Annual report of the National Influenza Surveillance Scheme, 1999

Jennifer Thomson,[1] Ming Lin,[1] Alan Hampson[2]

Abstract

An effective national surveillance system is an essential component of a program for the control of influenza. The National Influenza Surveillance Scheme includes data from sentinel general practice consultations for influenza-like illness, laboratory reports of influenza and absenteeism rates from a national employer. The 1999 season peaked between May and September with maximal activity between July and August. Influenza A was the dominant type in all States and Territories with influenza A H3N2 viruses predominating and influenza A H1N1 occurring sporadically. There was no evidence of significant drift among the H3N2 isolates (A/Sydney-like strains) whereas the H1N1 isolates showed significant antigenic changes from the vaccine strain A/Beijing/262/95 and were closely related to a new variant A/New Caledonia/20/99. A small peak in influenza B activity occurred towards the end of the influenza season and isolates remained closely related to the vaccine reference strain B/Beijing/184/93. *Commun Dis Intell* 2000;24:145-152.

Keywords: surveillance, influenza, vaccine, antigenic drift, case definition

Introduction

Influenza infection is mostly associated with an acute self-limiting upper respiratory tract infection. However, complications may occur and these most commonly include lower respiratory tract infection - in particular primary and secondary pneumonia, exacerbation of chronic obstructive pulmonary disease[1,2] and exacerbation of cardio-pulmonary disease.[1] Influenza-related morbidity (measured as excess hospitalisation) and mortality are most often due to these

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complications.[1,2] Although influenza infection affects all age groups, the rates of serious morbidity and mortality tend to be highest amongst those aged 65 years and over and those with chronic medical conditions.[1,3,4] Young infants and pregnant women are also recognised as being at increased risk of hospitalisation from influenza.[1,2]

Since 1977 influenza A (H1N1 and H3N2) and influenza B viruses have been in global circulation.[5] Influenza outbreaks usually occur during the 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.[1,2,4,6] During an epidemic the overall attack rate is high such that even a low frequency of complications results in an increase in the number of hospitalisations and often in mortality.[1] Every 10-30 years influenza may cause pandemics in which a quarter or more of the population may be affected over a short period and during which the rates of illness and death from influenza can increase dramatically.[2,3]

An effective national surveillance system is an essential component of a program for the control of influenza 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.[5,6] The major objectives of such surveillance include:[4]

(i) early detection of epidemics to enable the implementation of public health measures such as immunisation of the at risk groups, control campaigns and provision of clinical services,

(ii) characterisation of the nature of the epidemic and evaluation of the impact of the epidemic and associated public health measures, and

(iii) isolation and antigenic characterisation of influenza virus to assist in the formulation of the following season's vaccine.

The Annual Influenza Report provides a summary of the surveillance methods and data for the previous year (1999).

Surveillance Methods

Routine surveillance of influenza in Australia comprises three systems:[4,5,6]

- laboratory diagnosis including virus isolation and serology by laboratories participating in LabVISE (Laboratory Virology and Serology Reporting Scheme);
- consultation rates for clinically diagnosed influenza illness by sentinel general practitioners;
- absenteeism data of workers from a national employer.

At the National Centre for Disease Control from May to October these data are compiled, analysed and reported in *Communicable Diseases Intelligence (CDI)* regularly and a summary is included in the annual report of the National Influenza Surveillance Scheme.

Additional information is provided by the WHO Collaborating Centre for Reference and Research on Influenza and by Australia wide surveillance programs organised by pharmaceutical companies for the last two years (1998,1999) as part of multi-centre drug trials conducted in the Southern Hemisphere.

Laboratory surveillance (LabVISE)

Laboratory reports of influenza are sent to LabVISE all year round. This is a national scheme of sentinel laboratories Australia wide: in 1999 a total of 13 sentinel laboratories contributed to the scheme, although not all provided reports each month. Influenza diagnosis and reporting for the Northern Territory was referred to laboratories in Queensland, South Australia or Western Australia, and for Tasmania to one of the laboratories in Victoria. Additional data for 1999 were received directly from South Australia at the time of compilation of this report; these have been added to existing 1999 data provided through LabVISE from South Australia so duplication of data may have occurred. 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 Polymerase Chain Reaction (PCR) is now in limited use and some notifications, especially from Western Australia and Victoria, have been based on this.

Criteria for a laboratory diagnosis of influenza are direct detection of viral antigen, or isolation of virus, or serological markers of recent infection. When performed, detection of viral RNA by PCR may also be used to indicate influenza infection.

Sentinel general practitioner surveillance

Sentinel general practitioner surveillance schemes mostly detect and record clinical diagnoses of influenza-like illness. At a national (or multi-state) level there is ASPREN (Australian Sentinel Practice Research Network); and at a State or Territory level there are the New South Wales Sentinel General Practice Scheme, the Victorian Sentinel General Practice Scheme and the Northern Territory Tropical Influenza Surveillance Scheme. The New South Wales and Victorian schemes report cases of influenza-like illness from the beginning of May to September each year. ASPREN and the Northern Territory schemes report throughout the year. The ASPREN scheme is the only sentinel surveillance scheme that reports on cases of influenza-like illness from sentinel general practices located throughout Australia (Figure 1).

Most participating sentinel general practices are located in metropolitan areas and on the southeast coast. In all sentinel general practice surveillance systems, participation is voluntary; in 1999 the number of contributing practices

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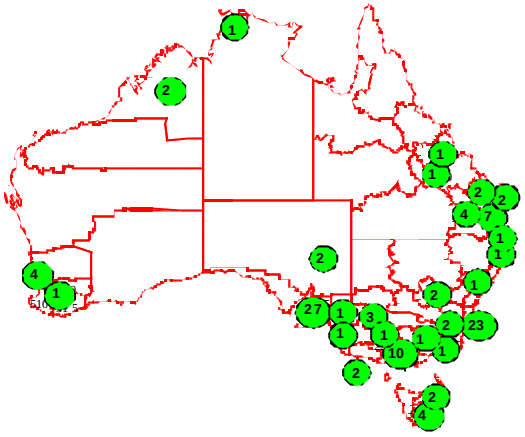
Figure 1. Geographic distribution of ASPREN sentinel sites, by number of sites and location



varied from 30-62 per reporting period for the ASPREN scheme, 14-33 for the New South Wales scheme, 6-18 for the Victorian scheme and 6-18 for the Tropical Influenza Surveillance Scheme from the Northern Territory.

The case definition for a clinical diagnosis of an influenza-like illness varies between the different sentinel general practice surveillance schemes.

The case definition for ASPREN, and the Victorian and Northern Territory schemes is:

- viral culture or serological evidence of influenza virus infection; or
- influenza epidemic, plus four criteria listed below; or
- six of the following clinical criteria
  - sudden onset (within 12 hours),
  - cough,
  - rigours or chills,
  - fever,
  - prostration and weakness,
  - myalgia, widespread aches and pains,
  - no significant respiratory physical signs other than redness of nasal mucous membranes and throat,
  - influenza in close contacts.

An alternative, used by the New South Wales scheme, is :

- cough; and
- myalgia; and
- no abnormal respiratory physical signs other than redness of nasal mucous membranes and throat; and
- two of the following
  - sudden onset,
  - rigours or chills or fever,
  - prostration or weakness,
  - influenza in close contacts.

Absenteeism surveillance

Australia Post provided de-identified sick leave absenteeism data during 1999. Absenteeism was defined as an absence due to sickness for at least 3 consecutive days. This definition was used to increase the specificity for absenteeism related to influenza infection. Absenteeism was reported as the rate per 100 employees and rates were calculated on a weekly basis.

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 in Australia. This information is used to monitor the nature of influenza strains present in Australia and the rest of the world, assess suitability of the current vaccine (level of matching between circulating strains and the current vaccine) and determine the composition of the following year's vaccine.

Independent influenza surveillance program

A number of pharmaceutical and laboratory companies conducted surveillance programs in Australia from April to September 1999. The largest involved sentinel general practitioner sites selected from New South Wales, Queensland, Victoria, South Australia and Western Australia. Approximately 1,000 nose and throat swabs were collected from individuals fitting the ASPREN clinical case definitions for influenza-like illness (some States used different definitions) and these were processed for virus isolation. The laboratories involved in this program were the Institute of Clinical Pathology and Medical Research (New South Wales and Queensland), Victorian Infectious Diseases Reference Laboratory (Victoria), Institute of Medical and Veterinary Science (South Australia) and PathCentre (Western Australia).

Results

Laboratory surveillance (LabVISE)

A total of 3,247 reports was received with 2,861 for influenza A and 386 for influenza B. The ratio of influenza A to B was 7.4:1.

Total influenza reports showed a low grumbling baseline until May, a small peak of 85 reports per week in June (week 23), a second higher and broader peak from late June to early September (weeks 26 to 37) with a maximum of 212 reports per week (week 29) and then a decline to a low grumbling baseline that continued from mid-October until the end of December (weeks 41-53, Figure 2). This primarily reflected the pattern for influenza A which predominated with peaks of 78 reports per week in early June (week 23), 200 reports per week in mid-July (week 29) and 186 reports per week in early August (week 32). The pattern for influenza B was a low grumbling baseline with a delayed peak from late August to early September (33-37 weeks) with a maximum of 29 reports per week (35 and 37 weeks) (Figure 2).

The overall pattern of total influenza reports for 1998 and 1999 was similar, with a slightly delayed and lower and flatter peak of 803 reports in July 1999 compared with 980 reports in July 1998 (Figure 3).

Figure 2. Laboratory reports of influenza, Australia, 1999, by influenza type and week of specimen collection

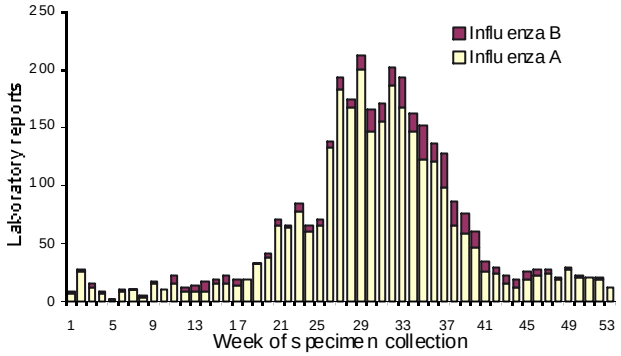


Figure 3. Laboratory reports of influenza, Australia, 1998 to 1999, by month of specimen collection

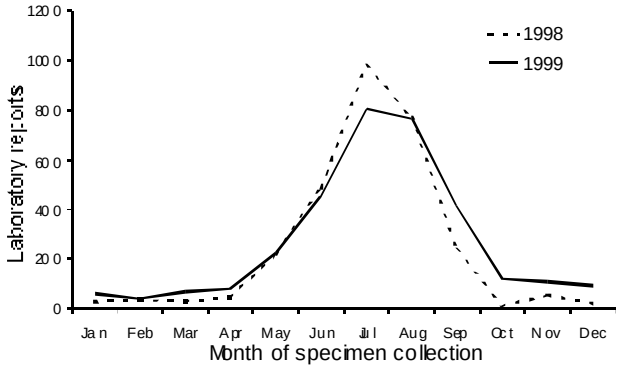
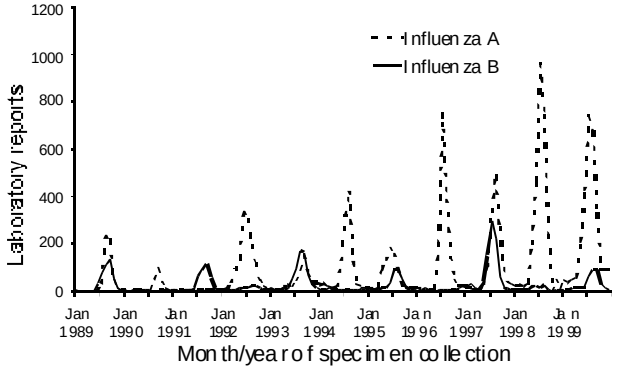


Figure 4. Influenza A and B laboratory reports, Australia, 1989 to 1999, by month/year of specimen collection



The pattern of influenza A and B reports was examined over a 10-year period from 1989 to 1999. Over this period annual peaks of influenza A occurred mostly in July with the highest peaks in 1998 (980 reports in July) followed by 1996 (758 reports in July) and then 1999 (740 reports in July). Peaks of influenza B mostly occurred biennially. The expected peak in 1999 was delayed and small (91 reports in August and 91 reports in September) in contrast with the previous highest peak of 301 reports in July 1997 (Figure 4).

The 15-44 year age range yielded the largest number of laboratory reports although a similar but slightly lower level of laboratory reports was reported for children aged 0-4 years. Overall there were similar numbers of reports for males and females (1,683:1,541 ie. 1.1:1). Figure 5 shows some variation in the ratio of males to females by age group.

The State or Territory of origin of laboratory influenza reports was based on the State or Territory of residence of the patient (Figure 6a). In 39% of reports (1,273/3,247) postcode of residence was unknown. For comparison a further figure has been provided using the State or Territory of the reporting influenza laboratory (Figure 6b). This comparison shows a similar pattern except that, using the State or Territory of residence of the patient, a small number of reports from the Northern Territory, Australian Capital Territory and Tasmania were seen and these were not seen using the State or Territory of the laboratory. No reports were seen from South Australia using the State or Territory of residence of the patient but reports from South Australia were seen when the State or Territory of the laboratory was used. Laboratory staff in South Australia confirmed that the reporting system that existed in 1999 did not include information on the State or Territory of residence of the patient (Dr Geoff Higgins, Institute of Medical and Veterinary Science, South Australia; personal communication). As information on the State or Territory of residence of the patient more accurately reflected the distribution of influenza activity, subsequent comments on the pattern of influenza relate to Figure 6a.

Of the 2,861 reports of influenza A, information on the State or Territory of residence of the patient was unknown for 38% (1,102). As South Australia did not provide information on the State or Territory of residence of the patient, all data from South Australia were included as part of the unknown

Figure 5. Laboratory reports of influenza, Australia, 1999, by age and sex

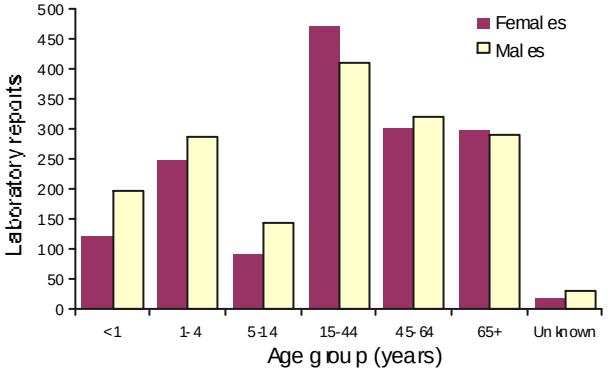


Figure 6a. Laboratory reports of influenza, Australia, 1999, by influenza type and State/Territory of residence

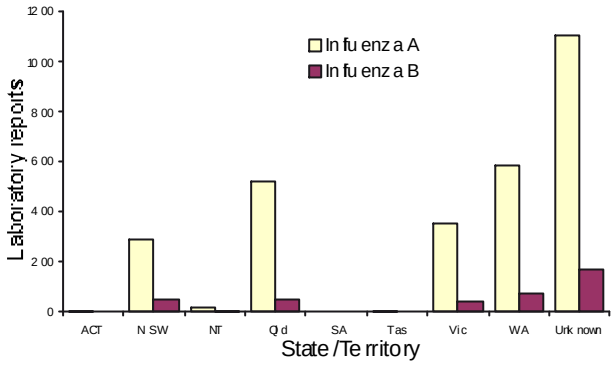


Figure 6b. Laboratory reports of influenza, Australia, 1999, by influenza type and State/Territory of laboratory

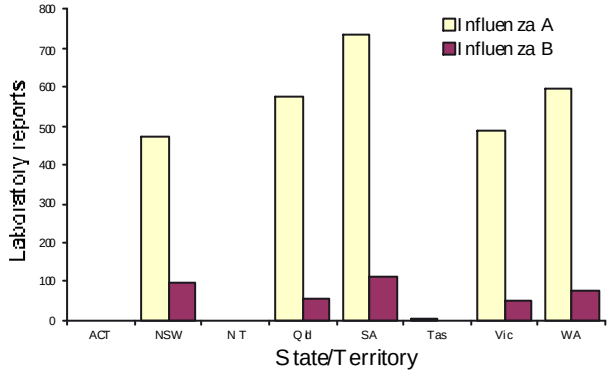
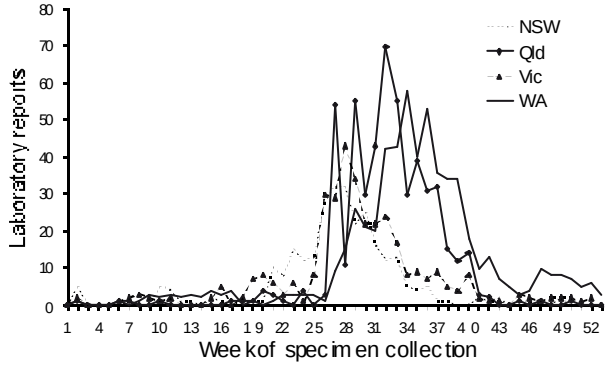


Figure 7. Influenza A laboratory reports, Australia, 1999, by week and State



group. Of the remaining reports with information on the State or Territory of residence of the patient (1,759) the greatest number was from Western Australia (582), followed by Queensland (521), Victoria (351), New South Wales (286), and the Northern Territory (16).

A smaller number of influenza B reports (386) was received from all States and Territories. The postcode of patient residence was unknown for 44% of reports (171/386). South Australia did not provide information on the State or Territory of residence of the patient, so all South Australian data were included in the unknown group. Of the remaining 215 reports with information on the State or Territory of residence of the patient, the greatest number was from Western Australia (73), followed by Queensland (50), New South Wales (47), Victoria (43) and the Northern Territory (2) (Figure 6a).

A breakdown of weekly reports for influenza A by State or Territory showed that the peak in reports occurred first in New South Wales (32 reports per week for weeks 27 and 28) followed by Victoria (43 reports per week for week 28) at the beginning of July, then Queensland (70 reports per week for week 32) in early August and later in Western Australia (58 reports per week for week 34) in mid-August (Figure 7). A low baseline of reports was received from the Northern Territory (maximum 4 reports per week), 2 reports from Tasmania, and one report from the Australian Capital Territory. South Australian data were included in the unknown group.

Breakdown of influenza B weekly reports by State and Territory showed that the appearance of influenza B was delayed and the pattern differed from that seen for influenza A. A peak in influenza B reports was first seen in New South Wales in July (5 reports per week for weeks 27, 30, 34 and 36), followed by Victoria in mid-August to early September (4 reports per week for weeks 33 and 37), Queensland from late August to mid-September (9 reports per week for week 35 and 8 reports per week for week 38) and last in Western Australia in mid-September (8 reports per week for week 37). The Northern Territory had a low baseline of 1 report per week. There were no reports from Tasmania nor the Australian Capital Territory. South Australian data were included in the unknown group.

Sentinel general practitioner (GP) surveillance

Both ASPREN and the New South Wales Sentinel General Practice Scheme showed a wide peak of GP attendances for influenza-like illness from mid-May to September 1999. The Victorian Sentinel General Practice Scheme showed a smaller peak in July. The Northern Territory Tropical Influenza Surveillance Scheme showed a clear bimodal pattern with peaks in March to April and July to September (Figure 8).

GP attendances for influenza-like illness peaked in the 15-44 year age group. Overall there was a similar rate amongst males and females, although males predominated in those younger than 14 years and in the peak age group of 15-44 years; and females predominated in those older than 45 years (Figure 9).

Comparison of ASPREN and LabVISE (Figure 10) showed a similar pattern and level of activity with the trend in ASPREN data followed about two weeks later by the trend in LabVISE data.

Figure 8. Sentinel general practitioner consultation rates, influenza-like illness, 1999, by week and sentinel surveillance scheme

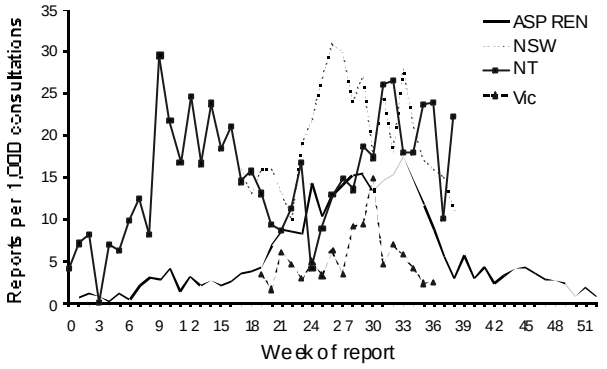


Figure 9. ASPREN reports of influenza-like illness, Australia, 1999, by age and sex

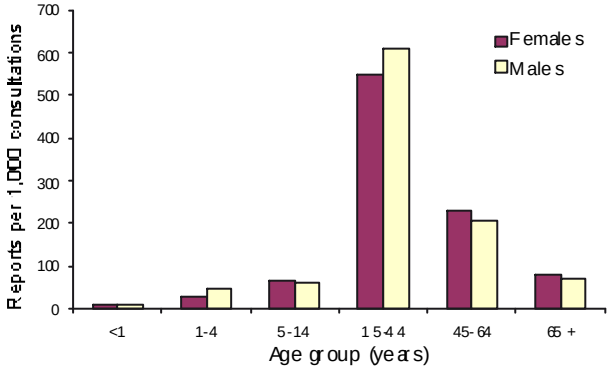
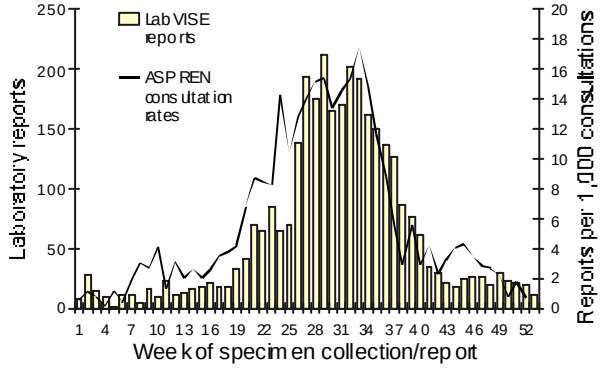


Figure 10. Comparison of LabVISE influenza reports and ASPREN influenza-like illness consultation rates, Australia, 1999, by week of specimen collection/report



Absenteeism surveillance

The national rate of absenteeism of three days per week reported by Australia Post was between 0.2% and 1% in the period from the end of March to September 1999 with the highest level of absence in August and September (Figure 11).

Independently conducted influenza surveillance program

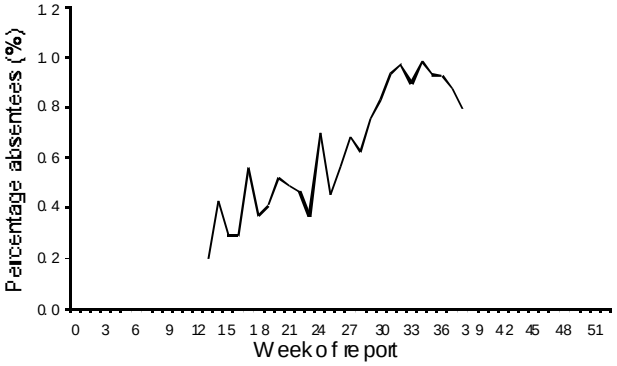
Influenza virus isolation and influenza-like illness rates peaked earlier on the east coast than the west coast, with maximal activity in June for Victoria (week 25) and South Australia (week 26), in July for New South Wales and Queensland (week 28) and in August for Western Australia (week 33). The overall ratio of influenza A to B was approximately 5:1, and rates were similar to 1998. Influenza B activity occurred later in the season. Most isolates were A Sydney 5/97 H3N2-like viruses

WHO Collaborating Centre for Reference and Research on Influenza

Influenza Virus Isolates

A total of 813 viable isolates of influenza was received from Australian laboratories for antigenic analysis, less than the number of viable isolates received in the two previous years (1,127 in 1998 and 1,178 in 1997) and representing 25% (813/3,247) of total influenza reports through LabVISE compared with 38% (1,127/2,943) for 1998. Of these 813 isolates, 683 were influenza A and 130 influenza B, a ratio of 5.3:1. The majority of influenza A strains were H3N2 subtype with only three H1N1 subtype isolates. Antigenic and genetic analysis indicated that the influenza A H3N2 subtype viruses were closely related to the A/Sydney/5/97 vaccine strain. As in the previous season there was some antigenic heterogeneity among these isolates, with approximately 20% reacting more strongly with antisera against a recent isolate A/Moscow/10/99 than the A/Sydney/5/97 vaccine strain. However, overall there was no evidence of substantial antigenic drift among the influenza A (H3N2) isolates. The three A (H1N1) isolates did demonstrate significant antigenic changes from the vaccine strain A/Beijing/262/95 and were closely related to a new

Figure 11. Percentage absenteeism in Australian Post, Australia, 1999, by week of report



variant A/New Caledonia/20/99. Influenza B isolates remained closely related to the vaccine reference strain B/Beijing/184/93.

World Trends

The pattern of influenza in Australia was similar to that seen in most parts of the world during 1999: influenza A/Sydney-like H3N2 subtype viruses predominated, influenza B/Beijing/184/93-like strains were present in smaller numbers and influenza A H1N1 subtypes mostly occurred sporadically. A/Sydney/5/97-like viruses were first identified in Australia (June 1997) and since then have spread around the world becoming the predominant strain in most regions.

The level of influenza activity in Australia was lower than many regions in which more severe outbreaks occurred. In particular, in the Pacific region there was significantly increased influenza activity reported in New Zealand and New Caledonia. In New Zealand the level of influenza activity (as measured by reports of influenza-like illness and laboratory-confirmed cases) was greater than in the two preceding years, although in 1998 influenza activity in New Zealand occurred at a low to moderate activity. New Caledonia recorded two significant outbreaks of influenza: the first was due to influenza A H3N2 A/Sydney-like viruses in February and March 1999; and the second was due to influenza A H1N1 viruses in May and June. Of importance, influenza A H1N1 viruses from the second outbreak in New Caledonia showed significant antigenic-drift from the A/Beijing/262/95 vaccine reference strain. Subsequently this new influenza A (H1N1) variant (A/New Caledonia-like strains) became prominent in many parts of Asia during the latter part of 1999.

Discussion

Overall there was consistency in the pattern of virological findings from LabVISE, the WHO Centre and the pharmaceutical surveillance program. This is reassuring, as virological isolation is the recognised gold standard.[7]

The 1999 influenza season in Australia had the third highest level of laboratory diagnosed influenza A for the last 10 years. The predicted biennial influenza B peak was small and delayed. Overall the timing of influenza activity in 1999 was slightly delayed compared with 1998, with a flatter and slightly lower peak from May to August. The overall pattern primarily reflected the pattern for influenza A, with a peak in influenza A reports from May to August, first in New South Wales and then Victoria in July, followed by Queensland in early August and then Western Australia in mid-August. Influenza B weekly reports peaked from July to September, first in New South Wales in early July, followed by Victoria and then Queensland in August and Western Australia again in September. These numbers and patterns need to be interpreted carefully as referral patterns could contribute to the observed pattern. South Australia did not provide information on the State or Territory of residence of the patient, so all data from South Australia were included in the unknown group.

The results from the pharmaceutical surveillance program were similar to the LabVISE results with influenza A predominating. There was also some similarity with respect to the timing and location of the peak for influenza overall, as well as for influenza A and influenza B individually. Although such surveillance programs are very useful and are used by pharmaceutical companies to trigger enrolment in clinical trials, they are transitory in their funding. One pharmaceutical company has discontinued its virus isolation based surveillance program, although another is continuing a similar program in 2000. A number of companies are undertaking influenza surveillance based on rapid point of care (or bedside) influenza tests, but their role in surveillance is as yet unknown, particularly in the absence of confirmatory virus isolations. As there is a risk that the plethora of surveillance schemes will lead to confusion and competition for sentinel practices, it is preferable that efforts and funding are directed towards a nationally consistent scheme as advocated in the Australian Influenza Pandemic Preparedness Plan.[5] Such a scheme could then act as a single source of information for a variety of purposes. It would also allow the proper evaluation of the new point-of-care tests and their role in surveillance.

Viable influenza isolates received by the WHO Centre for 1999 were less than the numbers received for each of the last 2 years. Most circulating influenza A strains were the H3N2 subtype with only three H1N1 subtype isolates. Of note there was evidence of significant antigenic drift amongst the H1N1 subtype isolates from the vaccine strain A/Beijing/262/95 to strains closely related to a new variant A/New Caledonia/20/99.

In general the trend of the GP surveillance schemes mirrored the pattern seen for laboratory reports from LabVISE, with a peak from May to September. As seen in 1998 there was a delay of two weeks between the timing of the peak for GP surveillance schemes and the LabVISE surveillance scheme. The lag may reflect a delay in laboratory testing and reporting. As in previous years, the Northern Territory Tropical Influenza Surveillance Scheme showed a bimodal pattern with an early peak in March to April heralding the beginning of the influenza season.

The expected predominance amongst the elderly of influenza reports or consultations was not seen in the collected surveillance data. The predominant age groups varied between the GP surveillance scheme and LabVISE. Most cases of influenza-like illness from GP surveillance were reported from the 15-44 year age range. In contrast the main groups affected by influenza according to LabVISE were children aged 0-4 years and adults aged 15-44 years. The laboratory reporting pattern may reflect selection bias in that samples for testing were more likely to be taken from children presenting to hospitals with respiratory symptoms. The GP consultation pattern may also reflect selection bias in that this age group largely reflects working adults who may require a GP consultation for the purpose of certification for work or symptom management. Laboratory-based surveillance in Western Australia has noted that direct detection data is skewed towards children who go to hospital and adults who go to surveillance sites. However, serological data which reflects more significant adult disease, particularly lower respiratory tract infection, showed a peak in the elderly for 1999 (Dr David Smith, PathCentre, Western Australia; personal communication).

The predominant age groups seen in 1999 were as seen in 1998. Australian Bureau of Statistics mortality data now available for 1998 show that peak mortality occurred in the older age groups. Overall, mortality data from 1998 showed a decline from 1997 levels, but the decline in mortality due to pneumonia was smaller. Similar mortality rates were seen

for males and females with overall mortality most frequent in those aged greater than 79 years and pneumonia-related mortality greatest in those aged greater than 74 years.

The number of influenza-like illness consultations per 1,000 consultations per week in 1999 peaked at 30, an increase from 1998 which peaked at 25, but less than 1997 which peaked at 35 and similar to 1995 and 1996.[6] In contrast, laboratory reports from LabVISE decreased in 1999 compared with 1998,[6] which may reflect less laboratory testing of suspected influenza cases or may reflect a different age distribution affected by influenza with consequent differences in testing.

National absenteeism rates reported by Australia Post showed a broad peak from July to September consistent with information from the other surveillance systems. This may reflect the maturing of this surveillance system as well as the high incidence of influenza.

The frequent development of antigenic variants through antigenic drift is the virological basis for seasonal epidemics and the reason for the incorporation of one or more new strains in each year's influenza vaccine.[3] The composition of the influenza vaccine for 2000 was determined on the basis of the strains in circulation during 1999 in Australia and the rest of the world. The Australian Influenza Vaccine Committee (AIVC), in conjunction with the WHO recommendations, decided that the influenza vaccine composition for the year 2000 season should be as follows:[8]

- H1N1 A/New Caledonia/20/99-like strain
- H3N2 A/Sydney/5/97-like strain
- B B/Beijing/184/93-like strain

This differs from the 1999 vaccine by the replacement of the A/Beijing/262/95-like strain with the A/New Caledonia/ 20/99-like strain due to the detected antigenic drift.

Influenza vaccination is the primary method for preventing or attenuating influenza infection and its more severe complications. Vaccination is offered in the autumn and is primarily targeted at people aged 65 years and over, and people under 65 years with chronic underlying medical conditions.[2,3] More recently, additional groups for whom influenza vaccination is suggested include those with respiratory disease and pregnant women who will be in their second and third trimester during the influenza season.

Awareness among health care providers of current influenza activity and circulating strains is necessary for reducing the impact of influenza and related complications. As an integral part of control of influenza the National Influenza Surveillance Scheme will continue conducting surveillance in the winter of 2000.[2]

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