergence of the severe acute respiratory syndrome or may be due to other respiratory pathogens, which cause ILI such as respiratory syncytial virus. ILI reporting is important timely information, but a non-specific index of influenza activity, which has to be interpreted in conjunction with the laboratory-based surveillance.

The National Health and Medical Research Council recommends annual influenza vaccination for all Australians aged over 65 years. In 2003, the vaccination coverage of Australians aged over 65 years was 77 per cent which was the same as 2002.³ Compared to 2002, notification rates of influenza declined in the over 65 age group but increased among the 0–4 year age group and remained unchanged in the rest of the age groups. Influenza vaccination can mitigate the impact of morbidity and mortality from annual influenza epidemics on the most susceptible populations.⁴

The Australian influenza vaccine for 2003 contained A/New Caledonia/20/99(H1N1)-like, A/Moscow/10/99 (H3N2)-like and B/Hong Kong/330/2001-like antigens. The WHO reference centre identified that there had been significant antigenic drift in the A(H3) subtype and the majority of influenza isolates in 2003 were A/Fujian/411/2002(H3N2)-like. Consequently, vaccine-induced responses against the drifted strains were lower than those for A/Moscow-like viruses and some reduction in vaccine effectiveness may have been expected.

The majority of outbreaks in the Northern Hemisphere 2003/04 winter were also due to A(H3N2) A/Fujian-like strains. The United States of America recorded severe outbreaks with associated excess mortality characteristic of an A(H3N2) season and there were some reports of serious infections in children.⁵

For 2004, the recommended Australian influenza vaccine retained B/Hong Kong/330/2001-like, and A/New Caledonia/20/99(H1N1)-like virus components, and replaced A/Moscow/10/99 (H3N2)-like virus with an A/Fujian/411/2002-like virus.

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