

## Annual reports

# ANNUAL REPORT OF THE NATIONAL INFLUENZA SURVEILLANCE SCHEME, 2006

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### Abstract

Influenza surveillance in Australia is based on laboratory isolation of influenza viruses, sentinel general practitioner reports of influenza-like illness, and absenteeism data from a major national employer. In 2006, 3,130 cases of laboratory-confirmed influenza were reported to the National Notifiable Diseases Surveillance System, which was one-third lower than in 2005. The influenza season started in mid-June, with peak activity in late August. Influenza A was the predominant type notified (71%), however influenza B activity continued to increase as a proportion of reported cases. Reports of influenza-like illness from sentinel general practitioners showed a slow but steady increase throughout the first half of the year to peak in late August. In 2006, 657 influenza isolates from Australia were antigenically analysed: 402 were A(H3N2), 24 were A(H1N1) and 231 were influenza B viruses. Continued antigenic drift was seen with the A(H3N2) viruses from the previous reference strains (A/California/7/2004 and A/New York/55/2004) and drift was also noted in some of the A(H1N1) strains from the reference/vaccine strain A/New Caledonia/20/99, although very few A(H1N1) viruses were isolated in Australia in 2006. The B viruses isolated were predominately of the B/Victoria-lineage and similar to the reference/vaccine strain B/Malaysia/2506/2004. *Commun Dis Intell* 2007;31:167–179.

**Keywords:** influenza, surveillance, vaccine, influenza-like-illness, sentinel surveillance

### Introduction

Influenza is an acute self-limiting viral disease of the upper respiratory tract. Influenza poses a major threat to worldwide public health because of its ability to spread rapidly through populations. Transmission is from person to person through infected respiratory droplets produced during coughing and sneezing.<sup>1</sup> The health and economic impact of influenza largely arise from related complications.

Influenza infections are seasonal in temperate climates, more commonly occurring in the colder months (June to September in the Southern

Hemisphere and December to April in the Northern Hemisphere) but may occur year-round in tropical regions.

Annual influenza vaccination is recommended for people who are at increased risk of complications from the disease, such as those aged 65 years or older, and people with conditions such as cardiovascular disease and lung conditions which predispose them to severe influenza, and others with impaired immunity. Complications from influenza can result in increased hospitalisations and mortality. People who develop secondary bacterial pneumonia, for example, are at high risk of severe illness or death.<sup>2</sup>

There are 3 types of influenza—A, B and C—which are classified according to their distinct internal proteins.<sup>3</sup> Influenza type A is further characterised by 2 surface proteins: haemagglutinin (H) and neuraminidase (N). These proteins change constantly over time in order to avoid the hosts' immune system, a process that has been termed 'antigenic drift'. This is the main reason why seasonal influenza epidemics occur and vaccines need to be regularly updated. The ancestral hosts for influenza A viruses are aquatic birds, however, it has also been established in some mammals, such as humans and pigs. The natural host for types B and C is humans, although influenza C has been isolated from pigs.<sup>4</sup> Influenza C is more like the common cold in its effect, being less severe than influenza A or B.<sup>5</sup> Influenza types A and B are responsible for major outbreaks.<sup>6</sup>

Three pandemics occurred in the 20th century: the 1918–1919 'Spanish Flu' A(H1N1); the 1957 'Asian Flu' A(H2N2); and the 1968 'Hong Kong Flu' A(H3N2). The Spanish Flu is estimated to have caused as many as 40 million deaths worldwide, with unusually high mortality among young adults.<sup>7</sup> In Australia, 60% of deaths occurred in those aged 20–45 years. Mortality associated with the Asian and Hong Kong influenza pandemics was less severe, with the highest mortality rates being in the elderly and people with chronic diseases.<sup>8</sup>

Pandemics are caused by the introduction of a new influenza A subtype into the naïve human population, sometimes by the mixing of parts of avian viruses (at least the haemagglutinin) with

human or swine influenza viruses, a process termed 'antigenic shift'. Currently, there is concern that the avian A(H5N1) virus that has infected and killed millions of poultry in many countries will undergo such changes or naturally mutate to make it easily transmissible in humans and hence trigger a pandemic. While a complete understanding of this process is still lacking, it now appears that there are multiple changes that would be required to achieve this outcome. For example, scientists have experimentally added several human influenza genes from a recent A(H3N2) virus into to a current avian A(H5N1) virus and this reassorted virus was not more transmissible in mammalian animal models than the original avian A(H5N1) virus.<sup>9</sup>

An effective national surveillance system is essential for the control of seasonal epidemics and preparedness for potential pandemics, particularly as the timing and severity of a future pandemic cannot be predicted. Virological and epidemiological monitoring are important components of influenza surveillance.

The main objectives of influenza surveillance are:

- 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;
- characterisation of the nature of the epidemic and evaluation of its impact and associated public health measures; and
- 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.

Fortnightly influenza surveillance data were published throughout the 2006 season on the Communicable Diseases Australia website (<http://www.health.gov.au/cda>). This report is a summary of Australian surveillance information gathered throughout 2006, and includes a summary of international influenza activity.

## Surveillance methods

Influenza surveillance in Australia is based on the following data sources:

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

- subtype and strain data of circulating influenza viruses provided by the World Health Organization (WHO) Collaborating Centre for Reference and Research on Influenza;
- consultation rates for influenza-like illness diagnosed by sentinel general practitioners;
- absenteeism data of workers from a national employer; and
- hospitalisations and mortality data.

## National Notifiable Diseases Surveillance System

In all jurisdictions except South Australia, laboratory-confirmed influenza is a notifiable disease under state and territory legislation. Although influenza is not a notifiable condition in South Australia, laboratory reports are collected and sent to NNDSS. In this report, data are analysed by the date of onset, but when this was not available the earliest date from specimen collection date and notification date was used.

## Laboratory surveillance

LabVISE is a national scheme of sentinel laboratories that reports influenza diagnoses throughout the year. In 2006, 11 laboratories from all jurisdictions except the Australian Capital Territory and the Northern Territory contributed to the scheme. Data were reported to LabVISE monthly and analysed by specimen collection date.

## Sentinel general practitioner surveillance

Sentinel general practitioner surveillance schemes for influenza monitor the consultation rates for influenza-like illness (ILI). Sentinel surveillance schemes in Australia include: the Australian Sentinel Practice Research Network (ASPREN), which collects data at a national level as well as reporting for South Australia; the Queensland Influenza-like Illness Sentinel Surveillance in General Practice Program; 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.

The national case definition of ILI is: presentation with fever, cough and fatigue. All sentinel surveillance schemes used the national case definition for ILI in 2006.

### Absenteeism surveillance

Australia Post, a major nationwide employer, provided sick leave absenteeism data collected weekly throughout 2006. Absenteeism, defined as an absence due to illness for more than 3 consecutive days, was presented as a rate per 100 employees per week, on an average of 32,798 employees per week. It is important to note that this measures absenteeism from all illness, not just influenza.

### WHO Collaborating Centre for Reference and Research on Influenza

The WHO Collaborating Centres for Reference and Research on Influenza located in Australia, Japan, the United Kingdom and United States of America, are responsible for analysing influenza viruses collected through an international surveillance network involving 117 national laboratories in 88 countries. The Melbourne Centre analyses viruses received from Australia and from laboratories throughout Oceania, the Asian region and beyond. All virus isolates are analysed antigenically and a geographically and temporally representative number of viruses, together with any strains demonstrating uncharacteristic reactions during antigenic characterisation, are further analysed by genetic sequencing of the viral haemagglutinin gene and the neuraminidase gene. Together with serological and epidemiological data, this forms the basis from which WHO makes recommendations in February (for the Northern Hemisphere) and in September (for the Southern Hemisphere) for the vaccine formulation to be used in the following winter.

WHO vaccine formulation recommendations are made in the context of strains that are antigenically 'like' laboratory reference strains that are named according to a standard nomenclature for influenza viruses. For human isolates, this nomenclature is based on type, the place of isolation, sequential number and year of isolation, and for influenza A, the subtype of the H and N may also be included in brackets after the designation. An example of a human isolate is A/Sydney/5/97(H3N2), an influenza A(H3N2) virus that was the 5th sequential influenza A isolated in Sydney for the year in 1997. The WHO recommendations (available from: <http://www.who.int/csr/disease/influenza/vaccinerecommendations/en/index.html>) are then translated into actual virus strains acceptable to regulatory authorities and vaccine manufacturers by national and regional committees (such as the Australian Influenza Vaccine Committee, available from <http://www.tga.gov.au/committee/aivc2007.htm>)

### Hospitalisations data

Data on hospital separations are available from the Australian Institute of Health and Welfare. These

data are coded using the *International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification* (ICD-10-AM).

In this report, hospital separations for 2004–05 with a principal diagnosis of influenza due to identified influenza viruses (ICD-10-AM J10) and influenza where the virus was not identified (ICD-10-AM J11) are presented.

### Mortality data

Mortality data are compiled by the Australian Bureau of Statistics from information provided by the state and territory Registrars of Births, Deaths and Marriages, and are coded using the tenth revision of the *International Classification of Diseases and Related Health Problems* (ICD-10). In this report, deaths for 2005 with an underlying cause of influenza and pneumonia (ICD-10 J10–J18) are presented.

### Adult Vaccination Survey

The 2006 Adult Vaccination Survey was conducted in October 2006 and surveyed 8,022 Australians aged 18 years or over. The survey, which is the sixth national survey in its series, was conducted using computer-assisted telephone interview methodology. The survey included questions about influenza vaccination.

## Results

### National Notifiable Diseases Surveillance System

There were 3,130 notifications of laboratory-confirmed influenza reported to the National Notifiable Diseases Surveillance System in 2006, which is approximately two-thirds the number of cases reported in 2005 (Table 1). This equates to a rate of 15.2 notifications per 100,000 population.

Rates of laboratory-confirmed influenza in 2006 ranged from 5.7 notifications per 100,000 population in South Australia to 40.1 notifications per 100,000 population in Queensland.

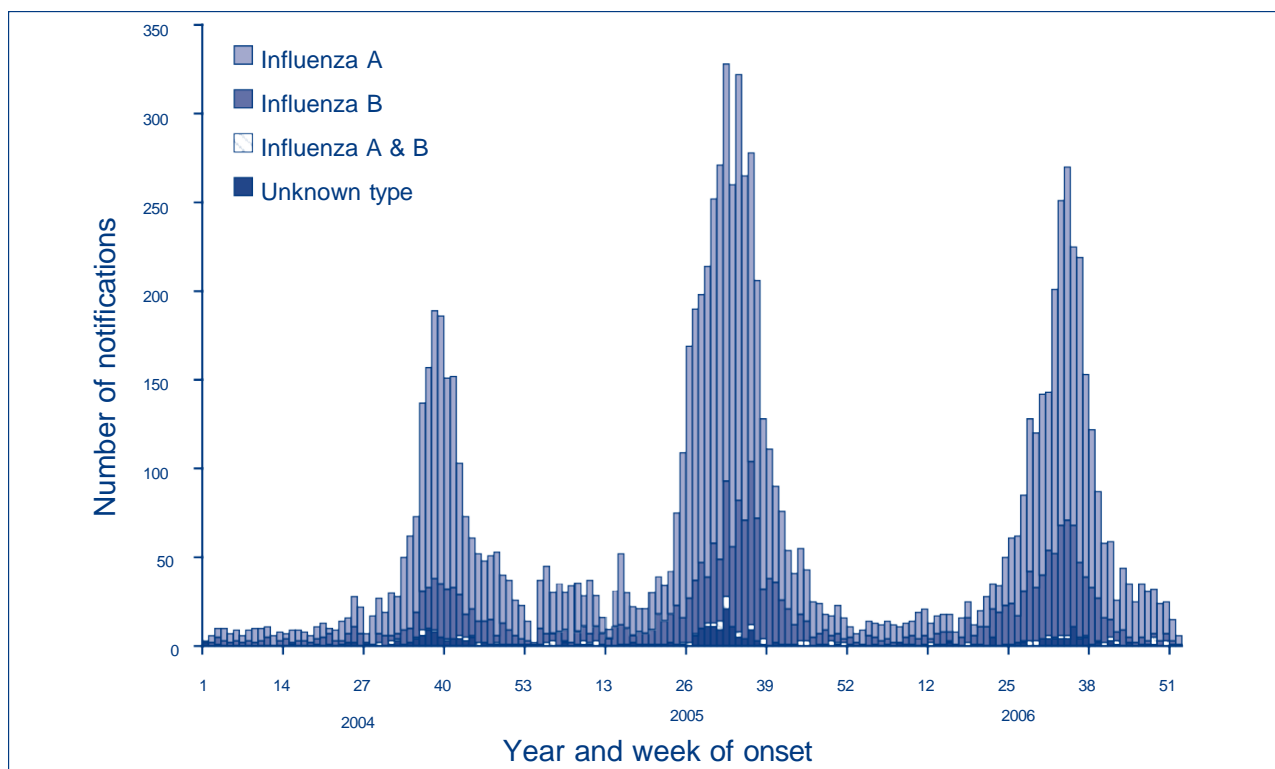
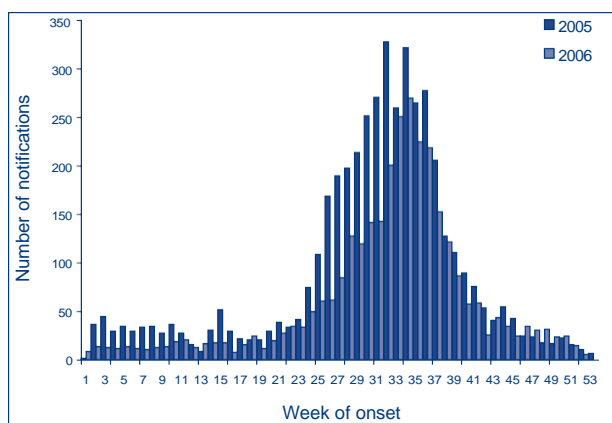
The majority of influenza cases in 2006 were type A (71%) (Figure 1). One-quarter (25%) were type B and just over 1% of cases were notified as testing positive for both types A and B.

Notifications of laboratory-confirmed influenza started to increase in late May (week 21) and peaked in late August (week 34) (Figure 2). The influenza season started at a similar time in 2005, however the number of cases increased more rapidly than in 2006 and notifications peaked about 2 weeks earlier.

**Table 1. Notifications of laboratory-confirmed influenza, Australia, 2004 to 2006, by type**

Year	Influenza type (per cent of notifications)				Number of notifications
	Type A	Type B	Types A & B	Unknown	
2006	70.8	25.6	1.3	2.2	3,130
2005	73.2	22.7	1.4	2.6	4,564
2004	75.8	19.6	1.2	3.4	2,133

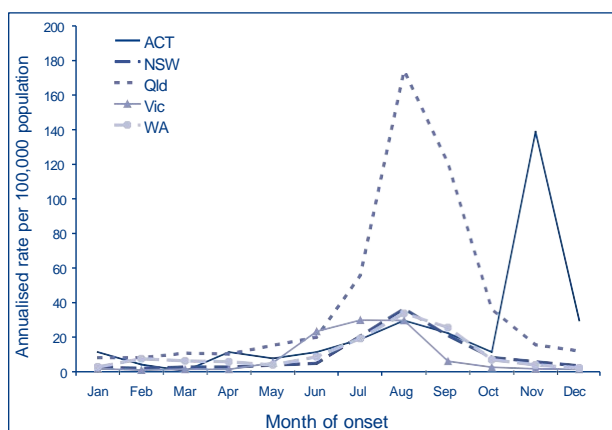
Source: National Notifiable Diseases Surveillance System

**Figure 1. Notifications of laboratory-confirmed influenza, Australia, 2004 to 2006, by type and week of onset****Figure 2. Notifications of laboratory-confirmed influenza, Australia, 2005 and 2006, by week of onset**

Influenza notification rates for selected jurisdictions are shown in Figure 3. Most jurisdictions showed peaks in notification rates around August. Peak rates in Queensland in August were substantially higher than in other jurisdictions (174 notifications per 100,000 population in Queensland, annualised compared to 60 for all of Australia).

There was an unseasonal peak in influenza notifications in November in the Australian Capital Territory. Between 11 October and 6 December, 77 people (55 of 132 residents and 22 of 173 staff) in an aged care facility reported symptoms of influenza-like illness. Of these, 19 people (18 residents and 1 staff) were found to have laboratory-confirmed Influenza A infection.<sup>10,11</sup> Eight of these had been vaccinated with the 2006 influenza vaccine prior to the outbreak. Ten deaths of residents aged

**Figure 3. Notification rates of laboratory-confirmed influenza, Australia, the Australian Capital Territory and Queensland, 2006, by month of onset**

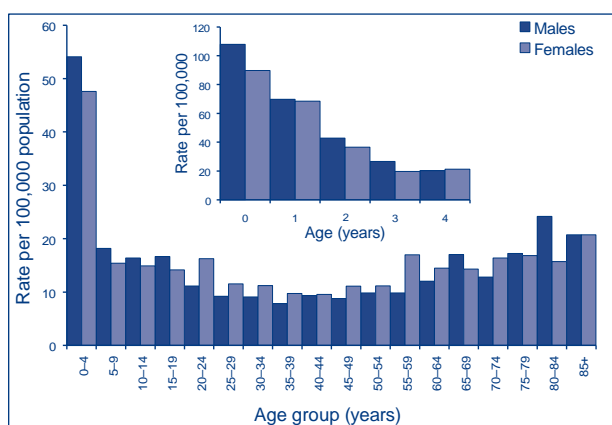


75–100 years were associated with the outbreak. Two of the residents who died had been fully vaccinated with the 2006 influenza vaccine.

Age-specific notification rates for laboratory-confirmed influenza reported to the NNDSS are shown in Figure 4. The highest notification rates were seen in those aged 0–4 years, with rates being around three times higher than for other age groups (51 cases per 100,000 population compared to an all-ages rate of 15 cases per 100,000 population). Figure 4 (insert) shows single-year age-specific rates for the 0–4 years age group. Within this group, rates showed a strong decline with increasing age; the notification rate for infants aged less than one year was 99 cases per 100,000 population, and in children aged 4 years was 21 cases per 100,000 population.

People aged 65 years and over are the target for influenza vaccination as they are at an increased risk of complications from influenza. Notification

**Figure 4. Notification rates of laboratory-confirmed influenza, NNDSS, Australia, 2006, by age and sex**



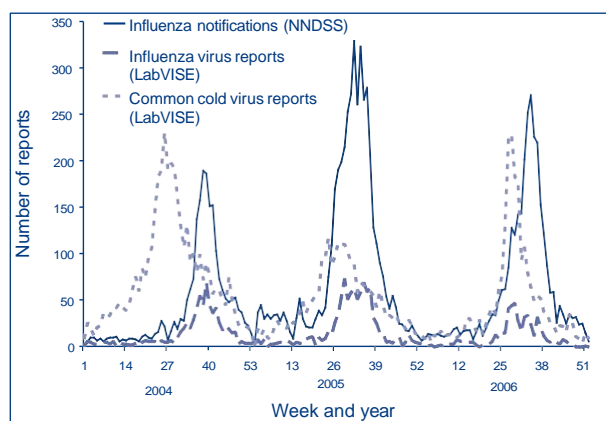
rates for people in this age group were 17 cases per 100,000 population for males and 16 cases per 100,000 population for females.

Notification rates were higher in males than females aged under 15 years, but higher for females aged 20–64 years. In infants aged less than one year, rates were higher for boys than for girls (108 cases per 100,000 population compared to 90 cases per 100,000 population).

### Laboratory surveillance

A total of 510 laboratory diagnoses of influenza were reported by the 11 laboratories participating in LabVISE in 2006, around half the number reported in 2005 (967 diagnoses) (Figure 5). Two-thirds (66%) of influenza isolates in 2006 were type A, with the remaining isolates being type B. The number of influenza reports to LabVISE started increasing in late May, peaked in mid-July (week 29), and declined around September. LabVISE influenza reports peaked around the same time in 2005 and 2006, however started decreasing earlier in 2006.

**Figure 5. Laboratory reports of influenza and common cold virus reports and notifications of laboratory-confirmed influenza reported to NNDSS, 2004 to 2006**



Note: LabVISE reports are by week of specimen collection, and NNDSS reports are by week of onset.

Reports of common cold virus isolates (defined as respiratory syncytial virus, parainfluenza viruses and rhinoviruses) were also collected by LabVISE. In 2006, 2,322 reports of the common cold were reported to LabVISE, similar to the number reported in 2005 (2,511) (Figure 5). The number of common cold reports started increasing in early May, and peaked in mid-July (week 28), and declined around October (week 42). More than three-quarters (78%) of the common cold virus reports in 2006 were due to respiratory syncytial virus. Common cold reports peaked at similar times in 2005 and 2006, although

in 2005 reports started increasing earlier in the season and in 2006 the peak was double the number of reports for 2005.

### Sentinel general practice surveillance

#### *Australian Sentinel Practice Research Network*

The ASPREN is a network of general practices that collect data on influenza-like illness. Sentinel practices contributing to ASPREN are located in all jurisdictions other than the Northern Territory. In 2006, an average of 27 general practices reported ILI cases to ASPREN at an average of 2,654 consultations per week (Table 2). The average number of participating practices and consultations has decreased since 2003.

In 2006, ILI reports to ASPREN started increasing in week 24, with peaks in weeks 25 (29.2 cases per 1,000 consultations, mid-June) and 35 (32.4 cases per 1,000 consultations, late August). In 2005, ILI reports peaked in early August (42.4 cases per 1,000 consultations) (Figure 6a).

#### *State and territory general practice influenza surveillance programs*

The Northern Territory collected information on ILI through the Tropical Influenza Surveillance System. Reports were received from 8 sentinel general practitioners (GPs) per week on average (range 1–12) with an average of 480 consultations per week (range 8–836). Reports of ILI peaked in early July (36 ILI cases per 1,000 consultations) with smaller peaks in mid-August (25 cases per 1,000), mid-September (29 cases per 1,000) and a late peak in late November/early December (26 cases per 1,000 consultations in week 49) (Figure 6b). The Northern Territory showed a different pattern to other jurisdictions due to its tropical climate (cases are spread throughout the year).

Queensland reported information on consultations for ILI over the period June to October. Reports were received from 22 sentinel GPs per week on average (range 9–28) with an average of 2,797 consultations per week (range 1,218–3,638). A preliminary peak

in ILI cases was seen in weeks 22 and 23 (17 ILI cases per 1,000 consultations) followed by a larger peak in week 34 (20 cases per 1,000) (Figure 6c).

South Australian ILI surveillance data are collected through ASPREN and were reported throughout 2006. On average, from late May to mid-October, 828 patients were seen by 8 doctors weekly, with 10 ILI cases being reported. Reporting of ILI cases started increasing in mid-May—with a spike in reports in mid-June—and started decreasing from mid-July (Figure 6d).

Victorian ILI surveillance data were reported by the Victorian Infectious Diseases Reference Laboratory for May to September 2006. On average, 23 general practices (range 19–25) reported 5,898 consultations per week (range 5,039–6,568). Consultations for ILI increased steadily from week 18 (1.8 ILI patients per 1,000 consultations) to an initial peak in early July (week 27, 9.1 ILI patients per 1,000) with a second peak in late August (week 33, 9.8 cases per 1,000) (Figure 6e).

Western Australian ILI surveillance data were reported by PathWest Laboratory Medicine WA for May to October 2006. On average, 11 practices (range 7–14) reported 54 ILI cases per week (range 14–121). Consultations for ILI increased steadily from initial reporting in early May (week 19) to peak in mid-July (week 29) with 82.1 ILI patients per 1,000 consultations (Figure 6f).

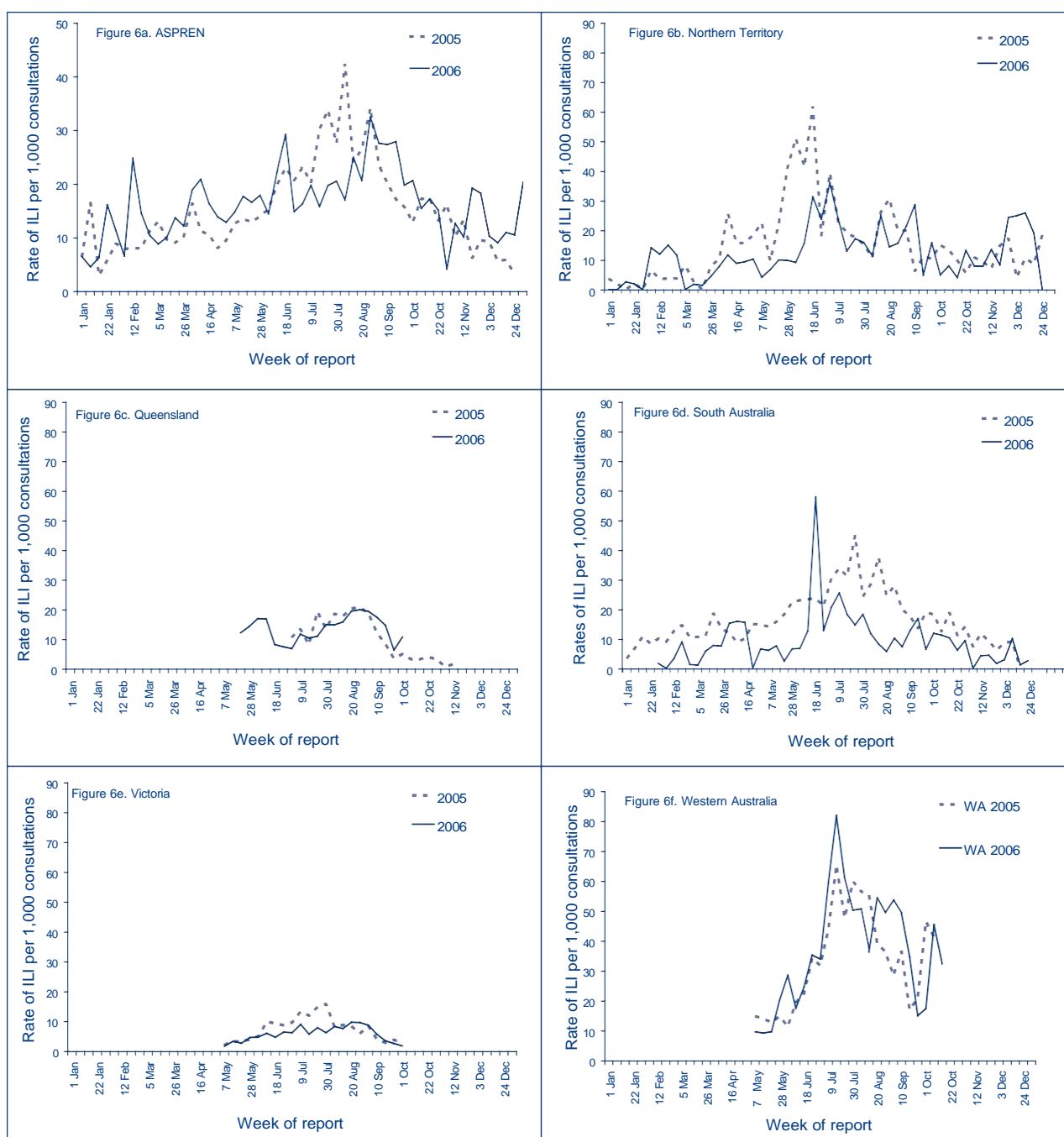
Table 3 summarises a comparison of rises and peaks in influenza reporting for the main data sources included in this report.

#### *Absenteeism surveillance*

Absenteeism surveillance is a non-specific index of influenza activity. In 2006, national absenteeism rates started increasing in early May (week 18) and peaked in early August (week 32) at 1.2% (Figure 7). This compares to an average absenteeism rate of 0.8% of employees per week during the reporting period (an average of 254 employees per week). Absenteeism rates declined again from early September (week 36), however remained relatively high until mid-December.

**Table 2. General practices reporting influenza-like illness to the Australian Sentinel Practice Research Network, 2003 to 2006**

Year	Reporting practices		Consultations	
	Average per week	Range per week	Average per week	Range per week
2006	27	11–39	2,654	934–3,999
2005	29	15–36	2,996	1,081–3,398
2004	31	11–42	3,321	1,224–4,219
2003	48	32–62	4,910	2,138–6,587

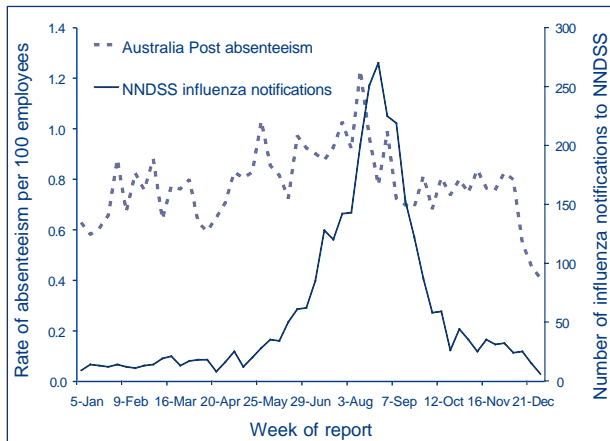
**Figure 6. Consultation rates for influenza-like illness, 2005 and 2006, by sentinel surveillance scheme and week of report****Table 3. Comparison of rises and peaks in influenza reporting, Australia, 2006**

Surveillance system	Illness	Week of first rise	Week(s) of peak(s)
NNDSS	Laboratory-confirmed influenza notifications	24	34
LabVISE	Influenza reports	23	29
	All common cold virus reports	24	28
ASPREN	Influenza-like illness reports	24*	25 & 35
Australia Post absenteeism data	Absenteeism rates	18*	32

\* ASPREN ILI cases and Australia Post absenteeism rates show reasonably steady increases throughout the first few months of the year.

A comparison of absenteeism rates and laboratory-confirmed influenza notified to the NNDSS show that while absenteeism rates were high when notifications peaked, absenteeism rates increased several weeks before notifications started increasing (Figure 7).

**Figure 7. Absenteeism rates and influenza notification rates, 2006, by week of report**



### Adult Vaccination Survey

Results from the 2006 Adult Vaccination Survey will be published in the forthcoming report *2006 Adult Vaccination Survey: summary results*.<sup>12</sup> The target population for influenza vaccination is Australians aged 65 years or over. An estimated 77.5% of people in the target group were vaccinated against influenza in 2006. Coverage was slightly lower in 2006 than in 2004 (when it was 79.1%), however the difference was not statistically significant. The highest vaccination coverage was seen in South Australia (83.9%) and the lowest in the Northern Territory (63.3%). Vaccination rates were higher for women than for men (79.2% compared with 75.4%).

### Hospitalisation and mortality data

There were a total of 1,378 hospital separations with a principal diagnosis of influenza in 2004–05 (the most recent national hospitalisations data); just over one-third (535 separations) were attributed to 'influenza due to identified influenza virus' (ICD-10-AM J10) and two-thirds (843 separations) to 'influenza, virus not identified' (ICD-10-AM J11).<sup>13</sup> Nearly one in 5 hospital separations (19%, 260 separations) for influenza were for people aged 65 years or over, including 50 separations for people aged 85 years or over. Females accounted for slightly more hospital separations than males (706 for females compared to 672 for males).

The most recent data on causes of death in Australia are for 2005. Influenza and pneumonia (ICD-10 codes J10–J18) were recorded as the underlying cause of death for 3,034 persons in 2005 (2.3% of all deaths).<sup>14</sup> More females than males died of influenza or pneumonia (1,703 females compared to 1,331 males); however the standardised death rate for males was higher than for females (15.8 versus 12.0). In 2004, 56% of influenza and pneumonia deaths were among people aged 85 years or over (whereas 31% of all deaths occurred among people in this age group).<sup>15</sup>

### WHO Collaborating Centre for Reference and Research on Influenza

The WHO Collaborating Centre for Reference and Research on Influenza received 657 isolates or clinical specimens from Australian laboratories in 2006 that yielded viable influenza viruses. This was the second lowest number of isolates received over the last 10 years (the lowest being in 2001). All of the 2006 viruses were analysed antigenically using the haemagglutination inhibition assay which identified 402 (61.2%) as A(H3N2) strains, 24 (3.6%) as A(H1N1) strains and 231 (35.2%) as influenza B strains. The 2006 Australian A(H3) viruses were mostly antigenically similar to the 2006 vaccine strain A/New York/55/2004 but a proportion of viruses had a reactivity pattern closer to A/Wisconsin/67/2005-like viruses and a significant proportion of viruses did not match either of these patterns (Table 4).

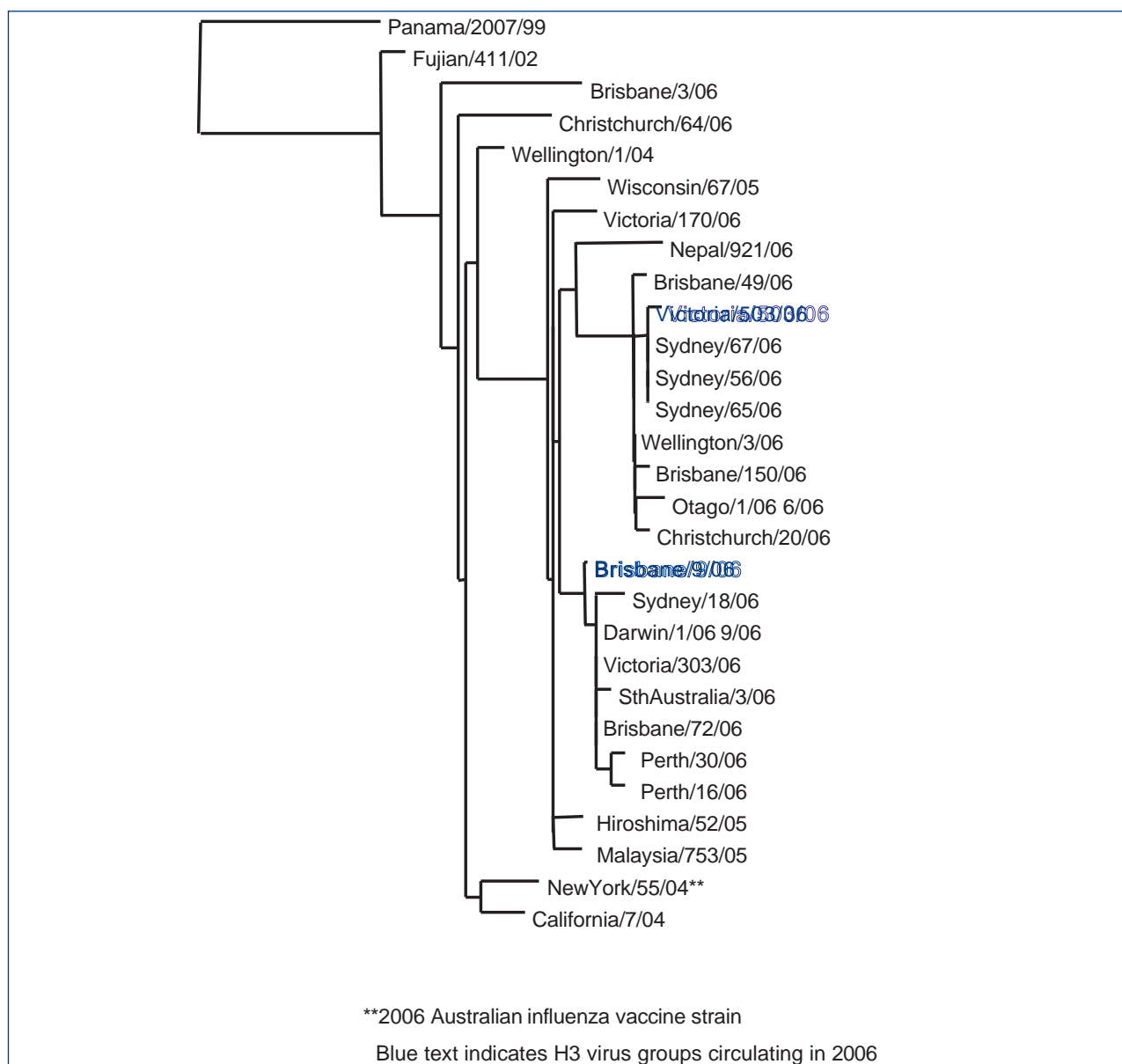
Consistent with the antigenic drift in the A(H3) isolates seen with ferret antisera, serological studies conducted with pre- and post-vaccination human sera from recipients of the 2006 vaccine containing the A/New York/55/2004 strain, showed a reduction in antibody titres to some 2006 A(H3) isolates. Antigenic analysis of the few Australian A(H1) strains that were isolated, showed that there was drift away from the 2006 vaccine strain A/New Caledonia/20/99, which was more pronounced than in recent years. Of the 231 influenza B viruses analysed, 93.5% were antigenically related to the 2006 vaccine strain B/Malaysia/2506/2004 (B/Victoria/2/87-lineage viruses) while the remaining 6.5% were closely related to B/Florida/7/2004 (B/Yamagata/16/88-lineage viruses), indicating a good match of the vaccine strain with the circulating B viruses.

Sequence analysis of the variable (HA1) region of the haemagglutinin gene was undertaken for 98 Australian 2006 strains [11 A(H1), 49A(H3) and 38 B] and for the neuraminidase gene, 46 Australian 2006 strains (7 H1, 25 H3, 14 B) were sequenced. The phylogenetic analysis of the 2006 A(H3) virus sequences (Figure 8) showed that most Australian viruses fell into one of 2 subgroups based on the HA1 domain of the

**Table 4. Antigenic comparisons of influenza A(H3) viruses by the haemagglutination-inhibition test**

Virus antigen	Ferret antiserum		
	Reciprocal haemagglutination-inhibition titre		
	A/Wellington	A/California	A/Wisconsin
A/Wellington/1/2004	640	640	320
A/California/7/2004*	320	640	320
A/Wisconsin/67/2005	320	320	1,280
A/Brisbane/69/2006	320	640	1,280
A/Perth/30/2006	160	320	1,280
A/Auckland/119/2006	80	160	320
A/Sydney/17/2006	40	320	160
A/Victoria/178/2006	160	160	80
A/South Australia/4/2006	80	80	40

\* An A/California/7/2004-like strain (A/New York/55/2004) was the H3 strain used in the 2006 Australian influenza vaccine.

**Figure 8. Evolutionary relationships between influenza A(H3) haemagglutinins (HA1 region)**

haemagglutinin gene. Both of these subgroups were closely related to the A/Wisconsin/67/2005 reference virus with one group similar to A/Victoria/503/2006 and the other group similar to A/Brisbane/9/2006. Viruses from the same cities and states fell into one of these 2 subgroups showing that both variants were co-circulating in Australia in 2006. The phylogenetic relationships of viruses A/Sydney/56/2006 and A/Sydney/65/2006 (a Canberra isolate) from influenza outbreaks in New South Wales and the Australian Capital Territory (Figure 8) showed that these were similar to other locally circulating A(H3) viruses.

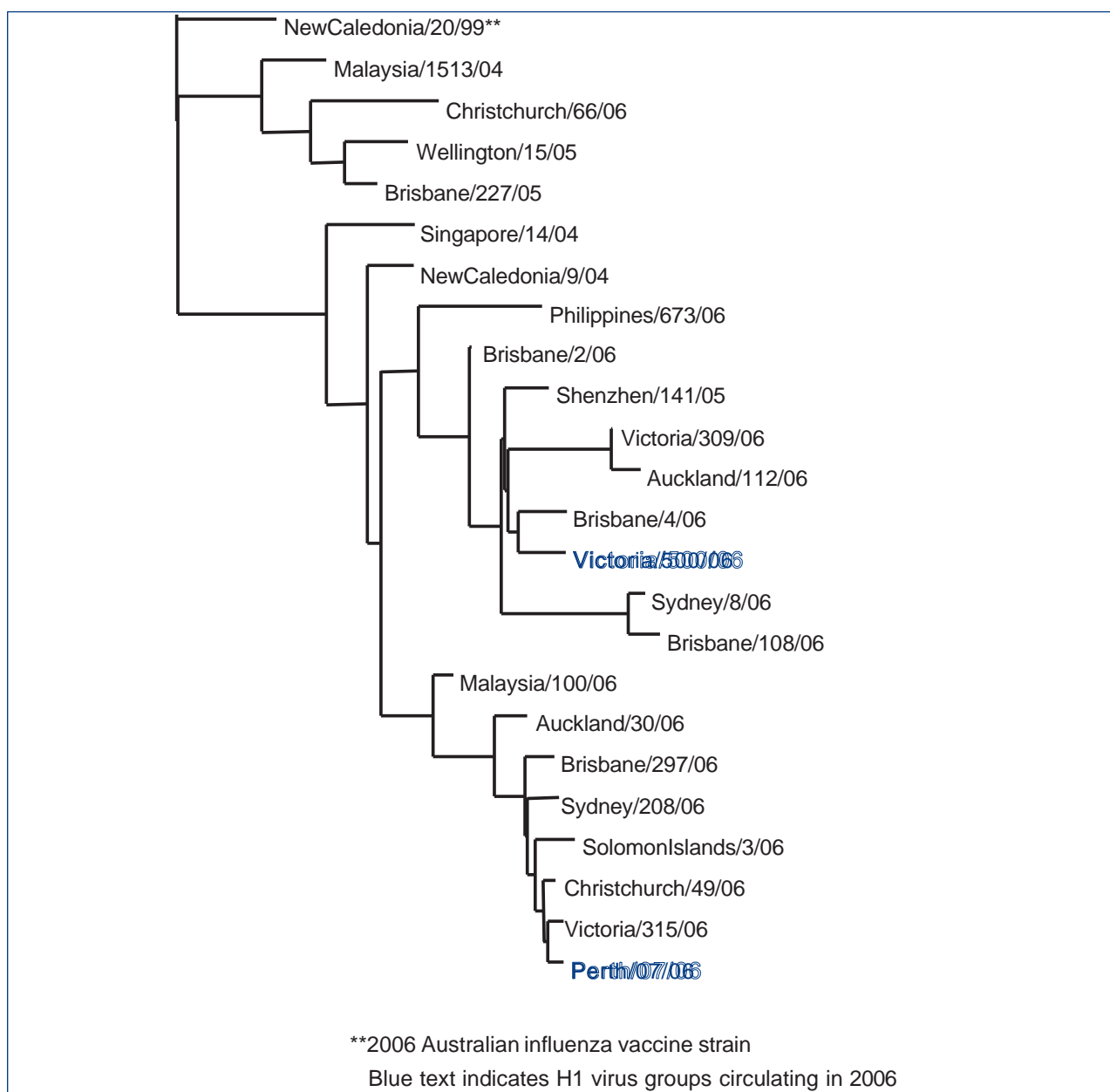
Genetically, most of the A(H1) 2006 Australian viruses fell into 2 subgroups that were distinguishable from A/New Caledonia/20/99, one

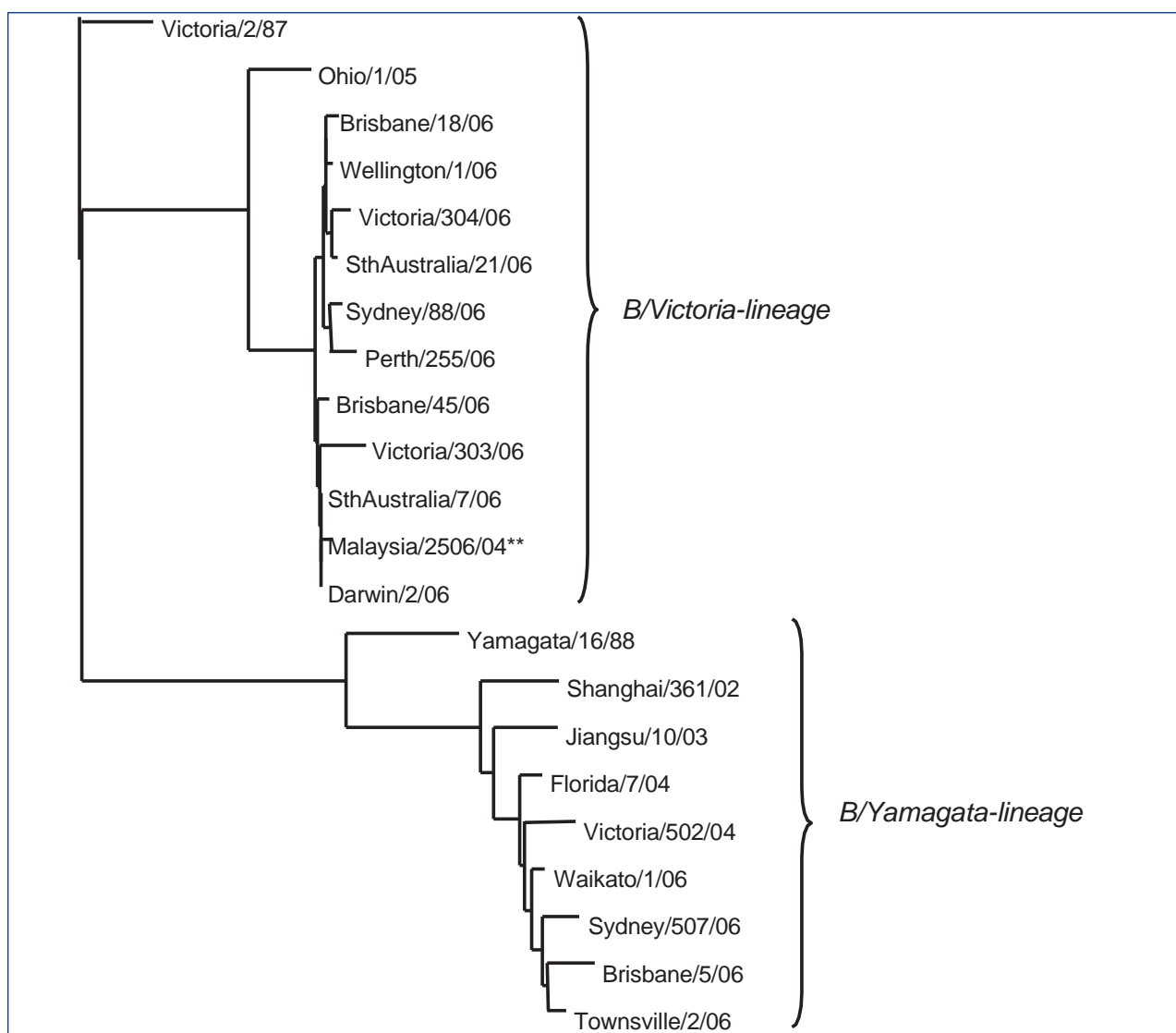
containing A/Perth/7/2006 (falling into the A/Malaysia/100/2006 group) and the another represented by the A/Victoria/500/2006 subgroup (Figure 9). The Australian 2006 influenza B isolates grouped into their respective lineages either the B/Victoria or B/Yamagata lineages with the B/Victoria-lineage, showing little change from the reference/vaccine strain B/Malaysia/2506/2004 (Figure 10).

### International trends in influenza

In 2006, global influenza activity was generally low compared to previous years. Influenza was detected in most countries although the number of influenza isolates obtained was markedly reduced compared

**Figure 9. Evolutionary relationships between influenza A(H1) haemagglutinins (HA1 region)**



**Figure 10. Evolutionary relationships between influenza B haemagglutinins (HA1 region)**

to recent years. Influenza A(H1N1), A(H3N2) and influenza B co-circulated in many countries. In the Northern Hemisphere, outbreaks of A(H1N1) occurred in Hong Kong (SAR), Egypt, Japan, Thailand, Spain and the United States of America (USA). Outbreaks of A(H3N2) occurred in Egypt, Madagascar, Canada, USA, Japan, Kazakhstan, the Russian Federation, Slovenia and several European countries. Influenza B outbreaks occurred in Egypt, USA, China, Hong Kong (SAR), Republic of Korea, Uzbekistan and in a number of European countries early in 2006. In the Southern Hemisphere, influenza activity began in April and was generally mild to low. In South America influenza A(H1N1) viruses predominated with an outbreak reported in Brazil. Other outbreaks due to influenza A(H3N2) were reported in New Zealand and South Africa while elsewhere in Africa and Oceania influenza activity was low.

There were widespread outbreaks of A(H5N1) highly pathogenic avian influenza (HPAI) in chickens, ducks and other birds in many parts of the world in 2006, with the exception of the Americas and Oceania. According to the official WHO figures for 2006, 115 human infections with H5N1 occurred in 9 countries resulting in 79 deaths, which was more deaths than recorded in 2004 and 2005 combined (for details see the WHO avian influenza web site [http://www.who.int/csr/disease/avian\\_influenza/en/](http://www.who.int/csr/disease/avian_influenza/en/)). No H5N1 infections were detected in humans or in birds in Australia in 2006.

While the temporal pattern of the annual influenza season in New Zealand is broadly similar to Australia, outbreaks often begin earlier in the year. In 2006, the New Zealand consultation rates for ILI started to increase in late May and peaked at week 27 (first week of July) with a second smaller peak at week 33 (mid-August). Influenza hospitalisations peaked at

week 28. Of the 438 New Zealand isolates typed at the WHO Influenza Centre, the vast majority were A(H3) (82.2%) with 73 A(H1) viruses (16.7%) and very few influenza B viruses (only 5 isolates; 1.1%). The low level of influenza B viruses is in contrast to the previous season when influenza B viruses of the B/Victoria-lineage predominated and led to several relatively severe outbreaks. Overall influenza activity in New Zealand in 2006 was low and below levels seen in 2003–2005. The full report on the 2006 influenza season in New Zealand, produced by the Institute of Environmental Science and Research Limited, is available from: [http://www.surv.esr.cri.nz/PDF\\_surveillance/Virology/FluAnnRpt/InfluenzaAnn2006.pdf](http://www.surv.esr.cri.nz/PDF_surveillance/Virology/FluAnnRpt/InfluenzaAnn2006.pdf).

## Discussion

The 2006 Australian influenza season was mild in comparison to previous years and was predominantly due to influenza A infections.

Notifications to the NNDSS, influenza and common cold reports from LabVISE, and ILI reports to ASPREN all started increasing mid-way through the year (weeks 23 & 24) however LabVISE reports peaked earlier than notifications to NNDSS (weeks 28 & 29 for LabVISE; week 34 for NNDSS). The major peak for ASPREN reports came 1 week later than for NNDSS. Differences in reporting patterns from various sources may be due to factors such as timeliness of laboratory testing and reporting, or occurrence of other respiratory illnesses symptomatic of ILI. Absenteeism rates—which relate to absence for illness of any cause and so are non-specific—showed no apparent trend that could be attributed to increased influenza activity.

The influenza types reported via NNDSS for 2006 were 70.8% influenza A, 25.6% influenza B, 1.3% influenza A and B and 2.2% unknown type. The finding of 1.3% of notifications having both types of influenza was similar to previous years and is higher than would be expected as documented reports of dual infections are rare.<sup>16</sup> This may warrant further investigation in the future to confirm true dual influenza infections.

People aged 65 years or over are eligible for free annual influenza vaccination in Australia. Notification rates in 2006 for people in this age group were similar to those for people of all ages. While people aged 65 years or over are a target for immunisation, the highest age-specific rates of laboratory-confirmed influenza were seen in children aged under 5 years. Influenza vaccine can be given to children from 6 months of age, however those under 5 years are at increased risk of minor adverse events.<sup>2</sup>

While the 2006 influenza season was relatively mild, an outbreak of influenza A(H3N2) occurred in an aged care facility in the Australian Capital Territory in October. The outbreak control strategy included vaccination clinics, enhanced infection control and isolation of cases. Prophylactic treatment through administration of Oseltamivir was recommended to residents through their medical practitioners and provided to asymptomatic staff. The public health response also included laboratory investigation of suspect cases, social distancing and other measures to assist containment.

The majority of the Australian isolates (62.1%) analysed at the WHO Influenza Centre were A(H3N2) strains (similar to 2005) and a significant number of these strains showed a degree of heterogeneity based on their antigenic and genetic characteristics. Many strains were antigenically similar to the vaccine strain A/New York/55/2004 and to the newer reference strain A/Wisconsin/67/2005, while others appeared to have drifted somewhat from both of these viruses. Genetic analysis showed there were only minor changes in the HA1 region in the 2006 A(H3) viruses from the A/New York/55/2004 strain with most 2006 strains more like the A/Wisconsin/67/2005 reference virus. Very few influenza A(H1) strains were isolated in Australia in 2006 (24) but some of these also showed some drift away from the vaccine strain A/New Caledonia/20/99. Influenza B strains were almost exclusively of the B/Victoria/2/87-lineage, unlike recent years when both B/Victoria and B/Yamagata/16/88-like viruses have co-circulated in roughly even proportions.<sup>17</sup> The 2006 B/Victoria-like viruses were closely related both antigenically and genetically to the vaccine strain B/Malaysia/2506/2004. Influenza patterns in New Zealand were similar to Australia with low activity and mainly A(H3) strains of the A/Wisconsin/67/2005 type however there were very few influenza B viruses isolated in 2006 compared with Australia.

The WHO annual consultation on the composition of influenza vaccines for the Southern Hemisphere, 2007 took place in Geneva from 18–20 September 2006. The recommended composition of influenza virus vaccines for use in the 2007 Southern Hemisphere influenza season was:

- an A/New Caledonia/20/99(H1N1)-like virus;
- an A/Wisconsin/67/2005(H3N2)-like virus;
- a B/Malaysia/2506/2004-like virus.

This recommendation has one change to the previous Southern Hemisphere vaccine for the 2006 influenza season, with the addition of a new A(H3) virus A/Wisconsin/67/2005 (replacing the vaccine

strain A/New York/55/2004). This recommendation was the same as the Northern Hemisphere recommendation for their 2006–07 influenza vaccine.

Preparation for a potential influenza pandemic is a high priority in Australia. In October 2006, the Australian Government Department of Health and Ageing (DoHA) coordinated and participated in Exercise Cumpston, Australia's largest ever health simulation exercise and one of the largest pandemic influenza exercises held in the world. The exercise tested Australia's preparedness for responding to pandemic influenza involving widespread human-to-human transmission of a new strain of the influenza virus. More information about the exercise and the Australian Health Management Plan for Pandemic Influenza can be found on the DoHA's website (<http://www.health.gov.au/internet/wcms/publishing.nsf/Content/Pandemic+Influenza-1>)

It is important to note that notifications of laboratory-confirmed influenza do not capture all cases of influenza in Australia. Those with mild disease may not present to a doctor, and those that do may not be referred for laboratory testing. Reporting of influenza-like illness by sentinel general practitioners is crucial for national influenza surveillance, as it provides an additional source of information and may provide an early warning system for increased influenza activity. Sentinel surveillance is currently being strengthened through ASPREN, who have undertaken a number of initiatives with jurisdictions to increase general practitioner recruitment and representativeness.

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