

Annual report of the National Influenza Surveillance Scheme, 2001

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Abstract

Surveillance of influenza in Australia in 2001 was based on data from national and state-based sentinel practice consultations for influenza-like illness, laboratory isolations of influenza virus and absenteeism rates from a national employer. In 2001, laboratory-confirmed influenza became a notifiable disease and was reported to the National Notifiable Diseases Surveillance System (NNDSS). Influenza A was the dominant type, 81 per cent of which were subtype H1N1 and 19 per cent were subtype H3N2. The influenza A (H1N1) analysed were all A/New Caledonia/20/99-like strains. The H3N2 isolates were antigenically similar to the reference strain A/Moscow/10/99 and the vaccine strain A/Panama/2007/99. The influenza B isolates, which made up only 10 per cent of all isolates, were mainly B/Sichuan/379/99-like strains but 10 per cent of isolates were more closely related to B/Harbin/7/94-like viruses, which circulated in previous years. The Australian 2001 influenza vaccine represented a good match for the circulating viruses and 77 per cent of persons over 65 years in Australia were vaccinated in 2001. *Commun Dis Intell* 2002;26:204–213.

Keywords: influenza, surveillance, vaccine, general practice, strain

Introduction

Influenza is an acute, self-limiting upper respiratory tract infection. Complications including lower respiratory tract infection (in particular secondary pneumonia and exacerbation of chronic obstructive pulmonary disease) and exacerbation of cardiopulmonary disease may occur.¹ Influenza-related morbidity (measured as excess hospitalisation) and mortality may result from these complications. Although influenza infection affects all age groups, the rates of serious morbidity and mortality tend to be highest among those aged 65 years and over, Aboriginal and Torres Strait Islanders and those with chronic medical problems. Young infants and pregnant women are also at increased risk of hospitalisation from influenza.

Influenza outbreaks usually occur during winter months in temperate climates (peaking between December and March in the Northern Hemisphere and June and September in the Southern Hemisphere), but may occur throughout the year in tropical regions. Even though the complication rate may be low, the overall high attack rate during epidemics leads to a considerable increase in hospitalisations and mortality. In Australia in 1999, pneumonia and influenza accounted for 1,898

deaths (ICD-10 codes J10–J18; 1.5 per cent of all deaths, Australian Bureau of Statistics, 2001). Influenza pandemics occur every 10 to 30 years. During these pandemics, a quarter or more of the global population may be affected within a short period and the rates of illness and death from influenza can increase dramatically.

Influenza viruses are successful human pathogens because of their ability to vary their two external proteins, haemagglutinin (H) and neuraminidase (N). Mutations cause a gradual change in these proteins called 'antigenic drift', which results in annual epidemics of influenza. The greater the change in these proteins, the less likely it is that the virus will be recognised by immune cells primed by exposure to earlier infections or vaccines, and the greater the epidemic potential. At irregular intervals, there are more dramatic changes in the viral proteins, called 'antigenic shift', which are a result of either direct introduction of avian influenza viruses into the human population or a reassortment between human and avian viruses which is believed to occur in intermediate hosts such as pigs. These 'shifts' result in the emergence of a new influenza virus. In the absence of immunity to these new viruses, there is rapid spread of influenza with dramatically increased rates of morbidity and mortality.

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After the pandemic of 1918 the H1N1 virus circulated widely in the human population until 1957. The Asian and Hong Kong pandemics in 1957 and 1968 introduced the H2N2 and H3N2 subtypes respectively, in each case replacing the previously circulating subtype of influenza A. There have been no major 'antigenic shifts' causing pandemics of influenza since 1968, however, the H1N1 subtype reappeared in the human population in 1977 and did not replace the H3N2 subtype. Since 1977, influenza A (H1N1), A (H3N2) and influenza B viruses have co-circulated and have been widespread globally, varying in frequency temporally and geographically.²

The formulation of influenza vaccines for use in Australia is determined annually by the Australian Influenza Vaccine Committee after review of the viruses circulating locally and internationally and after consideration of the World Health Organization (WHO) recommendations made in September. Influenza vaccination is provided free to non-Indigenous Australians aged 65 years and above and Indigenous Australians aged 50 years and above and is recommended for individuals with a range of underlying risk conditions, for pregnant women and for individuals who may transmit influenza to those with risk conditions.³

An effective national surveillance system is an essential component of a program for the control of influenza. Influenza surveillance is a mix of laboratory reporting of isolates and clinical diagnosis of influenza-like illness in sentinel practice schemes. Influenza surveillance aims to ensure the provision of timely information to public health departments, health care providers and the general public about levels of influenza activity and circulating strains. The major objectives of such surveillance include:

- (i) early detection of epidemics to enable the implementation of public health measures such as vaccination of the 'at risk' groups, 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
- (iv) evaluation of the impact of the epidemic and associated public health measures.

This annual influenza report provides a summary of the surveillance methods and data for 2001.

Surveillance methods

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

1. Notifications required by legislation to State and Territory health departments and nationally reported to the National Notifiable Diseases Surveillance System (NNDSS, from January 2001).
2. Laboratory diagnosis including virus isolation and serology by laboratories participating in the Laboratory Virology and Serology Reporting Scheme (LabVISE).
3. The WHO Collaborating Centre for Reference and Research on Influenza provides subtype data of influenza virus isolates forwarded by LabVISE laboratories.
4. Consultation rates for influenza-like illness diagnosed by sentinel general practitioners.
5. Absenteeism data of workers from a national employer.
6. Hospitalisation and mortality data.

National Notifiable Diseases Surveillance System

The Communicable Diseases Network Australia (CDNA) brings together communicable disease epidemiologists in all Australian States and Territories.⁴ The CDNA has revised the list of diseases, to be notifiable across all jurisdictions. From January 2001, this included laboratory-confirmed influenza for the first time. Because some States needed to make legislative changes to make influenza a notifiable disease, complete reporting for influenza was not available from all States and Territories and no data were received from Tasmania.

Laboratory surveillance

The Laboratory Virology and Serology Reporting Scheme (LabVISE) is a national scheme of sentinel laboratories. In 2001, 16 laboratories contributed to this scheme, although not all provided reports each month. Laboratory reports of influenza are sent to LabVISE all year round. Although viral isolation remains the gold standard for influenza diagnosis and surveillance, most reports have relied on the detection of viral antigen and serological markers. Nucleic acid detection by the polymerase chain reaction (PCR) is now in use for diagnosis.²

WHO Collaborating Centre for Reference and Research on Influenza

The WHO Collaborating Centre for Reference and Research on Influenza contributes reports on the subtypes and antigenic analysis of influenza viruses isolated throughout the year. This information is used to monitor the nature of influenza strains present in Australia and the rest of the world, to assess the suitability of the current vaccine (by measuring the degree of match between circulating strains and the current vaccine) and to determine the composition of vaccine for the following influenza season. Influenza viruses are named after the places where they were first identified. For example, A/Sydney/5/97 was first isolated in Sydney in 1997 and was influenza A isolate number 5 for that year.

The WHO Collaborating Centre for Reference and Research on Influenza conducts detailed antigenic analysis on all isolates received from Australian laboratories using conventional serological techniques. A geographically and temporally representative sample of isolates, together with any strains demonstrating uncharacteristic reactions during antigen characterisation were 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 assists in vaccine formulation decisions.

Sentinel general practitioner surveillance

Sentinel general practitioner surveillance schemes detect and record clinical diagnoses of influenza-like illness (ILI). The Australian Sentinel Practice Research Network (ASPREN) collects data at a national level. In addition, data are collected through 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.

Of sentinel general practices contributing to the ASPREN scheme, most are located in capital cities and larger regional centres, mostly on the east coast of Australia. In 2001, between 3,716 and 8,195 consultations were recorded each week. Participation is voluntary in all sentinel general practice surveillance systems, leading to variation in the number of contributors. In 2001, the number of contributing practices varied from 34 to 71 per reporting period.

The New South Wales Influenza Surveillance program collects clinical reports from New South Wales practitioners who are part of ASPREN and from three Area Health Services (AHS), two rural and one metropolitan (Southern AHS, North Sydney AHS and New England AHS). Reports were published weekly between 4 May and 28 September 2001. The total number of participating practices varied in 2001 from 6 to 37 and the number of consultations from 1,688 to 4,926 per week.

Table 1. Case definitions of influenza like illness used in different sentinel practice schemes

Program	Case definition
Victorian State program	Fever, cough, fatigue
Western Australia State program	Fever, cough, fatigue
New South Wales State program, Northern Territory and ASPREN	Six of the following criteria with sudden onset (<12 hours previously): cough, rigours or chills; fever; prostration and weakness; myalgia; redness of mucous membranes; influenza in close contacts.

(adapted from Watts and Kelly 2002 *Commun Dis Intell* 2002;26:8–12)

Absenteeism surveillance

Australia Post, a major nationwide employer, provided sick leave absenteeism data during 2001 between March and September. Absenteeism was defined as an absence due to illness for at least 3 consecutive days. Absenteeism was reported as the rate per 100 employees and rates were calculated on a weekly basis.

Hospitalisation data

To assess the impact of influenza on hospitalisation, the Australian Institute of Health and Welfare (AIHW) provide data on hospital separations and average length of stay in public and private hospitals. Information was accessed by ICD-10AM code that classifies influenza under two categories: cases of influenza where the virus is identified (J10) and cases where the virus is not identified (J11).

Results

The influenza surveillance data presented here are limited and should be interpreted with caution. Laboratory-confirmed influenza are 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 influenza-like-illness vary between sentinel practices (Table 1) which make comparisons of influenza incidence difficult. In addition, definitions of influenza-like illness have varied from year to year, so comparisons of data across years are complex.

National Notifiable Diseases Surveillance System

In 2001, 1,329 laboratory-confirmed cases of influenza were reported to the NNDSS. As noted above, not all jurisdictions submitted reports and the totals for some jurisdictions might represent less than 12 months data. The data collected are shown by jurisdiction in Table 2, along with the month from which influenza notifications commenced.

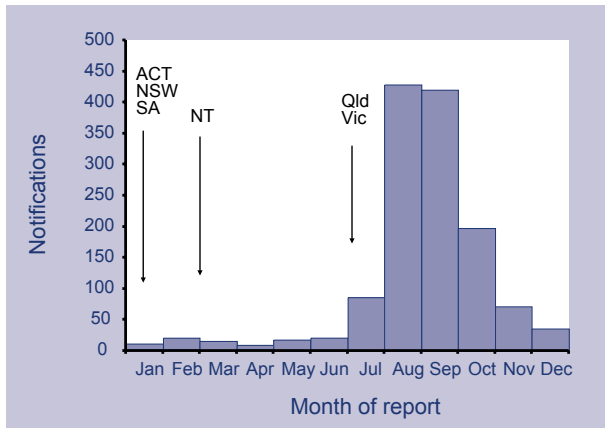
Table 2. Notifications of influenza to the National Notifiable Diseases Surveillance System, Australia, 1 January to 31 December 2001, by date of onset

	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Total
Notifications	15	282	95	392	135	NDR	174	236	1,329
Month when influenza notifications commenced	January	January	February	July	January	Did not report in 2001	July	January	

NDR: No data received. Updated as at 6 February 2002.

The notifications to NNDSS by month of report are shown in Figure 1. Notifications showed a peak in August (429 notifications) and September (420 notifications).

Figure 1. Notifications of laboratory-confirmed influenza, Australia, 2001, by month of report



The breakdown of laboratory-confirmed influenza cases to NNDSS by age and sex is shown in Figure 2. The overall male to female ratio for influenza in 2001 was 1.1:1. The age specific rates were highest among infants and children aged less than 5 years (32.1 cases per 100,000 population), 5 to 9 year olds (11.6 cases per 100,000 population) and among 80 to 84 year olds (7.9 cases per 100,000 population).

Laboratory surveillance

In 2001, a total of 1,076 laboratory diagnoses of influenza were made in participating laboratories of the LabVISE scheme. There were 869 reports of influenza A and 208 reports of influenza B, giving a ratio of influenza A to B of 4.2:1. This compared with 1,916 influenza reports to LabVISE in 2000, when the ratio of influenza A to B was 2.5:1. Total influenza reports showed a low level of activity until week 28 (15 July) when there was an increase in reports to approximately 35 per week, followed by a major peak of 64 reports per week in week 32 (12 August), then a decline to baseline (14 reports per week) by week 45 (11 November, Figure 3). There was a temporal difference in the peaks of influenza A (week 22) compared with influenza B (week 40) activity through the year. The peak of influenza activity in 2001 was earlier in the year than in 2000 (Figure 4).

The seasonal pattern of influenza A and B activity between 1996 and 2001 is shown in Figure 5. The pattern in 2001 closely resembled that in 1999 with a relatively small number of influenza B isolates and a large A:B ratio.

Figure 2. Notification rates of laboratory-confirmed influenza, Australia, 2001, by age and sex

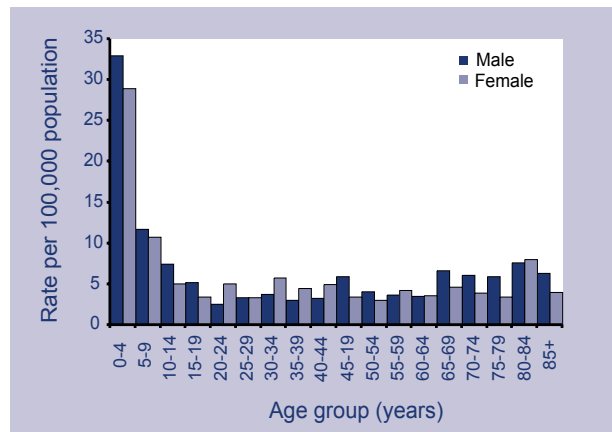


Figure 3. Laboratory reports of influenza, Australia, 2001, by type and week of specimen collection

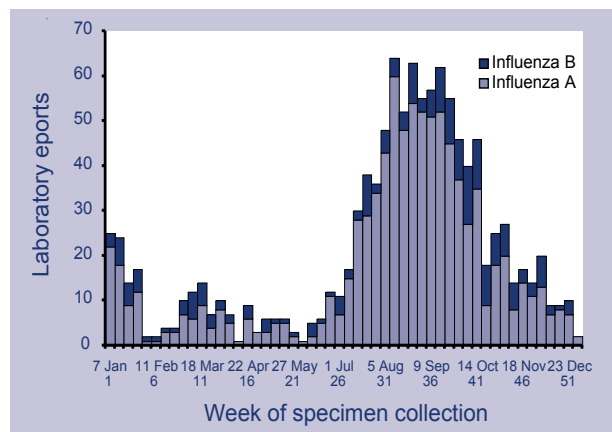


Figure 4. Laboratory reports of influenza, Australia, 2000 and 2001, by month of specimen collection

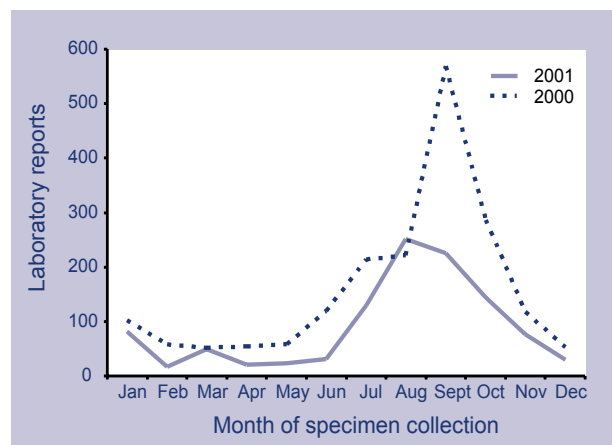
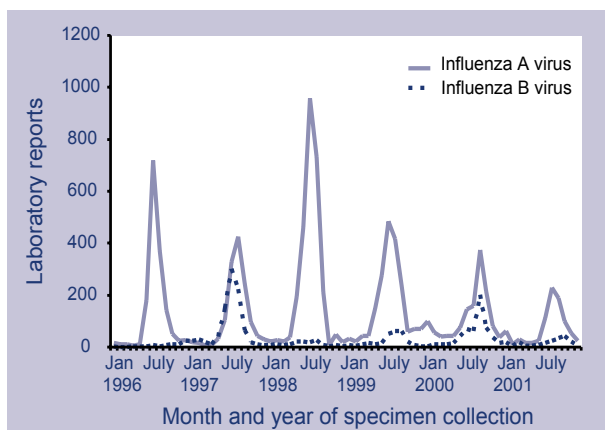


Figure 5. Laboratory reports of influenza, Australia, 1996 to 2001 by type and month of specimen collection



WHO Collaborating Centre for Reference and Research on Influenza

The Centre received 615 viable influenza isolates that could be analysed antigenically, approximately half the number received in 2000. Of these isolates 441 (71.7%) were influenza A(H1N1) subtype, 103 (16.7%) were A(H3N2), and 71 (11.5%) were influenza B. The variable region of the haemagglutinin antigen was sequenced in 83 (13%) isolates and the neuraminidase antigen was sequenced in 32 (5%) of the isolates. All of the A(H1N1) viruses were A/New Caledonia/20/99-like strains. Genetic analysis of these showed only minor changes from the reference strain. Viruses of the second A(H1N1) lineage (i.e. A/Bayern/7/97-like strains) were not seen among the Australian

isolates or in isolates received from the Asia-Pacific region. The A(H3N2) isolates were antigenically similar to the reference strain A/Moscow/10/99 and the vaccine strain A/Panama/2007/99. However, as is usually observed for this subtype, there was some antigenic and genetic heterogeneity (Figure 6). There was no evidence of emergence of a representative new antigenic variant and antibodies induced in vaccine recipients by the current A/Panama vaccine strain were of similar titre and frequency to viruses isolated throughout the year as to those against the vaccine virus. The neuraminidase antigen showed some evidence of genetic but not antigenic drift.

The Australian influenza B isolates were mainly B/Sichuan/379/99-like strains however, approximately 10 per cent of isolates were more closely related to older influenza B strains such as B/Harbin/7/94 which circulated previously (Figure 7). Antisera prepared against B/Sichuan/379/99-like strains, and post-vaccination sera from people receiving B/Sichuan-like vaccine, reacted strongly with these B/Harbin-like viruses. None of the Australian influenza viruses belonged to the more distinct influenza B lineage (often referred to as the B/Victoria/2/87 lineage), which has persisted in Asia and has been seen in some other regions recently.

Based on antigenic and genetic analysis, and post-vaccination human serology of the Australian 2001 vaccine represented a good match for the circulating viruses.

Figure 6. Evolutionary relationships between influenza H3 haemagglutinins (HA1 region)

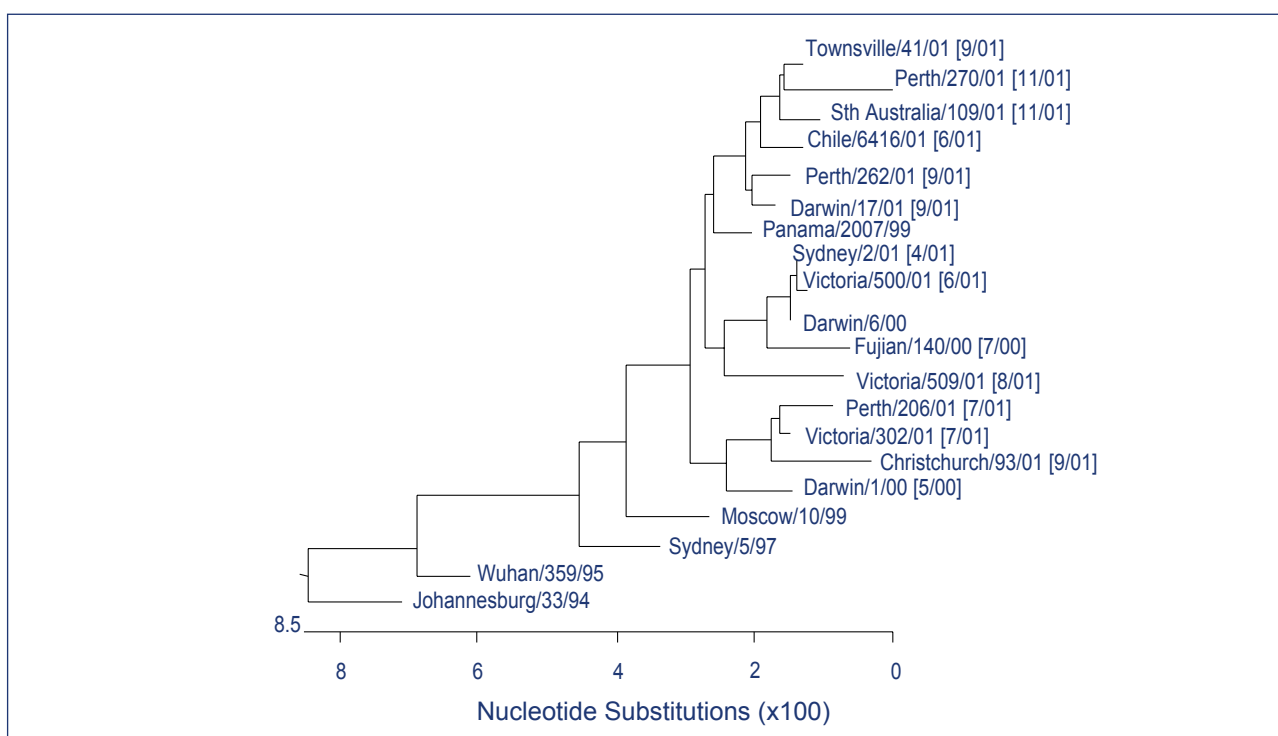
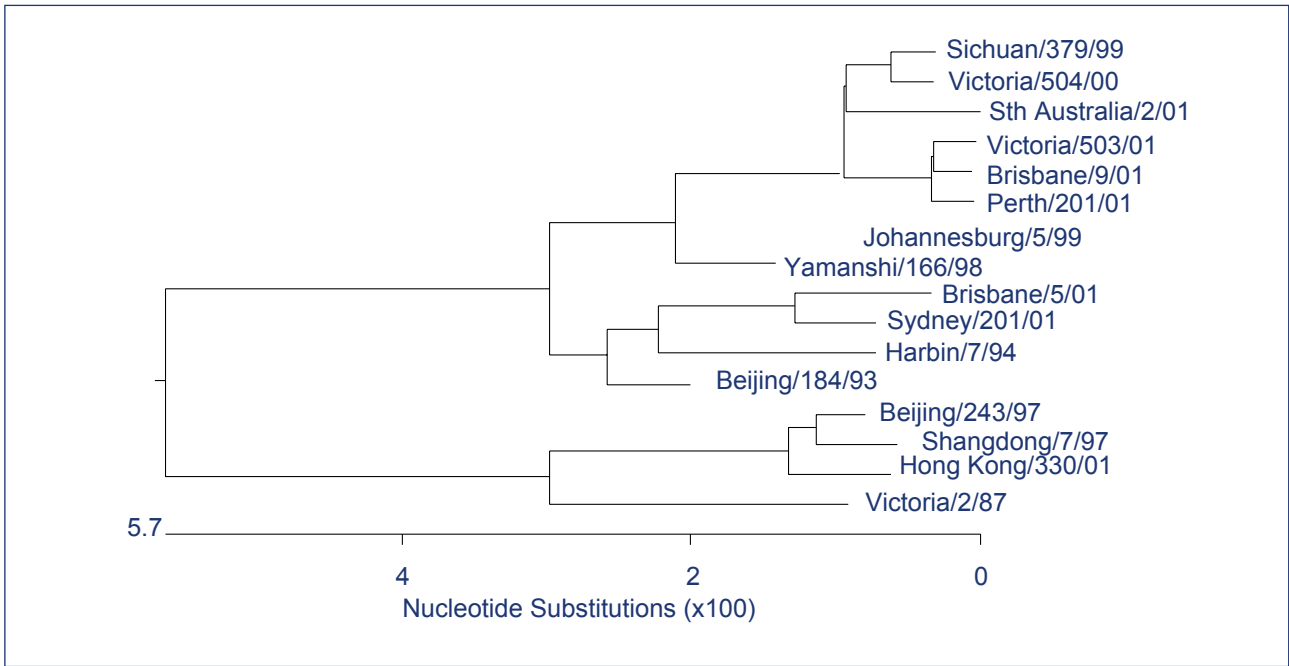


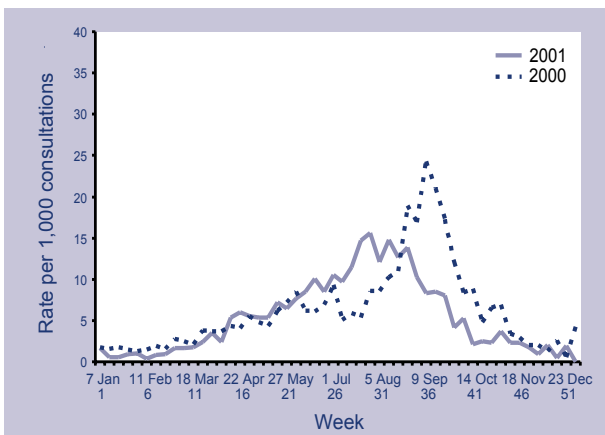
Figure 7. Evolutionary relationships between influenza B haemagglutinins (HA1 region)



Sentinel general practice surveillance

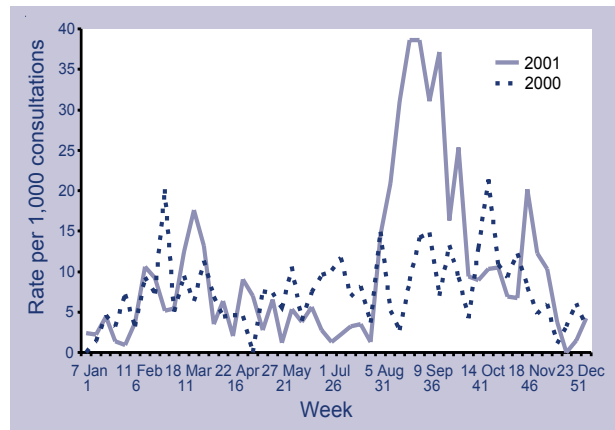
Reports of influenza-like illness to ASPREN practice sites showed a peak in week 30 (29 July, Figure 8) when reports reached a rate of 15.6 cases per 1,000 consultations. This peak in activity was lower and earlier in the year than the peak reporting in 2000 (24.3 cases per 1,000 consultations in week 36, 9 September).

Figure 8. ASPREN consultation rates for influenza-like illness, Australia, 2000 and 2001, by week of report



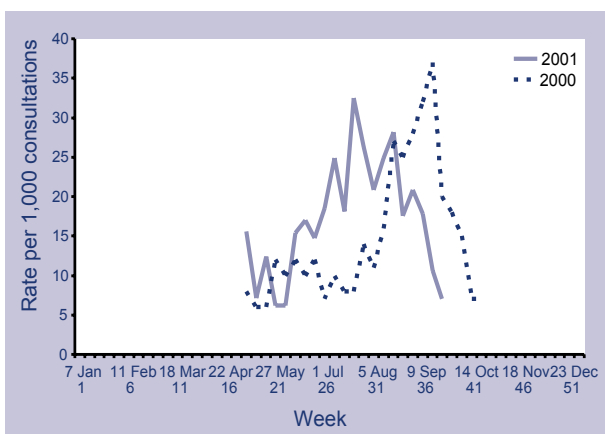
The Northern Territory Tropical Influenza Surveillance Scheme data showed two peaks of influenza activity in week 12 (25 March, 17.6 cases per 1,000 consultations) and weeks 34 and 35 (26 August to 2 September; 38.6 cases per 1,000 consultations). The influenza activity in the latter part of 2001 was greatly increased compared with 2000 (Figure 9).

Figure 9. Consultation rates for influenza-like illness, Northern Territory, 2000 and 2001, by week of report



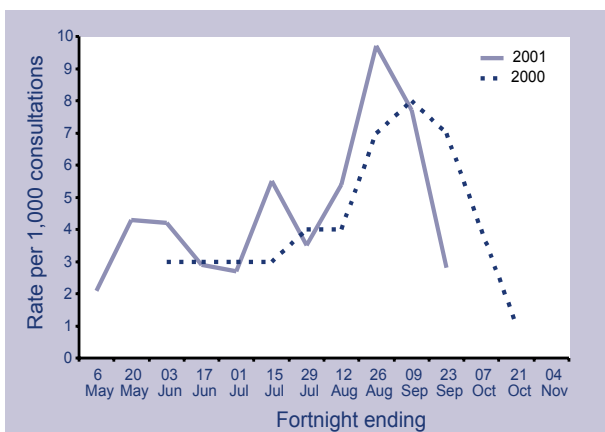
In New South Wales, influenza-like illness reports peaked in week 29 (22 July) at 32.5 cases per 1,000 consultations (Figure 10). In contrast with reports in 2000, the peak activity of influenza in New South Wales was earlier and lower – the peak in 2000 was in week 37 (16 September) at 37 cases per 1,000 consultations.

Figure 10. Consultation rates for influenza-like illness, New South Wales, 2000 and 2001, by week of report



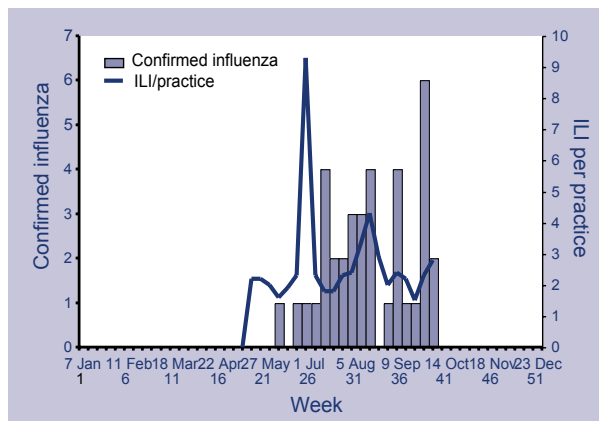
In Victoria, the reporting rate of influenza-like illness peaked at 9.7 cases per 1,000 consultations in the fortnight ending 26 August (Figure 11). The rate was higher in Victoria in 2001 and occurred earlier in the year than in 2000 (peak reporting in early September at 8 cases per 1,000 consultations).

Figure 11. Consultation rates for influenza-like illness, Victoria, 2000 and 2001, by fortnight of report



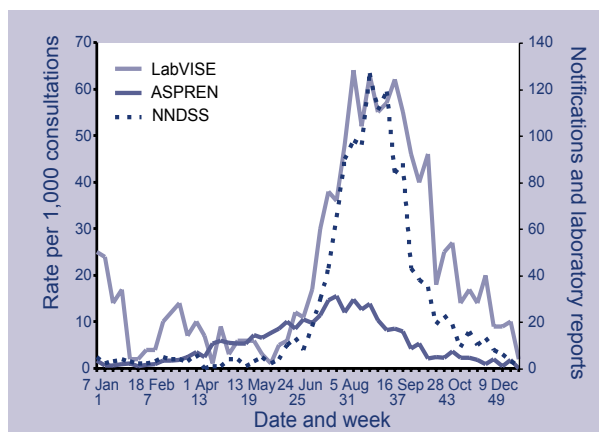
In Western Australia, the peak of reporting of influenza-like illness occurred in week 30 (29 July) at 9.3 cases per practice (Figure 12).

Figure 12. Consultation rate for influenza-like illness and laboratory reports of influenza, Western Australia, 2001, by week of report



A comparison of the NNDSS, ASPREN and LabVISE reports is shown in Figure 13. The peak in reports of influenza-like illness to ASPREN in week 30 preceded the peak of laboratory reports of influenza to LabVISE in week 32, which preceded the peak of notifications to NNDSS (week 34).

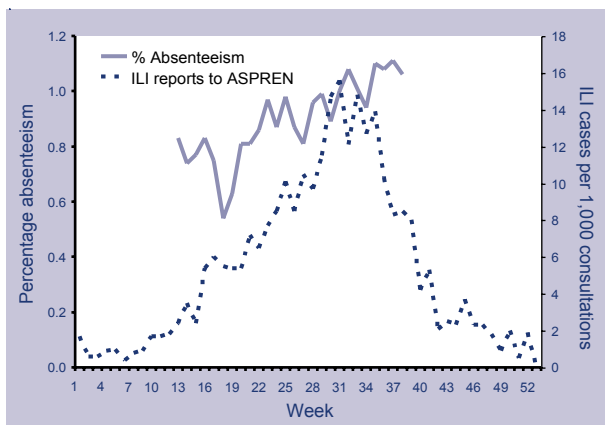
Figure 13. Laboratory reports to LabVISE, notifications to NNDSS and consultation rates in ASPREN of influenza, Australia, 2001, by week of report



Absenteeism surveillance

There was little evidence of any association between absenteeism and the peak in influenza activity in the data supplied by Australia Post. Data were only available up to week 37. Absenteeism was highest at 1.11 per cent in week 36 (Figure 14).

Figure 14. Rates of absenteeism and consultation rates for influenza-like illness, Australia, 2001, by week of report



Hospitalisation due to influenza

There were no data on hospitalisations or deaths due to influenza for 2001 available at the time of writing this report.

Discussion

In 2001, influenza activity in Australia was at low to moderate levels as assessed by all surveillance systems compared with activity in 2000. While influenza activity was moderate in temperate regions of Australia, a large outbreak was reported from the Northern Territory late in 2001. Two areas of the Northern Territory were affected – urban Alice Springs and an island off the north coast. While both areas reported a mixture of influenza types, influenza B was more common in Alice Springs and influenza A was more common on the island (Peter Markey, CDC Darwin, personal communication).

Overall, the influenza viral strains circulating in Australia in 2001 were similar to those seen in the previous season and were well matched to the strains in the 2001 vaccine. The proportion of influenza A H1N1 among circulating strains in Australia further increased in 2001, continuing a trend seen elsewhere in the world since 2000. The emergent A(H1N1) strains were A/New Caledonia/20/99-like. Influenza epidemics which are predominantly A(H1N1) have been shown to cause a lower rate of hospitalisation than epidemics which are predominantly A(H3N2).⁵ The number of viral isolates analysed in 2001 were half that analysed in 2000. A larger, more representative sample of influenza isolates should be analysed so that surveillance of circulating strains includes infrequent variant strains.

The 2001 to 2002 Northern Hemisphere influenza season was late to commence and severity has been generally moderate. Reporting from the United States of America up to mid-January 2002 showed low influenza activity nationwide, although influenza activity normally peaks in February.⁶ In contrast with the 2001 Australian influenza season, the majority of the circulating viruses in the Northern Hemisphere were H3N2 and were well matched by the vaccine strain.

Two variant influenza strains were noted in the Northern Hemisphere 2001 to 2002 influenza season.

Firstly, the emergence of some influenza B/Hong Kong/330/2001-like strains (B/Victoria/2/87 lineage) occurred in Europe. Viruses of this lineage are antigenically distinct from B/Sichuan/379/99 and during the past decade had circulated only in Asia. The current B/Sichuan/379/99-like vaccines induce antibodies that react poorly with the B/Hong Kong/330/2001-like strains. Secondly, a substantial number of genetic reassortant A(H1N2) viruses carrying an A/New Caledonia/20/99-like haemagglutinin and an A/Panama/2007/99-like neuraminidase were identified. Although A(H1N1) and A(H3N2) viruses have co-circulated in the human population since 1977, and genetic reassortment of influenza viruses occurs rather readily during mixed infections, viruses carrying mixed surface antigens from the two subtypes have been rather rare. Current vaccines and diagnostic reagents remain appropriate for the reassortant viruses.

Australian national influenza surveillance continues to rely on a number of different sources of data from independently operating schemes with distinct case definitions and surveillance practices. This complicates the analysis of national influenza activity and trends, as the data from different schemes are not always comparable. A survey of the detection of influenza-like illness in sentinel practice schemes in Australia has been recently published.⁷ This study based on a telephone survey in August 2001, found major differences in the definitions of ILI used by different sentinel schemes (Table 1) and variable access to, or use of laboratory testing. These differences confound attempts to compare influenza activity as measured by ILI rates in different parts of Australia. There is a need to standardise clinical definitions of ILI and to measure the sensitivity and specificity of ILI definitions relative to the diagnosis of influenza by laboratory techniques.

Laboratory-confirmed influenza is now a nationally notifiable disease in Australia. This means there is a legal obligation to report laboratory-confirmed cases from all Australian medical practices, hospitals and laboratories to State and Territory health departments. These in turn have agreed to send data to the National Notifiable Diseases Surveillance System. Up to 2001, data on laboratory-confirmed influenza cases were reported through the Virology and Serology Reporting Scheme, a sentinel reporting scheme in which a group of laboratories voluntarily report on laboratory diagnoses of influenza. In 2001, the number of notifications to NNDSS (1,329) was greater than laboratory reports to LabVISE (1,076). NNDSS data are more representative than LabVISE as NNDSS reports come from a larger number of laboratories. The NNDSS dataset has been undergoing extensive revisions and from 2002, a larger set of data will be reported on each case. For cases of influenza, it will be possible to record the virus type and (if available) the virus strain, and whether the case was vaccinated. In addition, it may be possible to identify cases linked in an outbreak.

Preparations for an influenza pandemic in Australia continued in 2001 with the development of the Australian action plan for pandemic influenza. The pandemic plan, under consideration by CDNA in February 2002, focuses on the responsibilities of the Commonwealth and the States and Territories in the phases of an influenza pandemic.⁸ The main priority in a pandemic will be to minimise morbidity and mortality. It will be essential to enhance influenza surveillance, ensure maintenance of health care and essential services, and implement a communication strategy for timely dissemination of information throughout the health care system and community in general. The action plan lists the main activities to be considered for these issues and the responsible agencies. It also recommends preparation of State and Territory action plans to increase coordination at all levels.

Influenza vaccination of vulnerable populations such as the elderly is an important public health activity to reduce the morbidity and mortality of annual influenza epidemics. The National Health and Medical Research Council recommends annual influenza vaccination for all Australians aged over 65 years and influenza vaccine is available free to Australians over 65 years. A national telephone survey conducted in October and November 2001 showed 77 per cent of Australians aged over 65 years received influenza

vaccination in 2001. This is an increase of 3 per cent of the vaccination rate in this age group in 2000. The vaccination rates in Australians aged 65 years or more with a chronic disease reached 84 per cent in 2001.⁹ The survey reported that under the National Influenza Vaccine Program, 89 per cent of the respondents in this age group had received the vaccine through the program.

The Australian 2002 influenza vaccine is composed of an A/New Caledonia/20/99(H1N1)-like strain, an A/Moscow/10/99(H3N2)-like strain and a B/Sichuan/379/99-like strain. Although the strain composition is the same as for vaccines issued in 2001, immunity to influenza vaccine is of limited duration and should be reinforced annually regardless of vaccine strain composition. Influenza vaccines have a limited shelf life and are intended for use during the year that they are distributed.

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