High proportion of influenza B characterises the 2008 influenza season in Victoria

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Abstract

The 2008 influenza season in Victoria was distinctive because of the increased proportion of influenza-like illness (ILI) cases due to influenza B infection and the lateness of the season compared with preceding years. Influenza activity fell within the bounds of normal seasonal activity thresholds. The average rate of ILI reported by general practitioners participating in sentinel surveillance was 5.5 cases per 1,000 consultations, peaking at 13.4 cases per 1,000 consultations. The average ILI rate reported by the Melbourne Medical Deputising Service was 5.1 cases per 1,000 consultations over the season peaking at 16.2 cases per 1,000 consultations at the same time as peak rates were reported by rural geneal practitioners (GPs), with a secondary peak observed 2 weeks later (10.9 cases per 1,000 consultations). Metro GP rates peaked in week 35 (week beginning 25 August) at 15.2 cases per 1,000 consultations. Influenza B cases notified directly to the Victorian Department of Human Services (DHS) from other sources peaked in the 1st week of September with peak numbers of influenza A notifications occurring the following week. Overall 56% of notifications of laboratory confirmed influenza to DHS and 56% of influenza positive swabs from sentinel surveillance were influenza type B. *Commun Dis Intell* 2009;33(3):328–336.

Keywords: surveillance, epidemiology, influenza

Introduction

A sentinel general practice (GP) program for the surveillance of influenza like illness (ILI) has been conducted in Victoria by the Victorian Infectious Diseases Reference Laboratory (VIDRL) and the Victorian Department of Human Services (DHS) since 1993. VIDRL coordinates the sentinel GP ILI surveillance program and laboratory testing of cases has been conducted at VIDRL since 1998.[1] Additionally, VIDRL monitors diagnoses of ILI made by the locum medical practitioners through the Melbourne Medical Deputising Service (MMDS). The DHS coordinates the surveillance of all laboratory confirmed influenza in Victoria, a prescribed group B notifiable disease under the *Health (Infectious Diseases) Regulations 2001*.[2]

The objectives of the influenza surveillance system are to:

- monitor the epidemiology of laboratory confirmed influenza in Victoria;
- identify the onset, duration and relative severity of annual influenza seasons in Victoria;
- provide samples for the characterisation of circulating influenza strains in the community to assist in the evaluation of the current season's and formulation of the following season's vaccine; and
- provide a role in early recognition of new influenza viruses and new or emerging respiratory diseases.

Additionally, the World Health Organization (WHO) Collaborating Centre for Reference and Research on Influenza provides data on strain typing of influenza isolates or Victorian influenza positive specimens forwarded by VIDRL and 2 Melbourne hospital laboratories.

In this paper we summarise findings from the Victorian Influenza Surveillance System in 2008.

Methods

General Practice Sentinel Surveillance

In 2008, 47 GPs from 17 metropolitan practices and 20 GPs from 11 rural practices participated in the VIDRL General Practice Sentinel Surveillance (GPSS) program (Figures 1a and 1b), which is approved for continuing professional development points by the Royal Australian College of General Practitioners and the Australian College of Rural and Remote Medicine.

The GPSS program for 2008 operated between 28 April and 2 November (weeks 18–44). This 4 week extension of the surveillance period in comparison with previous years allowed full capture of ILI cases in the later than usual season and improved comparability of our data with other surveillance programs in Australia.

The 67 participating GPs reported the total number of consultations per week and age, sex and vaccination status of any patients presenting with ILI. The

Figure 1a: Distribution of sentinel surveillance sites in metropolitan Victoria, 2008

Figure 1b: Distribution of sentinel surveillance sites in rural Victoria, 2008

accepted case definition for ILI is defined as fever, cough and fatigue/malaise.[3] ILI rates were calculated using the number of ILI patients per 1,000 consultations and were compared with previously established thresholds for Victorian influenza seasons.[4]

Nose and throat swabs were collected from patients presenting within 3 days of the onset of symptoms. Data including age, sex, symptoms (fever, cough, fatigue, myalgia, other), vaccination status and date, and Aboriginal and Australian Torres Strait Islander status were collected. GPs were also asked to indicate their confidence in their clinical diagnosis ('almost certain,' 'probable' or 'less likely'). Formal consent was obtained from all patients from whom a swab was collected. Virus detection was performed in the Virus Identification Laboratory at VIDRL using the respiratory virus reverse-transcriptase-polymerase chain reaction (RT-PCR)-based assay, which detects influenza viruses (types A and B), respiratory syncytial virus, parainfluenza viruses (types 1, 2 and 3), adenoviruses, rhinoviruses and enteroviruses.[5]

All specimens positive for influenza were forwarded to the WHO Collaborating Centre for Reference and Research on Influenza, for virus isolation and identification.

Melbourne Medical Deputising Service

The MMDS, formerly the Melbourne Medical Locum Service, is the largest medical locum service in Australia and has contributed to Victorian influenza surveillance since 2003. The MMDS provides a 24-hour medical service to patients in their own home or aged care facility. VIDRL has password protected access to the clinical database maintained by the MMDS and conducts weekly searches on the terms 'influenza' and 'flu'. This provides weekly rates of influenza-related diagnoses by MMDS clinicians per 1,000 consultations.

Notifications of laboratory confirmed influenza to the Department of Human Services

Under the Health (Infectious Diseases) Regulations 2001,[2] medical practitioners and pathology services are required to notify laboratory confirmed influenza cases to the DHS within five days of the positive test. Records of all laboratory confirmed influenza cases with a 2008 notification date were extracted for analysis from the DHS Notifiable Infectious Diseases Surveillance database on 19 January 2009.

Data collation and reporting

An SQL database (S Long, SL Digital, Melbourne), tailored to the needs of the GPSS program, was developed to assist with data storage and analysis, as well as report generation. Further to GPSS data, the MMDS ILI rate and summary results of all respiratory viruses detected by routine diagnostic PCR assays at VIDRL, were collated and entered weekly.

Summary information was reported to the DHS Communicable Disease Prevention and Control Unit (CDPCU) and to the Australian Government Department of Health and Ageing (DoHA) on a weekly basis. Summary reports of laboratory confirmed influenza notifications were updated daily and posted on the CDPCU website (http://www.health.vic.gov.au/ideas/surveillance/daily.htm). Laboratory confirmed influenza notifications were also reported by the CDPCU to the National Notifiable Diseases Surveillance System (NNDSS) and were published in the DoHA influenza surveillance report at: http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-ozflu-flucurr.htm

In 2008, surveillance reports were prepared and distributed to all participating GPs, state and territory health departments, other interested health professionals and health agencies, and were also made available on the VIDRL website (http://www.vidrl.org.au) on a weekly basis. Reports included summary strain data on isolates from Australasia and the South East Asia region prepared by the WHO Collaborating Centre for Reference and Research on Influenza, as well as a summary of national influenza activity from the NNDSS website.

Results

Influenza-like illness surveillance

For the first 23 weeks of surveillance, an average of 98% (66/67) of GPs returned tally sheets to VIDRL each week (range 94% to 100%). During the four weeks of the extended season an average of 83% of GPs (range 76% to 87%) continued reporting.

GPs reported having conducted 159,110 consultations (117,719 metropolitan and 41,391 rural) and identified 876 ILI cases (652 metropolitan and 224 rural) during the season; a rate of 5.5 cases per 1,000 consultations for metropolitan GPs and 5.4 cases per 1,000 consultations for rural GPs.

Figure 2 shows the weekly ILI rates by reporting source. All sources reported a relative increase in ILI rates in week 33 (week commencing 11 August), after which seasonal peak rates were reported in weeks 35 (metropolitan; 15.2 ILI cases per 1,000 consultations) and 36 (rural; 15.7 ILI cases per 1,000 consultations, MMDS; 16.2 ILI cases per 1,000 consultations). ILI rates fell in week 37 but rose sharply to secondary peaks in weeks 38 (MMDS; 10.9 ILI cases per 1,000), 39 (metropolitan; 8.3 ILI cases per 1,000 consultations) and 41 (rural; 7.0 ILI cases per 1,000 consultations), before declining to a combined baseline level of 1.9 ILI cases per 1,000 consultations at the end of week 43. Among consultations conducted by the MMDS during the 2008 surveillance season, 210 patients (0.5%) were diagnosed with 'flu' or 'influenza.' Unlike previous years, in which the MMDS ILI rate was generally higher, rates from MMDS in 2008 were similar to the overall GP ILI rate.[6]

Among the total ILI cases reported by GPs, 52% (458/876) were female and 48% (418/876) were male. The median age of ILI cases was 35 years (range 1–99 years) and 85% (745/876) were reported as being unvaccinated for the season (Table 1).

Using the previously described thresholds for GP sentinel surveillance in Victoria, ILI rates in 2008 were in the mid to high range of normal seasonal activity (Figure 3).

General Practice Sentinel Surveillance laboratory surveillance

Sentinel surveillance GPs submitted swabs to VIDRL from 403 ILI patients. In total, 43% (173/403) of submitted swabs tested positive to one of the respiratory viruses included in the multiplex respiratory RT-PCR. Of these, 29% (51/173) were positive for influenza A, and 38% (65/173) were positive for influenza B (Table 2). Of all swabs in

Figure 2: Weekly influenza-like illness rates reported by rural and metropolitan practices and the Melbourne Medical Deputising Service compared with influenza notifications, Victoria, 2008

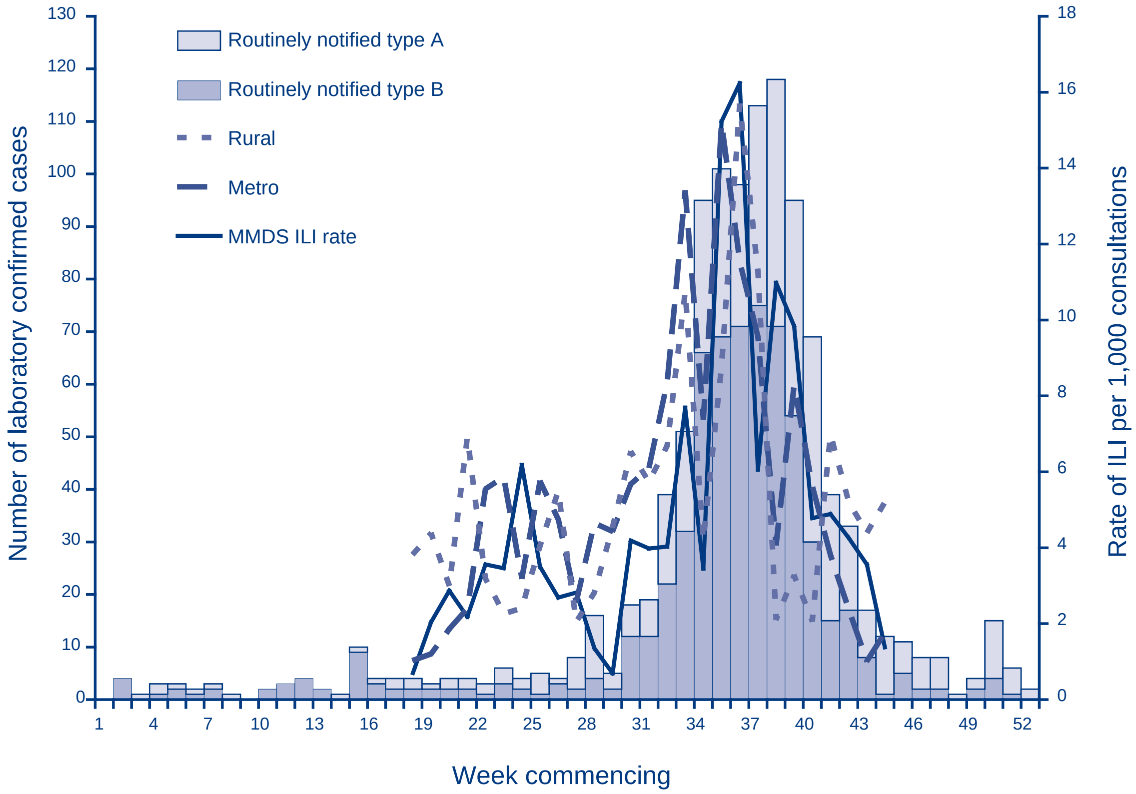


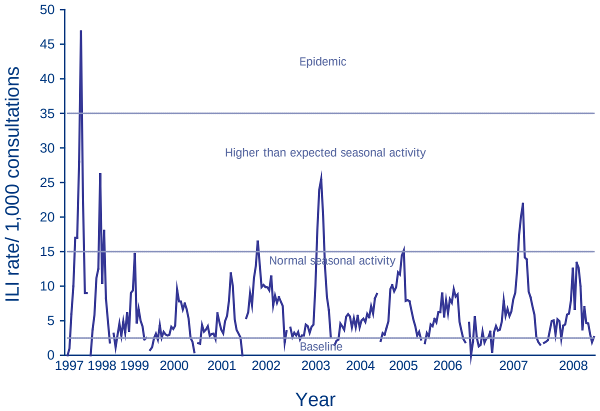
Table 1: Vaccination status for swabs and influenza-like illness patients with known vaccination status, by age group

Age group (years)	Total swabs				Total influenza-like illness patients			
	Vaccinated		Not vaccinated		Vaccinated		Not vaccinated	
	n	%	n	%	n	%	n	%
0–4	1	10.0	9	90.0	0	0.0	37	100.0
5–19	4	5.4	70	94.6	8	4.3	176	95.7
20–54	40	15.4	219	84.6	65	12.6	450	87.4
55–64	8	29.6	19	70.4	18	21.2	67	78.8
65+	21	75.0	7	25.0	40	74.1	14	25.9

which influenza was detected, 56% (65/116) were influenza B, which was higher than the proportion in 2007 (12%) (Table 2).

The positive predictive value (PPV) for the clinical diagnosis of influenza increased with increasing GP confidence in the diagnosis of influenza in 2008 and previous years (Table 3).

Figure 3: Fortnightly general practitioner sentinel surveillance influenza-like illness rates, Victoria, seasons 1997 to 2008



There was no significant difference in the proportion of influenza A or B positive patients by sex (females 53% (61), $P = 0.2$). Of the 116 influenza positive subjects 84% (98) reported being unvaccinated in 2008, 15% (17) being vaccinated and 0.9% (1) had unknown vaccination status.

Figure 4 the relative age distributions of notifications of influenza type A or B according to sentinel and non-sentinel GP notification. From GPSS influenza cases, the median age of patients with influenza A was 31 years (0–96 years) and of patients with influenza B was 20 years (0–58 years).

Notifications to the Department of Human Services

VIDRL was the most frequent notifier of laboratory confirmed cases in 2008, accounting for 30% of notifications. Gippsland Pathology Service and Melbourne Pathology were the next most common notifiers of influenza, comprising 24% and 13% of the total respectively. Eight other Victorian laboratories provided 30% of laboratory notifications and a further 3% of notifications were Victorian residents diagnosed by interstate laboratories.

Table 2: Respiratory viruses detected from general practitioner sentinel surveillance influenza-like illness patient swabs, Victoria, 2008

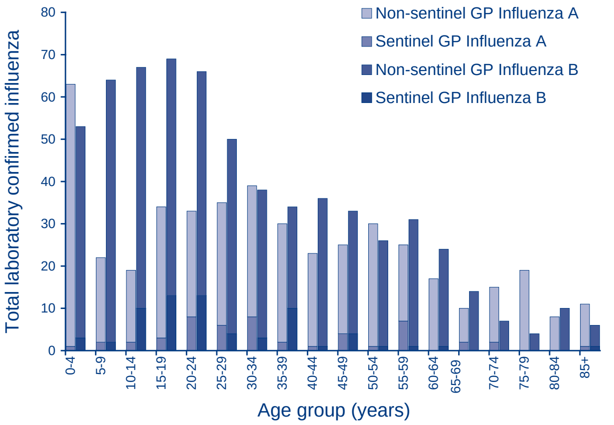
Respiratory virus	n detected	% detected (total swabs)	% detected (PCR positive swabs)
Influenza A	51	13	29
Influenza B	65	16	38
Picornavirus	42	10	24
Adenovirus	4	1	2
Parainfluenza virus	0	0	0
Respiratory syncytial virus	11	3	6
Total	173	43	100

PCR Polymerase chain reaction.

Table 3: Positive predictive value of clinical diagnoses of influenza, Victoria, 2002 to 2008, by general practitioner certainty of diagnosis

Year of surveillance	General practitioner certainty of diagnosis – number laboratory confirmed (PPV)									
	Almost certain		Probable		Less likely		Not stated		Total	
	n	PPV %	n	PPV %	n	PPV %	n	PPV %	n	PPV %
2003	87	45	73	29	4	9	20	38	184	34
2004	12	26	23	16	6	13	2	9	43	16
2005	74	61	90	41	8	15	10	43	182	43
2006	48	51	56	27	11	21	11	41	126	33
2007	85	64	91	44	5	13	8	38	189	47
2008	40	40	61	26	4	9	11	41	116	29

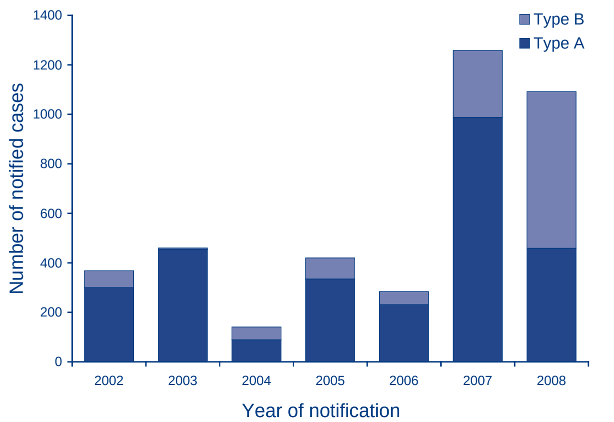
Figure 4: Laboratory confirmed influenza, sentinel and non-sentinel, Victoria, 2008, by age group and notification source



A total of 1,298 laboratory confirmed cases of influenza were notified to the DHS in 2008. Of these, 1,132 (87%) resulted from routine clinical presentations to Victorian GPs and hospitals, 116 (9%) were from sentinel GPs and 49 (4%) were identified from outbreak investigations. Of the total routine clinical presentation notifications in 2008, 90% (1,022/1,132) were identified during the surveillance period. There was a 1:1 male to female ratio among the routinely notified cases and the median age was 30–34 years for influenza A and 20–24 years for influenza B. Of the routinely notified cases, 41% (459/1,132) were influenza A, 56% (633/1,132) were influenza B, 38 (3%) were of an unknown type and two cases were notified with influenza A and B co-infection (Figure 5).

As shown in Figure 2, the trend of routine notifications of influenza A and B cases to DHS increased in parallel with MMDS and GPSS ILI rates. Peak

Figure 5: Notifications of laboratory confirmed influenza to the Department of Human Services from routine clinical presentations, Victoria, 2002 to 2009, by year and type



influenza A activity was observed in week 38 (week beginning 15 September) with 47 notifications and influenza B peak activity was observed in week 37 (week beginning 8 September) with 75 notifications. The total number of routine influenza notifications peaked in week 38 (week beginning 15 September) with 123 notifications, 3 weeks after the GP surveillance, and 2 weeks after the MMDS ILI peak rates were observed.

One case, an 89-year-old male, notified in week 47 (17 November) was reported to have died as a result of type A influenza virus infection. A patient, aged 96 years, was reported to have died with a type B influenza virus infection, but death was subsequently attributed to other causes.

World Health Organization Collaborating Centre for Reference and Research on Influenza

One hundred and sixty-seven specimens and 32 isolates collected in Victoria during 2008 were referred to the WHO Collaborating Centre for Reference and Research on Influenza. Of the 38% (75/199) that were propagated in tissue culture, 56% (42/75) were type A and 44% (33/75) were type B. One type A isolate was further characterised as an H1N1 strain that was A/Brisbane/59/2007-like. The remaining influenza A isolates were H3N2 strains, which were A/Brisbane/10/2007-like (including 8 low reactors). Forty-two per cent (14/33) of influenza type B isolates were designated as B/Florida/4/2006-like, of the B/Yamagata/16/88 lineage virus, and the remaining 58% (19/33) were characterised as B/Malaysia/2506/2004-like (low reactor) viruses, of the B/Victoria/2/87 lineage.

Outbreak investigations

Thirty respiratory outbreaks were notified to DHS in 2008 of which 27 were in aged care facilities. Among the aged care facility outbreaks, eight (30%) were determined to be caused by influenza type A virus, three (11%) by influenza type B virus, two (7%) each by respiratory syncytial virus and picornavirus, one (4%) by parainfluenza virus and the remaining 11 (41%) were of unknown aetiology. The 3 outbreaks not associated with an aged care facility all occurred in the same military facility: one in March was caused by influenza type B virus and there were concurrent outbreaks of influenza type A and type B viruses in August and September.

Discussion

The 2008 influenza season in Victoria was characterised by an unusually high proportion of influenza B virus circulation and a peak of influenza activity much later than previous years (Figure 6). The season remained within the normal seasonal activity thresholds. The delay between the increased GP and MMDS ILI rates and notifications to DHS can be explained by the time between the visit to a GP, laboratory confirmation of diagnosis and subsequent notification.[7]

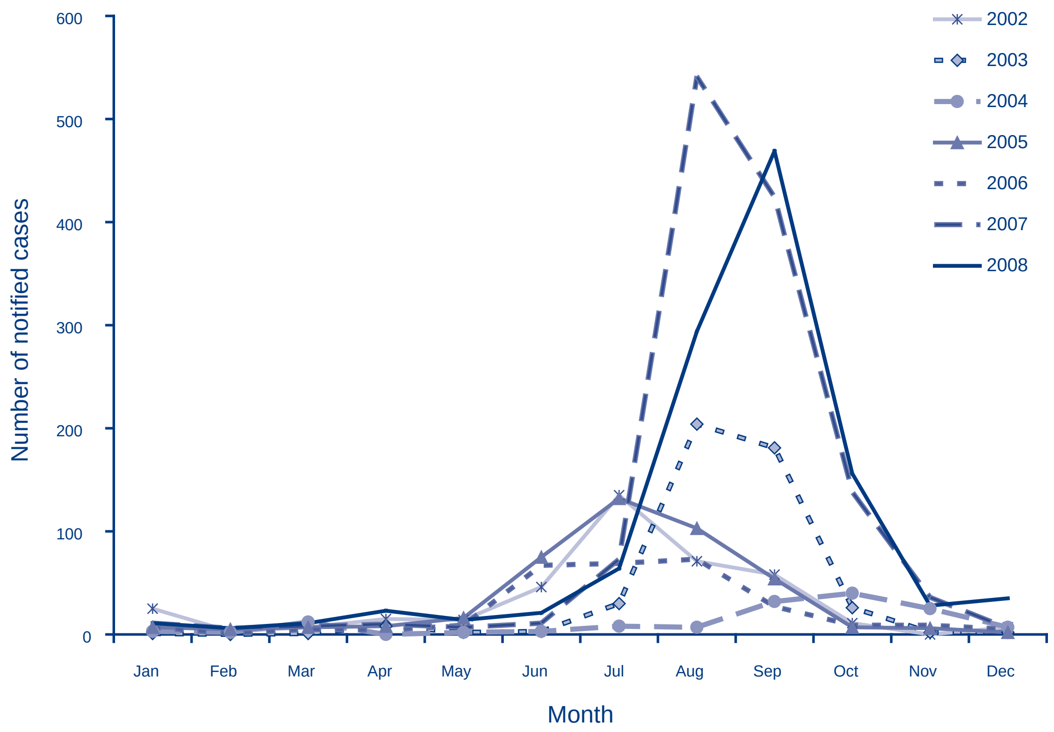
The average GP response rate of 98% was higher than previous years. GPs reported that participation in the program gave them a greater awareness of patterns of influenza symptoms and that feedback assisted with diagnosis, treatment and clinical decision making. This feedback was similar to previous years with weekly reporting further improving the relevance of the information for GPs.

Influenza type B was the predominant circulating seasonal influenza type in 2008 in Victoria. The proportion of influenza B from GPSS swabs was the highest observed since surveillance began, with previous highest percentages of influenza B detections in 2002 (33%) and in 2004 (23%). This increased proportion of influenza B was similarly reflected in laboratory confirmed notifications to DHS. According to NNDSS figures, there has not been an influenza season in Australia in which type B virus has been predominant since influenza became nationally notifiable in 2001.[8] This predominance of influenza B circulation in 2008 was also reported by the WHO in most Asian countries.[9]

Routine (non-sentinel) notifications to DHS of laboratory confirmed influenza are predominantly made from hospitalised patients who tend to be young children [10] and in those 65 years or over.[11] In contrast, workplace and university requirements for sick certificates, as well as greater compliance with swabbing procedures by sentinel surveillance participants, consistently result in a larger proportion of laboratory confirmed influenza from patients in the 15–44 year age group each year.[7]

The proportion of cases in older children and young adults relative to other groups was higher in 2008 compared with other recent influenza seasons.[12,13] This is largely explained by the younger median age of patients with influenza B infection.[14] During an influenza B outbreak in New Zealand in 2005, children in the 5–19 years age group had significant excess morbidity compared with the average from 1995 to 2004 for the same age group, with 3 influenza B associated deaths in children.[15] School absenteeism rates were also significant, with 1 school in Wellington temporarily closing.[16,17] Previous studies have demonstrated higher attack rates with influenza B among school aged children compared with other age groups.[18] An influenza B outbreak in 2006 in North Carolina, United States of America, resulted in an increase in student and school staff absenteeism and nine school closures.[19] In 2008, there were media reports of influenza outbreaks in schools in Australia, with a primary school in Tasmania reporting 250 students and 10 teachers absent during August.[20]

Figure 6: Notifications of laboratory confirmed influenza to the Department of Human Services from routine clinical presentations, 2002 to 2008, Victoria, by month and year



The Southern Hemisphere 2008 influenza vaccine contained A/Solomon Islands/3/2006 (H1N1), A/Brisbane/10/2007 (H3N2) and B/Florida/4/2006 influenza strains.[21] In 2008, the predominant circulating type A strain was H3 (A/Brisbane/10/2007-like – 98% (41/42)) matching the vaccine strain, with only 1 vaccine mismatch H1 strain (A/Brisbane/59/2007-like) identified from the type A circulating strains.

Since 1987 two antigenically distinct strains of influenza B, B/Victoria/2/87 and B/Yamagata/16/88, have co-circulated in varying proportions, causing seasonal outbreaks in Australia and the Asia–Pacific region.[22] In the 2008 influenza season in Victoria, these 2 distinct strains of influenza B (B/Florida/4/2006-like [14/33] of the B/Yamagata/16/88 lineage virus, and B/Malaysia/2506/2004-like [19/33] viruses, of the B/Victoria/2/87 lineage) co-circulated with the influenza A viruses. There is some suggestion that residual protective antibody may be produced against viruses from different influenza B lineages thus providing some residual immunity due to previous exposure to type B viruses of both lineages.[23] This low level cross protection may be due to the greater antigenic stability of influenza B and may explain the higher susceptibility of younger age groups not previously exposed to influenza B.

The 2008 national laboratory confirmed notifications were lower than in the previous year (9,121 notifications in 2008 compared with 10,446 notifications in 2007).[8] As with the previous 4 years the majority of national notifications in 2008 came from Queensland (41%), New South Wales (20%) and Victoria (14%). However, these figures may reflect good surveillance and data capture programs in those states, as well as larger populations rather than truly higher rates of influenza. Whilst the total number of notifications has increased during the last 2 years, with 2007 having higher than expected activity and several highly publicised influenza related deaths, notifications can be influenced year to year by outbreak investigations and testing propensity and may not necessarily reflect the levels of influenza in the community.

Threshold analysis indicated that the 2008 season remained within the normal seasonal activity levels, and highlights the importance of using several influenza and influenza-like illness surveillance systems to describe and assess the epidemiology of each season.

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