RECOMMENDATION FOR SEASONAL INFLUENZA VACCINE COMPOSITION FOR NEW ZEALAND FOR 2017

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RECOMMENDATIONS

The Australian Influenza Vaccine Committee (AIVC) met with a New Zealand representative (Appendix 1) in Canberra on 13 October 2016 to consult on the influenza vaccine composition for 2017 for New Zealand, Australia and South Africa. The recommended composition for trivalent vaccines was:

- A(H1N1) an A/Michigan/45/2015 (H1N1)pdm09 - like virus
- A(H3N2) an A/Hong Kong/4801/2014 (H3N2) - like virus
- B a B/Brisbane/60/2008 - like virus (belonging to B/Victoria lineage)

Quadrivalent vaccines contain the above three viruses and plus one more vaccine component:

- B a B/Phuket/3073/2013 - like virus (belonging to B/Yamagata lineage)

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Decision		Use year	A H3N2	A H1N1	B (Trivalent)	B (Quadrivalent)
NZ & WHO*	2016	2017	A/Hong Kong/4801 /2014	A/Michigan/45/2015	B/Brisbane/60/2008	B/Phuket/3073/2013
NZ & WHO*	2015	2016	A/Hong Kong/4801 /2014	A/California/7/2009	B/Brisbane/60/2008	B/Phuket/3073/2013
NZ & WHO*	2014	2015	A/Switzerland/9715293/2013	A/California/7/2009	B/Phuket/3073/2013	B/Brisbane/60/2008
NZ & WHO*	2013	2014	A/Texas/50/2012	A/California/7/2009	B/Massachusetts/2/2012	B/Brisbane/60/2008
NZ & WHO*	2012	2013	A/Victoria/361/2011	A/California/7/2009	B/Wisconsin/1/2010	
NZ & WHO*	2011	2012	A/Perth/16/2009	A/California/7/2009	B/Brisbane/60/2008	
NZ & WHO*	2010	2011	A/Perth/16/2009	A/California/7/2009	B/Brisbane/60/2008	
NZ & WHO*	2009	2010	A/Perth/16/2009	A/California/7/2009	B/Brisbane/60/2008	
NZ & WHO*	2008	2009	A/Brisbane/10/2007	A/Brisbane/59/2007	B/Florida/4/2006	
NZ & WHO*	2007	2008	A/Brisbane/10/2007	A/Solomon Islands/3/2006	B/Florida/4/2006	
NZ & WHO*	2006	2007	A/Wisconsin/67/2005	A/New Caledonia/20/99	B/Malaysia/2506/2004	
NZ & WHO*	2005	2006	A/California/7/2004	A/New Caledonia/20/99	B/Malaysia/2506/2004	
NZ & WHO*	2004	2005	A/Wellington/1/2004	A/New Caledonia/20/99	B/Shanghai/361/2002	
NZ & WHO*	2003	2004	A/Fujian/411/2002	A/New Caledonia/20/99	B/Hong Kong/330/2001	
NZ & WHO*	2002	2003	A/Moscow/10/99	A/New Caledonia/20/99	B/Hong Kong/330/2001	
NZ & WHO*	2001	2002	A/Moscow/10/99	A/New Caledonia/20/99	B/Sichuan/379/99	
NZ	2000	2001	A/Sydney/5/97	A/New Caledonia/20/99	B/Beijing/184/93	
WHO*	2000	2001	A/Moscow/10/99	A/New Caledonia/20/99	B/Beijing/184/93	
NZ & WHO*	1999	2000	A/Sydney/5/97	A/Beijing/262/95	B/Beijing/184/93	
NZ	1998	1999	A/Sydney/5/97	A/Bayern/7/95	B/Beijing/184/93	
WHO**	1997-98		A/Wuhan/359/95	A/Bayern/7/95	B/Beijing/184/93	
NZ	1997	1998	A/Wuhan/359/95	A/Texas/36/91	B/Beijing/184/93	
WHO**	1996-97		A/Wuhan/359/95	A/Singapore/6/86***	B/Beijing/184/93	
NZ	1996	1997	A/Johannesburg/33/94	A/Texas/36/91	B/Beijing/184/93	
WHO**	1995-96		A/Johannesburg/33/94	A/Singapore/6/86	B/Beijing/184/93	
NZ	1995	1996	A/Guangdong/25/93	A/Texas/36/91	B/Panama/45/90	
WHO**	1994-95		A/Shangdong/9/93	A/Singapore/6/86	B/Beijing/184/93	
NZ	1994	1995	A/Beijing/32/92	A/Texas/36/91	B/Panama/45/90	
WHO**	1993-94		A/Beijing/32/92	A/Singapore/6/86	B/Panama/45/90	
NZ	1993	1994	A/Shanghai/24/90	A/Texas/36/91	B/Panama/45/90	
WHO**	1992-93		A/Beijing/353/89	A/Singapore/6/86	B/Yamagata/16/88 or B/Panama/45/90	
NZ	1992	1993	A/Beijing/353/89	A/Victoria/36/88	B/Yamagata/16/88 or B/Panama/45/90	
WHO**	1991-92		A/Beijing/353/89	A/Singapore/6/86	B/Yamagata/16/88 or B/Panama/45/90	
NZ	1991	1992	A/Beijing/353/89	A/Victoria/36/88	B/Yamagata/16/88	
WHO**	1990-91		A/Guizhou/54/89	A/Singapore/6/86	B/Yamagata/16/88	

* WHO recommendations are for the Southern Hemisphere winter

* * WHO recommendations are for the Northern Hemisphere winter

1. INFLUENZA EPIDEMIOLOGY

1.1. WORLD-WIDE INFLUENZA ACTIVITY, JANUARY TO SEPTEMBER 2016

Between January and August 2016, low to widespread influenza activity was reported in Africa, the Americas, Asia, Europe and Oceania predominantly due to the circulation of influenza A(H1N1)pdm09 and B with some outbreaks of A(H3N2) viruses.

In the northern hemisphere, influenza activity was high from January until April/May and declined thereafter with the exception of several countries in the Americas and Asia. In the southern hemisphere, activity remained low until March after which moderate to high activity was reported by a number of countries.

NORTHERN HEMISPHERE TEMPERATE REGION

Regional and widespread influenza activity was reported until April/May with influenza A(H1N1)pdm09 and B viruses co-circulating in most countries of Europe and several countries in Asia. In addition, a few countries in Europe and Asia, including China, reported regional outbreaks of A(H3N2) influenza virus in the early part of the year. North America reported high influenza activity caused by A(H1N1)pdm09 from January until May, type B viruses from January until June and A(H3N2) from March until May.

SOUTHERN HEMISPHERE TEMPERATE REGION

Influenza activity was low in the early part of the year. Regional and widespread activity was reported from May onwards in southern Africa with early predominance of influenza B viruses, followed by the circulation of influenza A(H3N2) and A(H1N1)pdm09 viruses. Regional to widespread activity was reported in the southern cone of the Americas from March onwards with influenza B virus co-circulating with A(H1N1)pdm09 and regional A(H3N2) activity was reported in May. Oceania reported low circulation of viruses until March. High A(H1N1)pdm09 activity was reported in Papua New Guinea in March and in Fiji A(H3N2) activity was high in May. Australia reported high activity of A(H3N2) with co-circulation of influenza B virus from June to September.

TROPICAL AND SUBTROPICAL REGIONS

Influenza activity was variable but low overall in the tropical and subtropical regions of Africa. In

Egypt there was an influenza B virus outbreak from March to May. In West Africa there was low influenza activity; however Ghana reported local to regional A(H3N2) activity from April to July. In Central Africa widespread activity was reported by the Democratic Republic of Congo from April to July and the Central African Republic from July to September. Influenza activity was variable in tropical America with a few countries reporting regional A(H1N1)pdm09 activity between March and June. Influenza activity was variable in tropical and subtropical Asia with regional outbreaks of A(H1N1)pdm09 followed by co-circulation of A(H3N2) and B viruses reported by several countries in tropical Asia and some countries in the Middle East from January until April.

(Abridged from the Weekly Epidemiological Record, 2016 91(41):469-484).

INFLUENZA LABORATORY SURVEILLANCE FROM WHO COLLABORATING CENTRE AT MELBOURNE

The WHO Collaborating Centre for Reference and Research on Influenza in Melbourne, Australia (Melbourne WHOCC) analysed influenza isolates received from New Zealand, Australia, South Africa and Southeast Asia during the period of 1 February to 22 September 2016. Influenza A(H3N2) virus was the predominant strain which accounted for 44% (952/2152) of isolates, while 36% (783/2152) were A(H1N1)pdm09, 5% (105/2152) were B/Yamagata lineage and 6% (139/2152) were B/Victoria lineage (Table 2.1 in Appendix 2).

(Abridged from a report by Dr Ian Barr, WHO Collaborating Centre for Influenza, Melbourne).

1.2. INFLUENZA ACTIVITY IN AUSTRALIA, FEBRUARY TO SEPTEMBER 2016

Influenza activity in Australia in 2016 was moderate with some regional variations in types/subtypes. There are 7 influenza surveillance systems in Australia, which can be divided into three categories.

INFLUENZA-LIKE-ILLNESS SURVEILLANCE

- **Australian Sentinel Practice Research Network (ASPREN).** This system has general practitioners (GPs) who report influenza-like illness (ILI) presentation rates in New South Wales, South Australia, Victoria, Queensland, Tasmania, Western Australia and the Northern Territory. As jurisdictions joined ASPREN at different times and the number of GPs reporting has changed over time, the representativeness of ASPREN data in 2016 may be different from that of previous years. The national case definition for ILI is presentation with fever, cough and fatigue. Overall, the rate of ILI consultations peaked during the week 33 ending 21 August. The peak ILI rate was lower than 2015 and 2014.

- **FluTracking.** FluTracking is an online health surveillance system to detect influenza epidemics. It involves participants from around Australia completing a simple online weekly survey, which collects data on the rate of ILI symptoms in communities. Overall, the rates of fever and cough among participants in 2016 reached a plateau between weeks 32 (ending 14 August) and 36 (ending 11 September), lower than the peak rate observed in 2015.

LABORATORY SURVEILLANCE

- **National Notifiable Disease Surveillance System (NNDSS).** In Australia, laboratory-confirmed cases of influenza became notifiable to state and territory health departments from 1 January 2001. From 1 January to 30 September 2016, there have been 74,326 laboratory-confirmed notifications of influenza diagnosed and reported to NNDSS. Of these, 90% were influenza A (72% A(unsubtyped), 11% A(H3N2) and 7% A(H1N1)pdm09), 10% of cases were reported as influenza B and less than 1% were influenza C, influenza A & B co-detections or untyped. In addition, so far in 2016, notification rates have been highest in adults aged 75 years or older, with a secondary smaller peak in the very young, aged less than 5 years. While influenza A(H3N2) is detected across all age groups, it accounts for a greater proportion of influenza A where subtyping is available in adults aged 65 years or

older, than in any other age group. Overall, the 2016 notification data have been lower than 2015.

- **WHOCC Laboratory Surveillance.** This is conducted by the Melbourne WHOCC. A total of 1554 influenza viruses from Australia were received for analysis at the Melbourne WHOCC from 1 February to 22 September 2016. Of them, 47% were influenza A(H3N2), 35% A(H1N1)pdm09 and 4% influenza B/Yamagata and 3% B/Victoria. Of the 1240 influenza viruses tested for neuraminidase inhibitor resistance, there influenza A(H1N1)pdm09 viruses have shown highly reduced inhibition to the antiviral drug oseltamivir by enzyme inhibition assay.

SEVERITY SURVEILLANCE

- **Influenza hospitalisations.** The Influenza Complications Network (FluCAN) collects detailed clinical information on all hospitalised cases of influenza and pneumonia from a sample of four sentinel hospitals across Australia. Since 1 April 2016, a total of 1628 people have been admitted with confirmed influenza, of which 319 (20%) were children aged less than 15 years and 716 (44%) were adults 65 years of age or older. About 10% of influenza patients have been admitted directly to ICU (influenza B (13%) had higher ICU admission than influenza A (9%)). The majority of hospital admissions have been due to influenza A (94%). Overall, 72% of all cases have known medical co-morbidities with the presence of risk factors increasing with age.

- **Australian Paediatric Surveillance.** This surveillance system reports on hospital admissions of children aged 15 years and under to intensive care units (ICUs) around Australia following complications due to influenza infection, and was initiated at the start of June 2009 through the Australian Paediatric Surveillance Unit (APSU). Details of admissions are reported weekly. Between 1 July 2016 and 30 September 2016, there have been 10 hospitalisations associated with severe complications of influenza reported. The median age of these cases was 3.2 years. All cases were associated with influenza A infection.

- **Death associated with influenza and pneumonia.** Nationally reported influenza deaths are notified by jurisdictions to the NNDSS. So far in 2016, 65 influenza associated deaths have been notified to the NNDSS, with a median age of 79 years (range 0 to 99 years). The number of influenza associated deaths reported to the NNDSS is reliant on the follow up of cases to determine the outcome of their infection and most likely does not represent the true mortality impact associated with this disease.

(Abridged from the Australian Influenza Surveillance Report 2016, No.9, Department of Health and Ageing, Australia and a report by Dr Ian Barr, WHO Collaborating Centre for Influenza, Melbourne).

1.3. INFLUENZA ACTIVITY IN SOUTH AFRICA, FEBRUARY TO SEPTEMBER 2016

Influenza surveillance in South Africa in 2016 consisted of 4 main surveillance programmes:

- **Viral watch programme.** This program was established in 1984. It focuses on patients with ILI consultations seen mainly by general practitioners (90%) as well as a few paediatricians and primary health care clinics across the country. This program includes doctors and primary health care nurses from 8 of 9 South African provinces.

- **ILI surveillance in public health clinics.** This programme was established in 2012. It systematically enrols patients meeting a clinical case definition of ILI. Patients are enrolled at 2 government funded primary health care clinics in two provinces of South Africa. Detailed epidemiologic data are collected on all patients.

- **National syndromic surveillance for pneumonia.** The SARI (pneumonia) surveillance programme was established in 2009 and it monitors SARI cases in hospitalised patients. Detailed epidemiologic data are collected on all patients. This programme currently includes 6 hospitals as 5 sentinel sites covering 5 provinces.

- **Private hospital consultation surveillance.** This programme was established in 2002. It is based on hospital discharge data (ICD-codes J10-J18) for those private hospitals. No specimens for pathogens testing were collected for surveillance purpose.

In 2016, a total of 4500 suspected influenza specimens were processed up to week 34. Of which, 750 influenza viruses were detected. This gave an overall detection rate of 17%. Among all detected influenza viruses, influenza A (47%) was detected in 349. Of which, 116 (33%) Influenza A(H1N1)pdm09 and 231 (66%) influenza A(H3N2). Of the influenza positive cases, 53% (401/760) were influenza B with 24 B/Victoria lineage strains sequenced.

A total of 30 seasonal influenza A(H3N2) viruses were sequenced and they were clustered genetically in group 3C.2a subgroup.

A total of 16 influenza A(H1N1)pdm09 viruses were sequenced and most of them were clustered genetically in subgroup 6B.1.

A total of 24 influenza B/Victoria lineage viruses were sequenced and most of them were clustered genetically in clade 1A.

(Abridged from a report by Dr Florette Treurnicht, National Institute for Communicable Diseases, South Africa).

2. INFLUENZA ACTIVITY IN NEW ZEALAND IN 2016

The national influenza surveillance system in New Zealand is an essential public health tool for assessing and implementing strategies to control influenza. The surveillance system includes community-based surveillance (HealthStat GP surveillance, Healthline - telephone health advice service) and hospital-based surveillance (SHIVERS SARI surveillance, Ministry of Health data on publicly funded hospital discharges, laboratory-based non-sentinel surveillance for outpatients and hospital in-patients).

2.1. COMMUNITY-BASED SURVEILLANCE

2.1.1 ESR's sentinel GP-based surveillance

New Zealand's longitudinal sentinel GP-based surveillance system was established in 1989 as part of the World Health Organization's (WHO) Global Influenza Surveillance and Response System. It is operated nationally by the ESR and locally by influenza surveillance co-ordinators in the public health services (PHS). Previously (1989–2015), every week during the influenza season from May to September (weeks 18–39), GPs are required to record the number of consultations for influenza-like illness (ILI) each week and the age group of the patient (<1, 1–4, 5–19, 20–34, 35–49, 50–64, 65+), for each case patient who meets the case definition for ILI, on a standardised form.

ILI is defined as "an acute upper respiratory tract infection characterised by an abrupt onset and two of the following: fever, chills, headache, and myalgia"[3].

While the sentinel GP-based surveillance system has been operating successfully for a number of years, the manual method of data collection is outdated and time-consuming. The process adds extra time to the sentinel practices during the busy winter season and only provides the surveillance system with very limited consultation data.

In 2016, a modernised electronic data collection was introduced, enhanced influenza-like illness surveillance (e-ILI). It used an interactive advance form designed by HealthLink to record a consultation-seeking patient with ILI. Symptoms and onset dates including demography (age, sex, and ethnicity), clinical information, medication, vaccination status, and specimen collection were collected electronically and data was sent directly to ESR.

The ILI case definition was also modified to "an acute respiratory illness with a history of fever or measured fever of ≥38°C, AND cough, AND onset within the past 10 days".

The syndromic eILI surveillance was all-year-round. The virological specimen collection and testing for those ILI patients was only during the influenza season, May-September inclusive.

Each participating practice from the Auckland and Wellington regions collected respiratory samples (ie, a nasopharyngeal or throat swab) from all ILI patients seen. For the remaining areas, three respiratory samples, one each from the first ILI patient examined on Monday, Tuesday and Wednesday were collected weekly.

All practices forwarded these samples to the WHO National Influenza Centre at ESR apart for those in the Canterbury, South Canterbury and West Coast DHBs who forwarded their samples to Canterbury Health Laboratories for virus characterisation. Laboratory identification included

molecular detection using the polymerase chain reaction (PCR), isolation of the virus or direct detection of viral antigens. Influenza viruses were typed as A or B. Influenza A viruses were further sub-typed as A(H3N2) or A(H1N1)pdm09. Influenza B viruses were further lineage-typed as B/Yamagata or B/Victoria lineage. Eight non-influenza respiratory viruses were also tested: respiratory syncytial virus, parainfluenza virus types 1, 2 and 3, rhinovirus, adenovirus, human metapneumovirus and enterovirus.

Canterbury Health Laboratory reported to ESR weekly on the total number of swabs received from each DHB and the influenza viruses identified, and updated details on influenza types and sub-types from previous weeks. ESR reports national information on epidemiological and virological surveillance of influenza weekly and yearly to relevant national and international organisations, including the WHO, with reports published on the ESR website: https://surv.esr.cri.nz/virology.php.

Consultation rates were calculated using the registered patient populations of the participating practices as a denominator in 2016.

The values for the different intensity levels for 2016 are listed in the table below. This is based on New Zealand's consultation rates from 2000–2015 (excluding the pandemic year, 2009) and WHO's interim guidance severity assessment.

Table 2. National ILI and influenza activity thresholds

ESR ILI surveillance		Seasonal level (per 100,000)			Above seasonal level (per 100,000)
Method	Below seasonal threshold	low	moderate	high	
MEM	<35.1	35.1-82.5	82.5-168.9	168.9-231.8	>231.8

ESR ILI-associated influenza		Seasonal level (per 100,000)			Above seasonal level (per 100,000)
Method	Below seasonal threshold	low	moderate	high	
MEM	<11.4	11.4-43.3	43.3-85.7	85.7-115.7	>115.7

In 2016, 84 sentinel practices were recruited from all 20 DHBs under ESR's sentinel GP-based surveillance with a total patient roll of 526,743. From week 18 (the week ending 8 May 2016) through week 35 (the week ending 4 September 2016), a total of 1320 consultations for ILI were reported from the 20 DHBs. The cumulative incidence of ILI consultation during this period was 250.6 per 100,000 population. The average weekly ILI consultation rate during this period was 13.9 per 100,000 population.

Weekly national ILI consultation rates for the study period were compared with years 2013–2015. From week 18 (ending 8 May 2016) through week 35 (ending 4 September 2016), influenza consultation activity remained below the seasonal threshold. The ILI consultation rate peaked during week 33 (week ending 21 August 2016) at 22.2 per 100,000 population.

Among the patients that met the ILI case definition, 776 (58.8%) had a specimen tested for influenza. Of these, 227 (29.3%) cases had influenza virus detected. Influenza peaked in week 34 (ending 28 August). Figure 1 and Figure 2 demonstrate that the 2016 season had below threshold ILI activity, whilst ILI-associated influenza reached the threshold level only between weeks 31 and 35 (Figure 3).

Figure 1. Weekly consultation rates for influenza-like illness in New Zealand in 2016 compared to 2013–2015

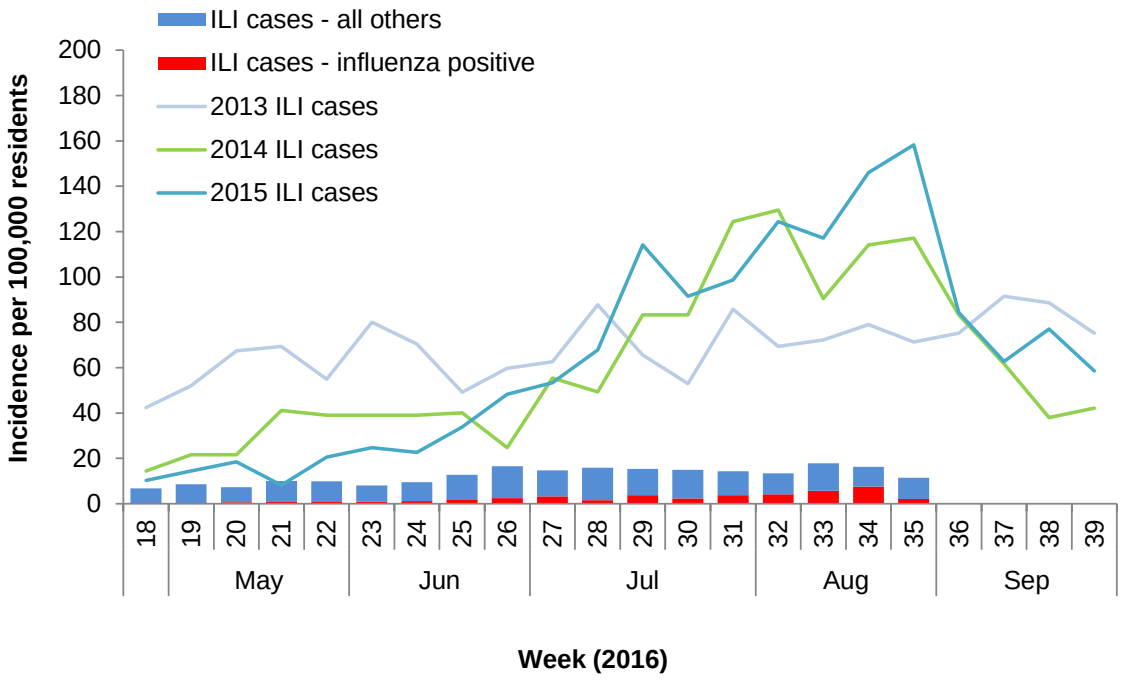


Figure 2. Weekly ILI-associated influenza rates in 2016 compared to 2013–2015

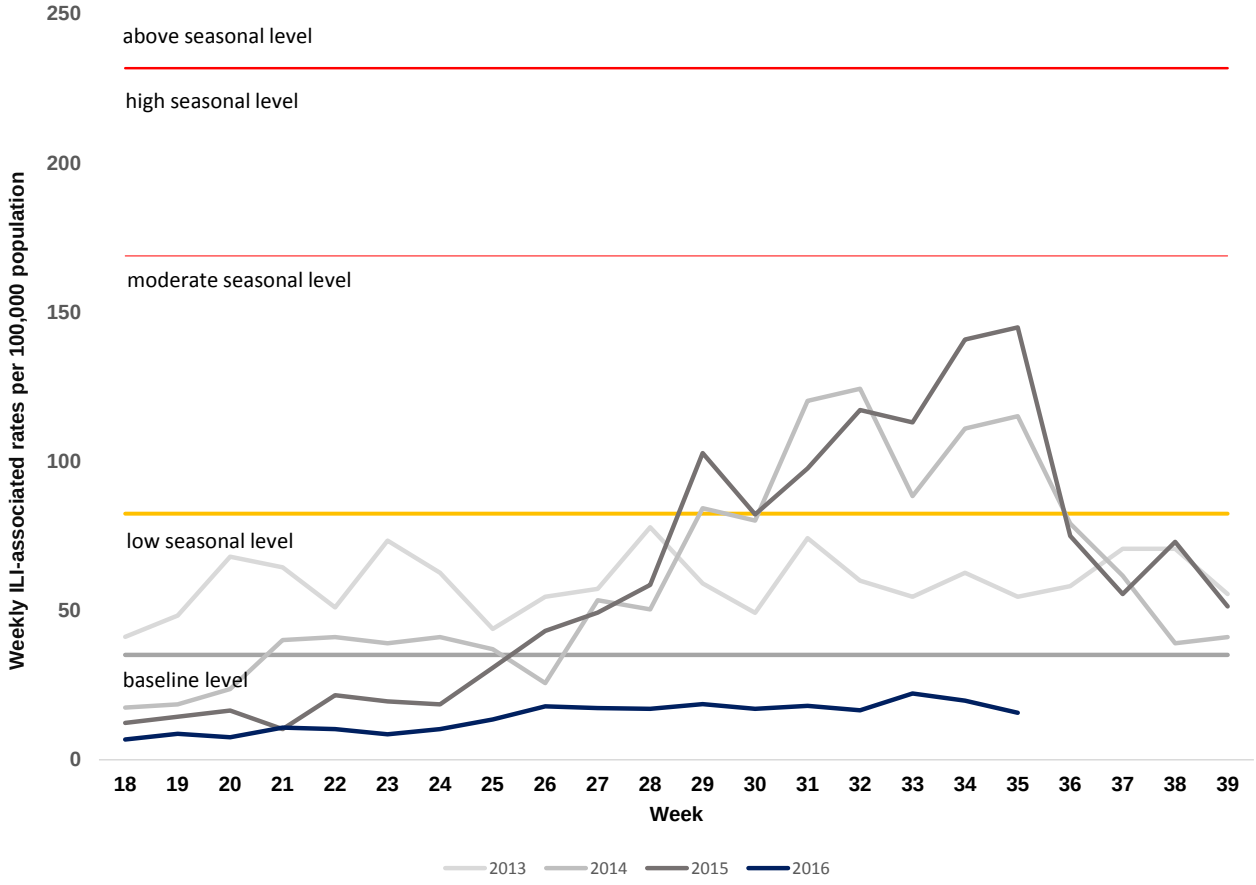
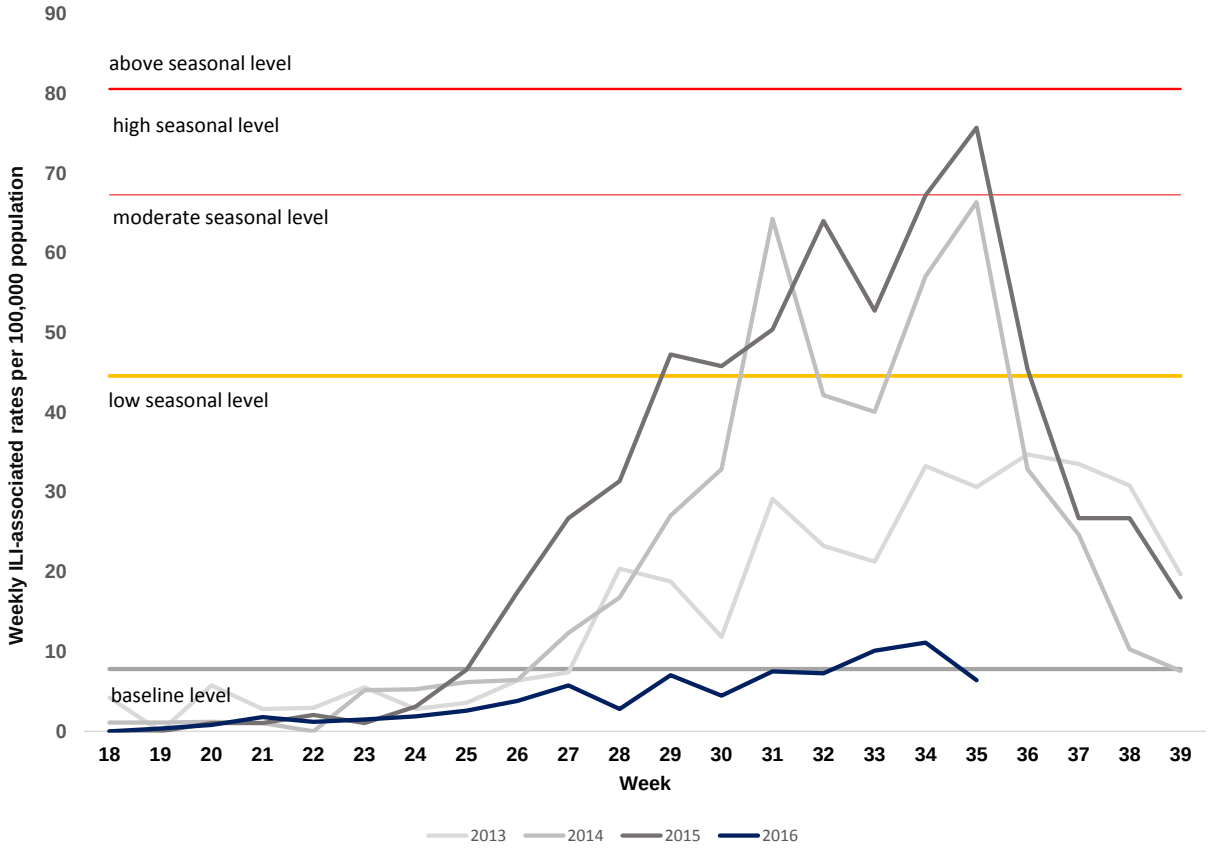
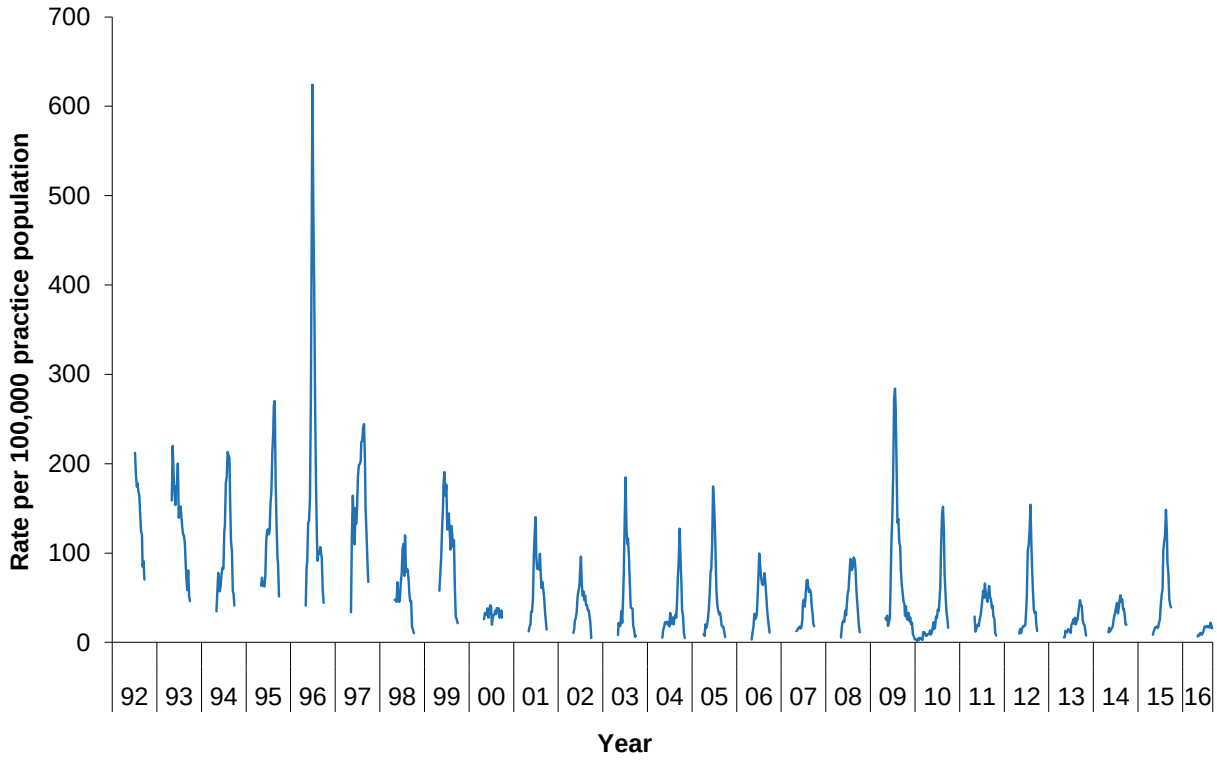


Figure 3. Weekly ILI-associated influenza rates in 2016 compared to 2013–2015



Weekly national ILI consultation rates for the study period were compared with the weekly consultation rates for ILI in 1992–2016 (Figure 4). The peak ILI rate in 2016 was the lowest during 2000–2015.

Figure 4. Weekly Consultation Rates for Influenza-like Illness in New Zealand, 1992–2016



As in previous years, 2016 consultation rates for ILI varied greatly among DHBs (Table 3). From week 18 (the week ending 2 May 2016) through week 35 (the week ending 4 September). Tairawhiti DHB had the highest average consultation rate (44.2 per 100,000), followed by South Canterbury (38.2 per 100,000), and Canterbury (33.7 per 100,000).

Table 3. Weekly consultation rate for influenza-like illness by District Health Board, 2016

DHB	Rate (per 100 000)																		Average rate
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Auckland	5.0	10.0	0.0	21.6	16.6	13.3	11.6	16.6	15.0	18.3	21.6	19.9	24.9	13.3	34.9	36.6	33.2	41.5	19.7
Bay of Plenty	33.7	13.5	6.7	20.2	13.5	20.2	6.7	13.5	13.5	6.7	6.7	20.2	0.0	33.7	0.0	26.9	0.0	13.5	13.8
Canterbury	6.3	9.4	7.9	20.5	17.3	15.7	25.2	31.5	48.8	59.8	45.6	58.2	53.5	56.7	42.5	53.5	36.2	17.3	33.7
Capital and Coast	3.9	3.9	11.7	19.5	11.7	19.5	11.7	38.9	27.3	31.2	58.4	38.9	11.7	46.7	38.9	54.5	42.8	19.5	27.3
Counties Manukau	0.0	2.5	1.2	1.2	3.7	1.2	0.0	13.7	8.7	12.4	5.0	6.2	8.7	3.7	5.0	10.0	3.7	7.5	5.2
Hawke's Bay	0.0	5.2	0.0	0.0	0.0	0.0	5.2	5.2	10.4	5.2	0.0	5.2	0.0	0.0	0.0	0.0	10.4	20.9	3.8
Hutt Valley	0.0	0.0	0.0	0.0	3.8	0.0	3.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Lakes	17.0	17.0	17.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	17.0	34.0	0.0	0.0	8.5
MidCentral	0.0	38.9	23.3	7.8	15.5	15.5	31.1	0.0	31.1	31.1	15.5	15.5	7.8	15.5	0.0	7.8	0.0	7.8	14.7
Nelson Marlborough	0.0	9.7	9.7	9.7	9.7	0.0	0.0	19.5	19.5	19.5	0.0	0.0	0.0	0.0	0.0	0.0	29.2	0.0	7.0
Northland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
South Canterbury	9.3	0.0	9.3	27.8	0.0	0.0	18.6	55.7	55.7	46.4	27.8	37.1	18.6	46.4	37.1	120.6	111.4	65.0	38.2
Southern	10.1	4.0	10.1	4.0	4.0	4.0	6.1	0.0	0.0	4.0	4.0	22.2	24.3	12.1	18.2	16.2	10.1	10.1	9.1
Tairawhiti	82.9	82.9	82.9	16.6	33.2	49.8	66.4	49.8	16.6	0.0	33.2	66.4	33.2	49.8	0.0	0.0	49.8	82.9	44.2
Taranaki	0.0	0.0	0.0	0.0	8.7	0.0	4.4	4.4	26.1	4.4	26.1	8.7	13.1	13.1	17.4	8.7	13.1	0.0	8.2
Waikato	3.5	0.0	3.5	0.0	3.5	7.0	10.6	0.0	7.0	0.0	3.5	0.0	7.0	0.0	0.0	7.0	10.6	0.0	3.5
Wairarapa	0.0	0.0	0.0	8.2	4.1	8.2	4.1	0.0	28.8	0.0	12.4	4.1	4.1	4.1	4.1	4.1	0.0	4.1	5.0
Waitemata	4.6	9.1	32.0	18.3	32.0	22.8	13.7	13.7	9.1	27.4	22.8	18.3	13.7	32.0	13.7	18.3	45.7	32.0	21.1
West Coast	6.3	19.0	6.3	19.0	6.3	6.3	25.4	6.3	0.0	6.3	19.0	12.7	31.7	12.7	19.0	6.3	38.1	12.7	14.1
Whanganui	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152.3	30.5	0.0	0.0	0.0	0.0	0.0	30.5	0.0	30.5	13.5
New Zealand	**5.3**	**7.0**	**6.6**	**9.9**	**9.3**	**8.5**	**10.3**	**13.5**	**17.8**	**17.3**	**17.1**	**18.6**	**17.1**	**18.0**	**16.5**	**22.2**	**19.7**	**15.8**	**13.9**

From 2 May to 4 September 2016, a total of 1320 ILI cases were identified. This gives a cumulative ILI incidence of 275.1 per 100,000 patient population (Table 4). Among the 776 tested ILI cases, 227 (29.3%) were positive for influenza viruses. This gives an ILI related influenza incidence of 80.5 per 100,000 patient population.

Table 4. Demographic characteristics of ILI and influenza cases, 2 May – 4 September 2016

Characteristics	ILI & influenza cases among sentinel practices				
	ILI cases	Influenza cases	Prop Influenza positive[1] (%)	ILI incidence (per 100 000)	Influenza incidence[2] (per 100 000)
Overall	**1320**	**227**	**29.3 (100.0)**	**275.1**	**80.5**
Age group (years)					
<1	10	2	28.6 (0.9)	136.1	38.9
1–4	76	7	16.3 (3.1)	280.4	45.6
5–19	293	61	35.5 (26.9)	299.2	106.1
20–34	405	66	31.0 (29.1)	383.0	118.7
35–49	259	51	30.5 (22.5)	278.2	85.0
50–64	185	31	27.2 (13.7)	218.0	59.3
65–79	79	7	13.7 (3.1)	164.7	22.6
>80	13	2	22.2 (0.9)	82.7	18.4
Unknown	0	0	0.0		
Ethnicity					
Māori	156	15	15.8 (6.6)	250.6	39.6
Pacific peoples	95	28	37.8 (12.3)	295.6	111.9
Asian	113	10	0.0	335.0	48.5
European and Other	956	174	32.3 (76.7)	272.6	88.2
Unknown	0	0	0.0	0.0	
Sex					
Female	736	126	29.1 (55.5)	294.3	85.6
Male	583	101	29.4 (44.5)	253.9	74.8
Unknown	1	0	0.0		

[1]Proportion of cases tested which were positive for influenza viruses

[2]Adjusted to positivity of tested cases

Between 2 May to 4 September 2016, a total of 776 ILI specimens were tested for influenza viruses (Table 5 and Figure 5) and 227 (29.3%) were positive with more influenza A (212) than influenza B (15) viruses: influenza A (not sub-typed) (58), influenza A(H3N2) (112), influenza A(H1N1)pdm09 (42) including A/California/7/2009(H1N1)pdm09-like (4), influenza B/Yamagata lineage (4), B/Victoria lineage (6) including B/Brisbane/60/2008-like (1), influenza B not lineage-typed (5). There were 15 co-detections of influenza and non-influenza viruses among ILI specimens.

Between 2 May to 4 September 2016, a total of 770 ILI specimens were tested for non-influenza viruses and 252 (32.7%) were positive with the following viruses: respiratory syncytial virus (63), rhinovirus (97), parainfluenza virus type 1 (28), parainfluenza virus type 2 (2), parainfluenza virus type 3 (6), adenovirus (28), human metapneumovirus (35) and enterovirus (10). 237 ILI specimens (94.0%) had single virus detection and 15 (6.0%) had multiple virus detection (Table 5 and Figure 6).

Table 5. Influenza and non-influenza respiratory viruses among ILI cases, 2 May to 4 September 2016

Influenza viruses	ILI
	Cases (%)
No. of specimens tested	776
No. of positive specimens (%)[1]	227 (29.3)
Influenza A	212
A (not subtyped)	58
A(H1N1)pdm09	42
A(H1N1)pdm09 by PCR	38
A/California/7/2009 (H1N1)pdm09 - like	4
A(H3N2)	112
A(H3N2) by PCR	112
A/Hong Kong/4801/2014 (H3N2) - like	0
Influenza B	15
B (lineage not determined)	5
B/Yamagata lineage	4
B/Yamagata lineage by PCR	4
B/Phuket/3073/2013 - like	0
B/Victoria lineage	6
B/Victoria lineage by PCR	5
B/Brisbane/60/2008 - like	1
Influenza and non-influenza co-detection (% +ve)	15 (6.6)

Non-influenza respiratory viruses	ILI
	Cases (%)
No. of specimens tested	770
No. of positive specimens (%)[1]	252 (32.7)
Respiratory syncytial virus (RSV)	63
Parainfluenza 1 (PIV1)	28
Parainfluenza 2 (PIV2)	2
Parainfluenza 3 (PIV3)	6
Rhinovirus (RV)	97
Adenovirus (AdV)	28
Human metapneumovirus (hMPV)	35
Enterovirus	10
Single virus detection (% of positives)	237 (94.0)
Multiple virus detection (% of positives)	15 (6.0)

[1]Number of specimens positive for at least one of the listed viruses; note a specimen may be positive for more than one virus.

A/Hong Kong/4801/2014 (H3N2)-like viruses were isolated but did not displayed here due to an IT issue.

Figure 5. Temporal distribution of the number and proportion of influenza viruses from ILI specimens, 2 May to 4 September, by type and week

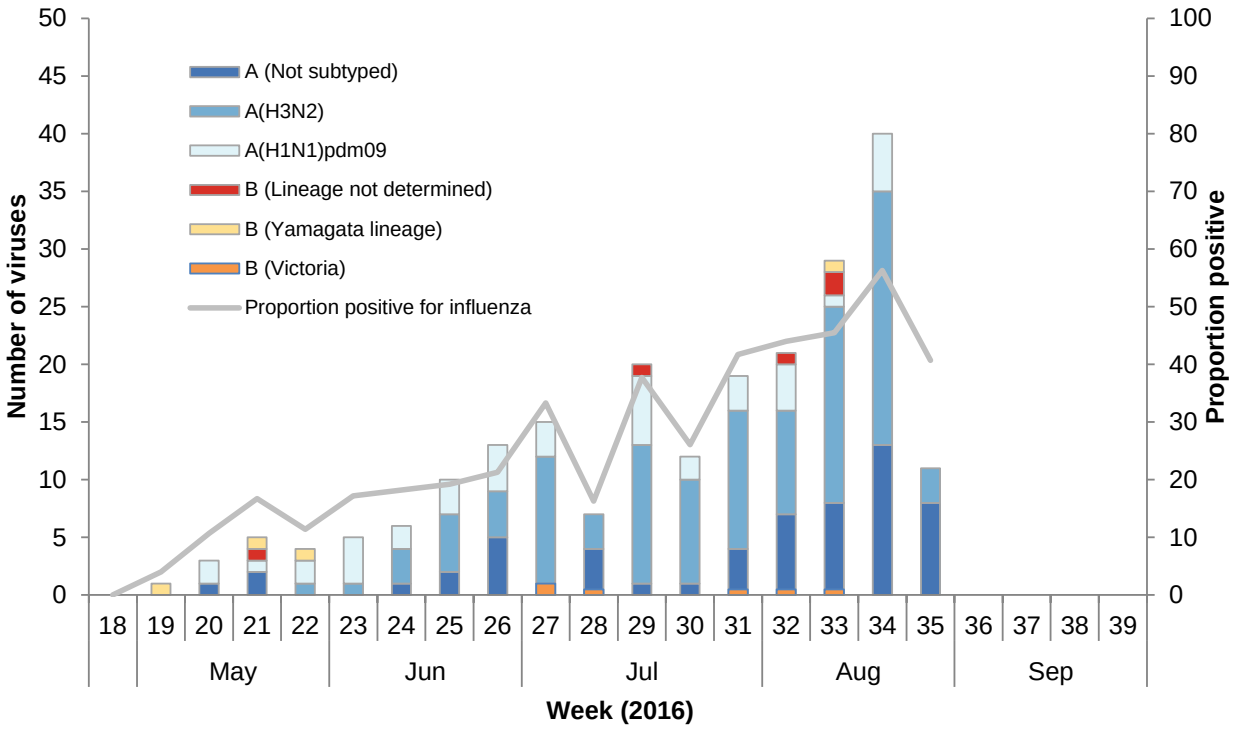
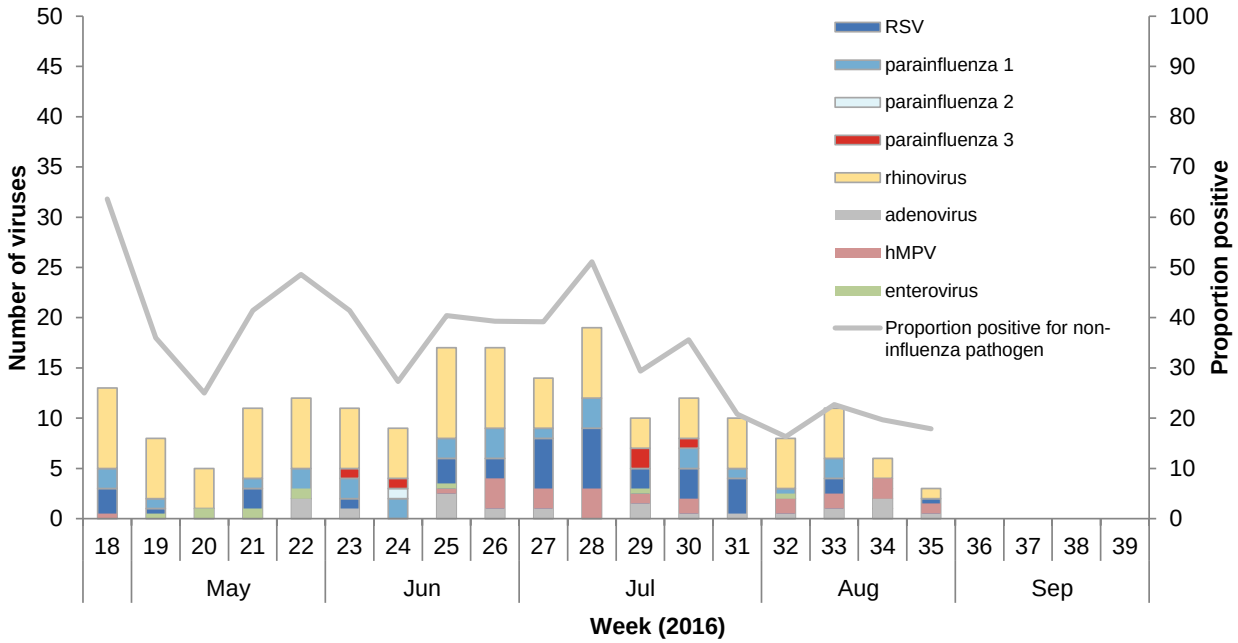


Figure 6. Temporal distribution of the number and proportion of non-influenza viruses from ILI specimens, 2 May to 4 September, by type and week



2.1.2 Healthline

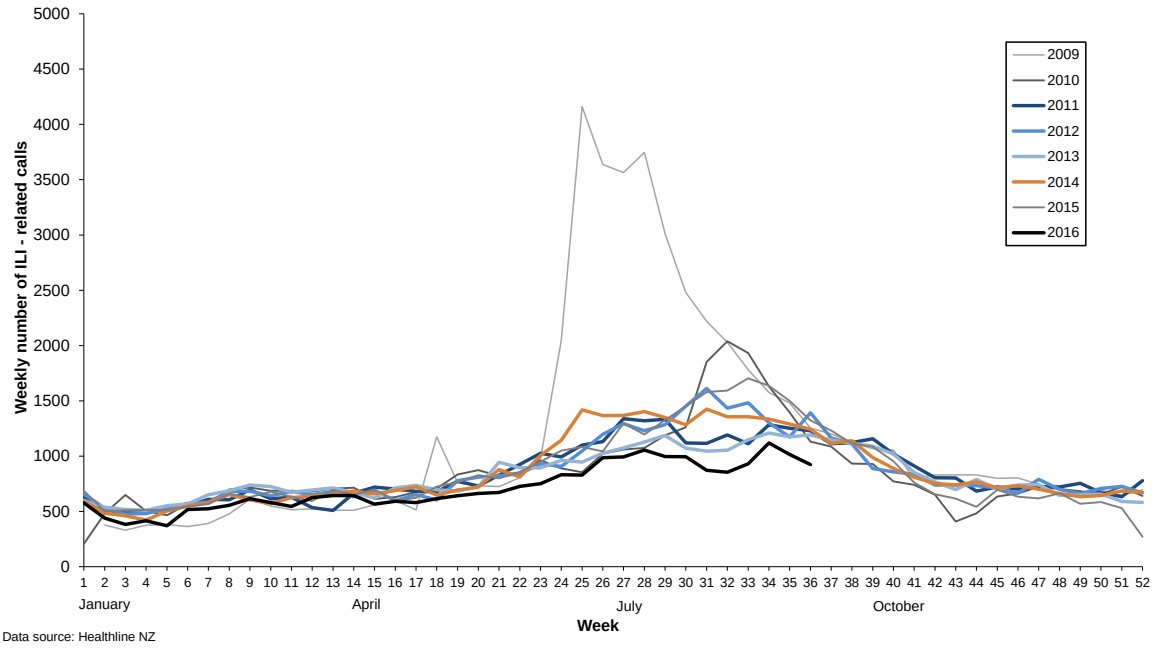
Healthline is the free national 0800 24 hour telephone health advice service funded by the Ministry of Health. Calls made to Healthline are triaged using electronic clinical decision support software. Data collected are daily counts of all symptomatic calls made to Healthline and those triaged for Influenza-Like-Illness (ILI). Note that about 70% of all calls to Healthline are symptomatic (other calls not part of this analysis include queries for information etc).

Analysis is frequency based with alarms raised by identifying statistical deviations (aberations) from previous calls. Data are reported for all ages and in five age bands (0–4, 5–14, 15–44, 45–64, 65+ years). The analysis of the call frequency is based on the cumulative summation (CUSUM) algorithm implemented in Early Aberration Reporting System (EARS) application developed by the Centres for Disease Control and Prevention (CDC), Atlanta, United States. EARS has three sensitivity thresholds (high, medium and low). If the daily call count exceeds a threshold a flag is signalled.

Cases of ILI are defined as those that are recorded in the Healthline database as having one of the following 18 guidelines: adult fever; breathing problems; breathing difficulty – severe (paediatric); colds (paediatric); cough (paediatric); cough – adult; fever (paediatric); flu-like symptoms or known/suspected influenza; flu like symptoms pregnant; influenza (paediatric); headache; headache (paediatric); muscle ache/pain; sore throat (paediatric); sore throat/hoarseness; sore throat/hoarseness pregnant; upper respiratory tract infections/colds; upper respiratory tract infections/colds – pregnant.

Figure 7 shows the weekly number of calls to Healthline for ILI during 2009–2016. Healthline calls in 2016 were lower than in the years 2009–2015.

Figure 7. Weekly number of ILI-related calls to Healthline, 2009–2016



Data source: Healthline NZ

Data source: Healthline NZ

2.2 Hospital-based surveillance

2.2.1 SHIVERS hospital-based Severe Acute Respiratory Illness (SARI) surveillance

In this active surveillance system, in-patients with suspected respiratory infections admitted overnight to any of the four hospitals (Auckland City Hospital and the associated Starship Children's Hospital, Middlemore Hospital and the associated Kidz First Children's Hospital) in the two DHBs, were screened by research nurses each day. Overnight admission was defined as: "*A patient who is admitted under a medical team, and to a hospital ward or assessment unit*". Case ascertainment followed a surveillance algorithm. The presence of the components of the case definition was determined through a combination of reviewing the clinician's admission diagnoses and by interviewing patients about their presenting symptoms. Records of all patients admitted overnight to medical wards were reviewed daily to identify anyone with a suspected respiratory infection. These patients were categorised into one of ten admission diagnostic syndrome groups. Research nurses then interviewed the patients and documented the components of the case definition that were present and differentiated patients into SARI and non-SARI cases.

The case definition being used is the World Health Organisation (WHO) SARI case definition: "an acute respiratory illness with a history of fever or measured fever of ≥38°C, and cough, and onset within the past 10 days, and requiring inpatient hospitalisation". If a patient with suspected respiratory infection met the SARI case definition, a respiratory sample was collected to test for influenza and other respiratory pathogens. In addition, patient information was captured via a case report form which included patient demographics, presenting symptoms and illness, pre-hospital healthcare, medication usage, influenza vaccination history, co-morbidities, disease course and outcome, including major treatments, ICU admission and mortality, epidemiologic risk factors and laboratory results.

The total numbers of all new hospital inpatient acute admissions and newly assessed and tested patients, including ICU admissions and deaths were collected. This allowed calculation of population-based incidence for SARI and associated influenza cases overall and stratified by age, sex, ethnicity and socio-economic status among the ADHB and CMDHB resident population (from 2013 census data). Incidence rates were calculated along with 95% confidence intervals (95%CI). In addition, this allowed the calculation of the proportion of SARI and associated influenza cases, including ICU admissions and deaths, by overall and stratified patients, among all acute admissions regardless of residence status. An acute admission is defined as an unplanned admission on the day of presentation at the admitting health care facility. Admission may have been from the emergency or outpatient departments of the health care facility, a transfer from another facility or a referral from primary care.

A case may have more than one specimen taken for influenza and non-influenza virus testing. The number of specimens can therefore differ from the number of cases and specimens and cases may be reported separately.

From 2 May to 4 September 2016, there were 49 067 acute admissions to ADHB and CMDHB hospitals. A total of 2928 patients with suspected respiratory infections were assessed in these hospitals. Of these, 1153 (39.4%) patients met the SARI case definition. Among these SARI patients, 100 (13.6%) had influenza viruses detected.

Of the 1153 SARI cases identified from 2 May to 4 September 2016, 848 were residents of ADHB and CMDHB, giving the SARI incidence rate of 93.6 per 100,000 population (Figure 8, Figure 9

and Table 6). Among the 647 tested SARI cases who were ADHB and CMDHB residents, 92 (14.2%) had positive influenza virus results. This gives a SARI related influenza incidence of 10.2 per 100,000 population (Figure 10 and Table 6).

Figure 8. Weekly resident SARI and SARI-associated influenza incidence, 2016

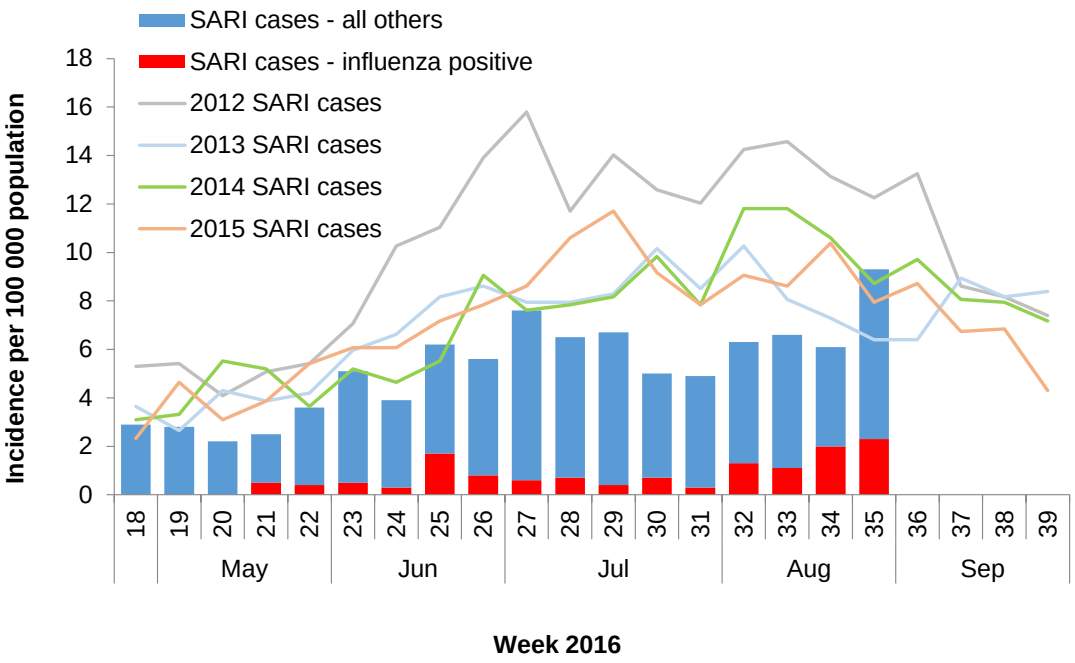


Figure 9. Weekly hospitalisation rates for SARI in 2016 compared to 2012–2015

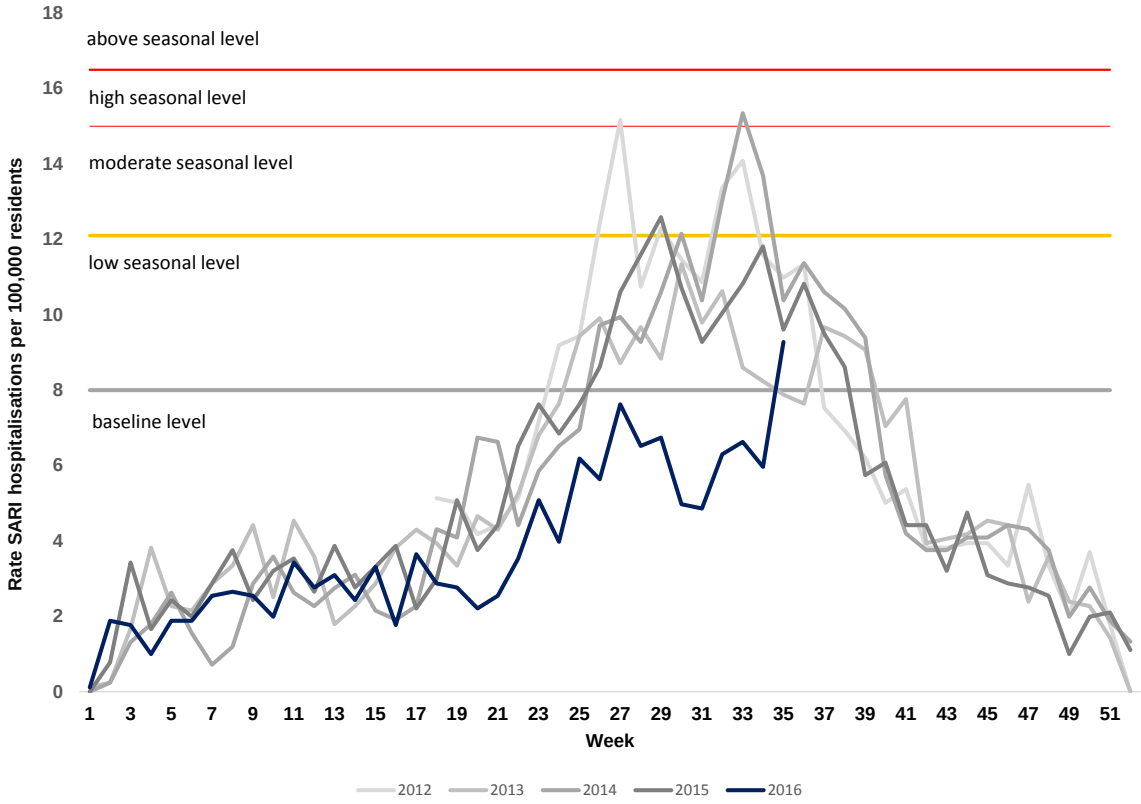
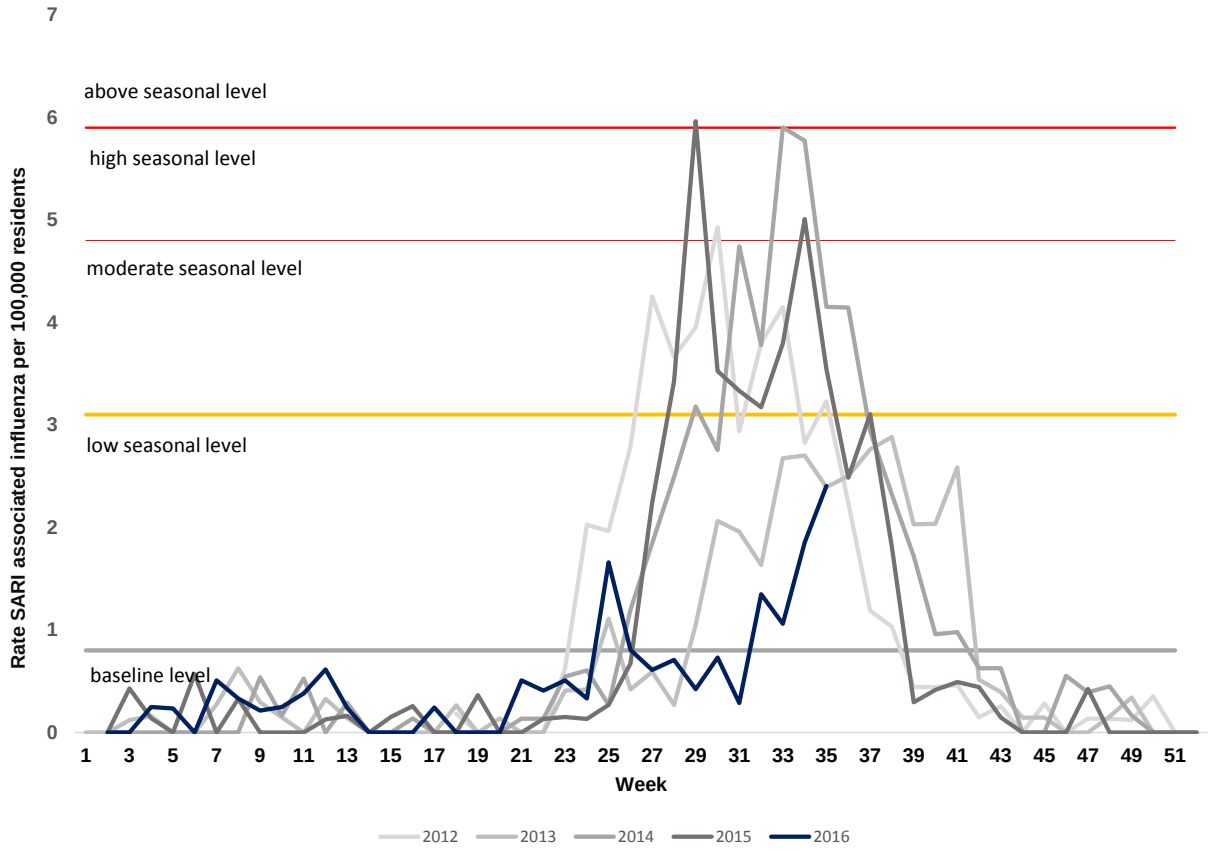


Figure 10. Weekly hospitalisation rates for SARI-associated influenza in 2016 compared to 2012–2015



During 2 May to 4 September 2016, the 1153 SARI cases give a SARI proportion of 23.5 per 1000 acute hospitalisations (Table 6). Of these SARI cases, 39.6% were children aged less than 5 years and 16.6% were adults 65 years and older. Seventy-six SARI cases have been admitted to ICU and 5 SARI-related deaths were reported during this period.

Table 6. Demographic characteristics of SARI cases and related influenza cases, since 2 May 2016

Characteristics	Admissions	Assessed	SARI & influenza cases among all hospital patients			SARI & influenza cases among ADHB & CMDHB residents			
			SARI Cases[2] (%)	Cases per 1000 hospitalisations	Influenza positive[1] (%)	SARI cases	SARI incidence (per 100 000)	Influenza Cases	Influenza incidence (per 100 000)
Overall	**49067**	**2928**	**1153 (39.4)**	**23.5**	**100 (13.6)**	**848**	**93.6**	**92**	**10.2**
Age group (years)									
<1	2004		252	125.7	9 (4.8)	227	1680.7	7	51.8
1–4	3418		205	60.0	17 (12.1)	171	323.4	17	32.1
5–19	5610		57	10.2	3 (7.7)	49	25.4	3	1.6
20–34	9732		54	5.5	12 (24.0)	51	24.5	10	4.8
35–49	7175		59	8.2	11 (22.9)	58	30.4	11	5.8
50–64	8344		118	14.1	20 (20.2)	109	72.4	17	11.3
65–79	7781		126	16.2	15 (14.6)	117	160.1	15	20.5
>80	5003		65	13.0	12 (21.8)	64	273.2	12	51.2
Unknown	0		215			0		0	
Ethnicity									
Māori	6600		189	28.6	17 (12.8)	167	167.9	13	13.1
Pacific peoples	10331		369	35.7	36 (12.7)	345	250.0	35	25.4
Asian	8022		85	10.6	7 (10.3)	77	36.6	7	3.3
European and Other	23806		295	12.4	39 (16.3)	259	64.5	37	9.2
Unknown	295		215	728.8		0		0	
Hospitals									
ADHB	28827	1553	596 (38.4)	20.7	63 (16.3)	362	83.0	56	12.8
CMDHB	20240	1374	557 (40.5)	27.5	37 (10.7)	486	103.6	36	7.7
Sex									
Female	25920		457	17.6	51 (14.4)	416	89.4	47	10.1
Male	23144		477	20.6	47 (12.8)	428	97.2	44	10.0
Unknown	3		219			4		1	

[1]Proportion of cases tested which were positive for influenza viruses

[2]Percentage for SARI assessed only

From 2 May to 4 September 2016, 780 SARI specimens have been tested and 104 (13.3%) were positive for influenza viruses with more influenza A (97) than influenza B (7) viruses (Table 7): A(H3N2) (23), influenza A (not sub-typed) (49), influenza B/Yamagata lineage (2) including B/Phuket/3073/2013-like (1), B/Victoria lineage (1) including B/Brisbane/60/2008-like (1), influenza B not lineage determined (4). There were 8 co-detections of influenza and non-influenza viruses among SARI specimens.

From 2 May to 4 September 2016, 314 SARI specimens were tested for non-influenza respiratory viruses (Table 7). Of these, 197 (62.7%) were positive with the following viruses: respiratory syncytial virus (111), rhinovirus (54), parainfluenza virus type 1 (14), parainfluenza virus type 2 (1), parainfluenza virus type 3 (2), adenovirus (25), human metapneumovirus (16) and enterovirus (4). 172 SARI specimens (87.3%) had single virus detection and 25 (12.7%) had multiple virus detection.

Table 7. Influenza and non-influenza respiratory viruses among SARI cases, 2 May – 4 September 2016

Influenza viruses	SARI		
	Cases (%)	ICU (%)	Deaths (%)
No. of specimens tested	780	72	2
No. of positive specimens (%)[1]	104 (13.3)	6 (8.3)	1 (50.0)
Influenza A	97	6	0
A (not subtyped)	49	5	0
A(H1N1)pdm09	25	0	0
A(H1N1)pdm09 by PCR	19	0	0
A/California/7/2009 (H1N1)pdm09 - like	6	0	0
A(H3N2)	23	1	0
A(H3N2) by PCR	23	1	0
A/Hong Kong/4801/2014 (H3N2) - like	0	0	0
Influenza B	7	0	1
B (lineage not determined)	4	0	0
B/Yamagata lineage	2	0	1
B/Yamagata lineage by PCR	1	0	1
B/Phuket/3073/2013 - like	1	0	0
B/Victoria lineage	1	0	0
B/Victoria lineage by PCR	0	0	0
B/Brisbane/60/2008 - like	1	0	0
Influenza and non-influenza co-detection (% +ve)	8 (7.7)	1 (16.7)	0 (0.0)

Non-influenza respiratory viruses	SARI		
	Cases (%)	ICU (%)	Deaths (%)
No. of specimens tested	314	12	2
No. of positive specimens (%)[1]	197 (62.7)	9 (75.0)	1 (50.0)
Respiratory syncytial virus (RSV)	111	3	0
Parainfluenza 1 (PIV1)	14	1	0
Parainfluenza 2 (PIV2)	1	0	0
Parainfluenza 3 (PIV3)	2	0	0
Rhinovirus (RV)	54	5	1
Adenovirus (AdV)	25	4	0
Human metapneumovirus (hMPV)	16	1	0
Enterovirus	4	0	0
Single virus detection (% of positives)	172 (87.3)	5 (55.6)	1 (100.0)
Multiple virus detection (% of positives)	25 (12.7)	4 (44.4)	0 (0.0)

[1]Number of specimens positive for at least one of the listed viruses; note a specimen may be positive for more than one virus

The temporal distribution of the number and proportion of the influenza viruses and non-influenza respiratory viruses is shown in Figure 11 and Figure 12. Influenza A(H3N2) was the predominant strain during 2 May–4 September 2016.

Figure 11. Temporal distribution of the number and proportion of influenza viruses from SARI specimens, 2 May – 4 September 2016, by type and week

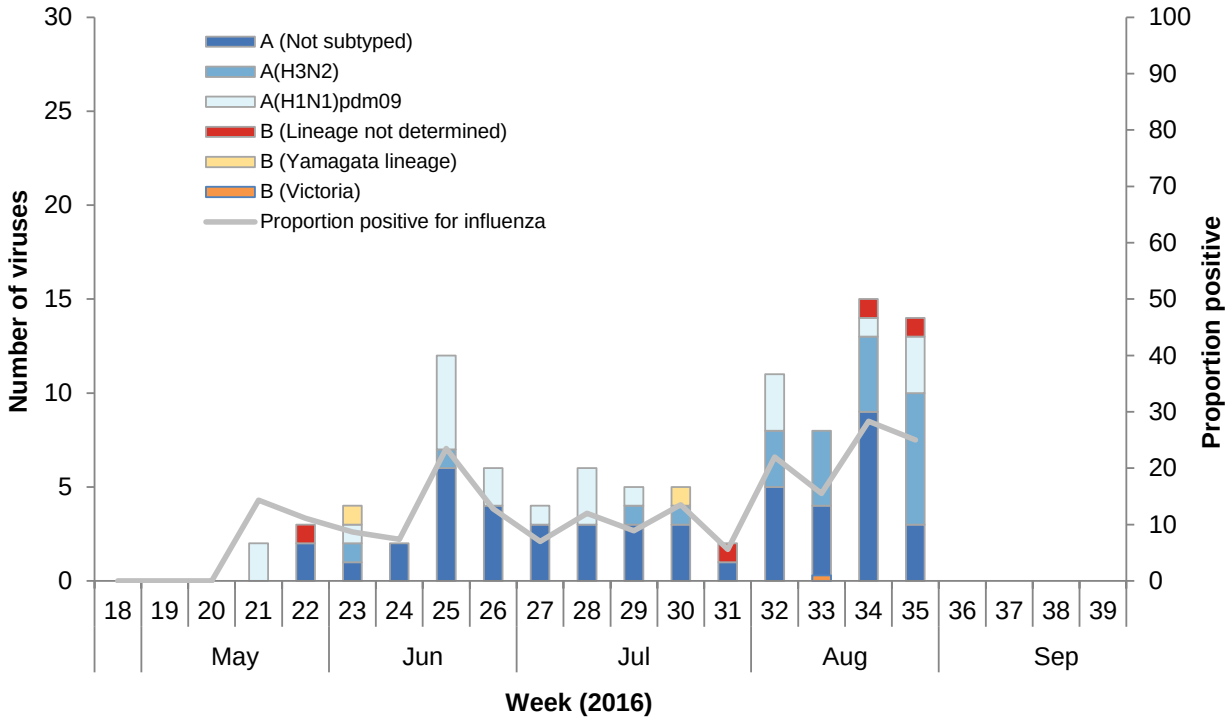
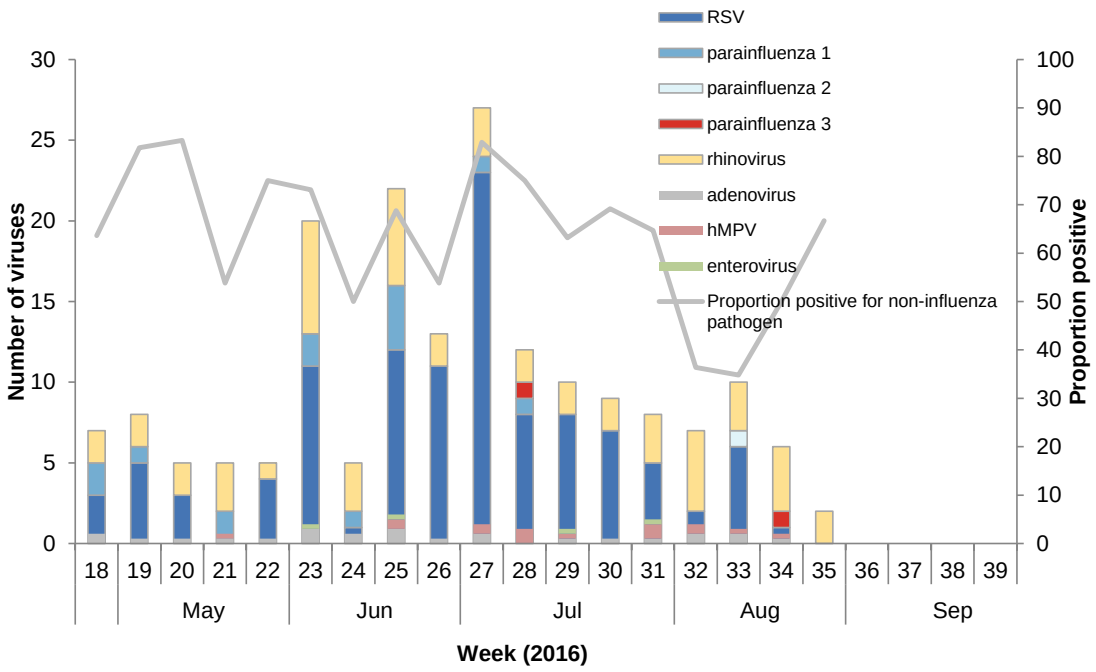


Figure 12. Temporal distribution of the number and proportion of non-influenza viruses from SARI specimens, 2 May – 4 September 2016, by type and week

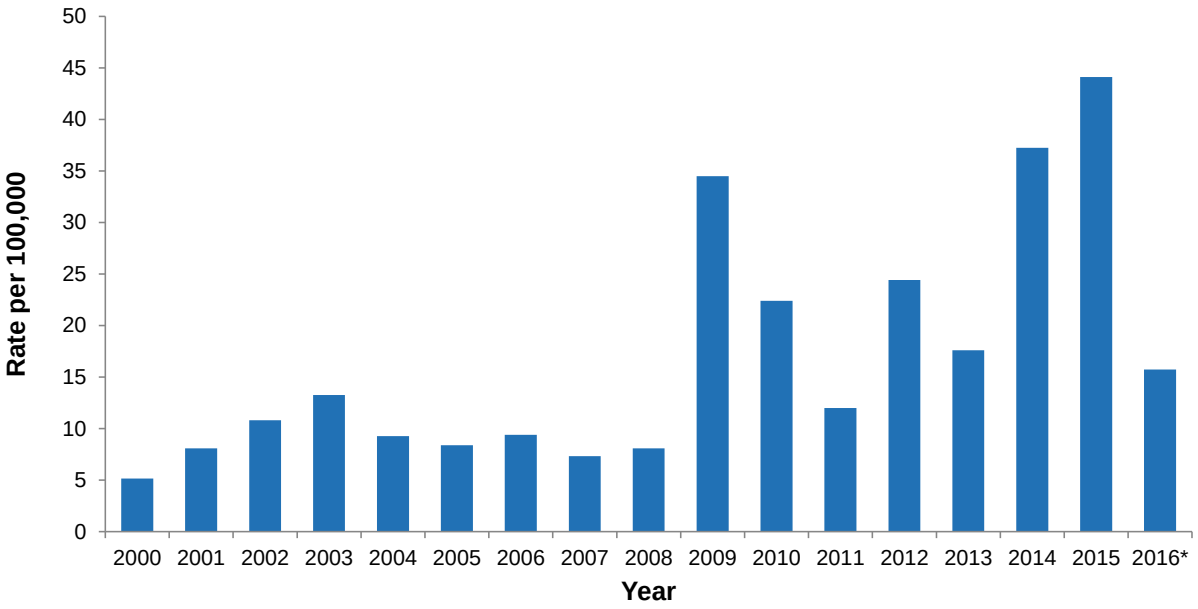


2.2.2 Ministry of Health data on publicly funded hospital discharges

Hospitalisation data for influenza (ICD-10AM-VI code I (J09-J11) for 2016 which correlate with previous versions of ICD-10AM codes J10-J11, were extracted from the New Zealand Ministry of Health's NMDS (by discharge date). In this dataset, people who received less than 1 day of hospital treatment in hospital emergency departments were excluded from any time series analysis of influenza hospitalisations during 2000–2016. Influenza-related hospitalisations were conservatively taken to include only those cases where influenza was the principal diagnosis. Repeat admissions were included, as infections with another influenza A subtype or B virus are possible.

From 1 January to 7 September 2016, there were a total of 723 hospitalisations for influenza (Figure 13). Influenza hospitalisation coding has not been completed for the year. This data only captured a proportion of influenza cases for the winter season of 2016.

Figure 13. Influenza hospital discharges, 2000–2016*

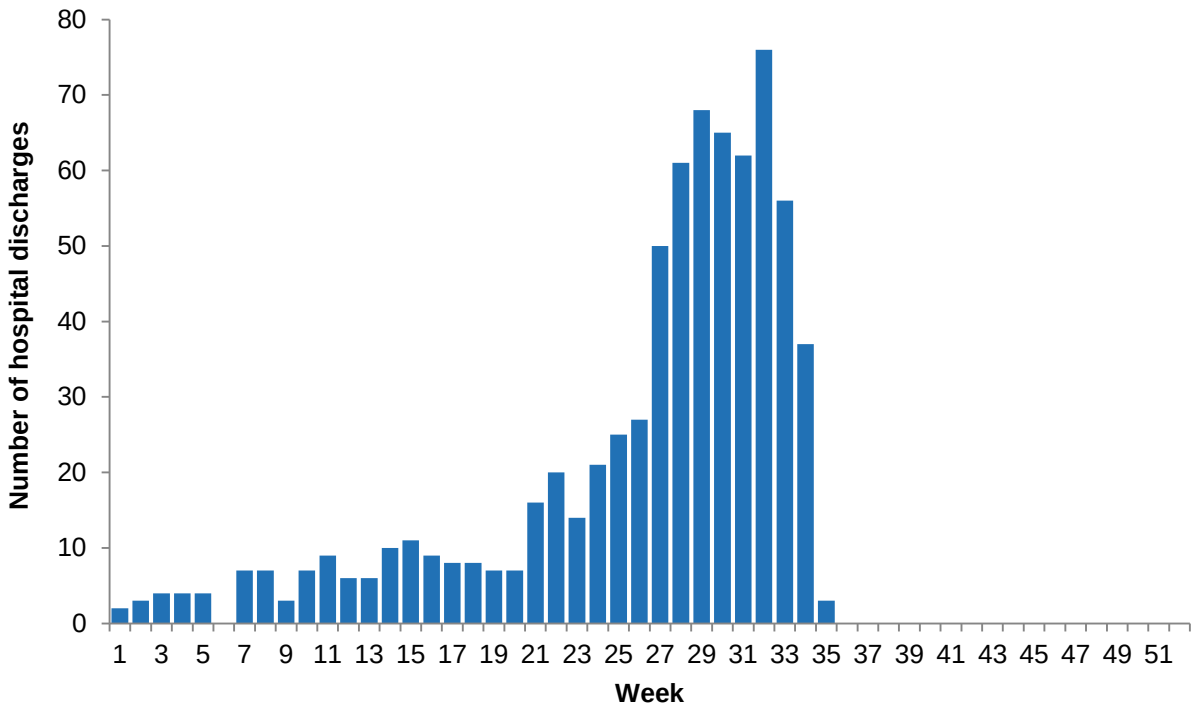


*Data from 1 Jan to 7 September only.

Source: Ministry of Health, NMDS (Hospital Events)

Figure 14 shows influenza hospitalisations by week discharged. The high number of hospitalisations (253) occurred in July (week 27–30).

Figure 14. Influenza hospital discharges by week, 2016*

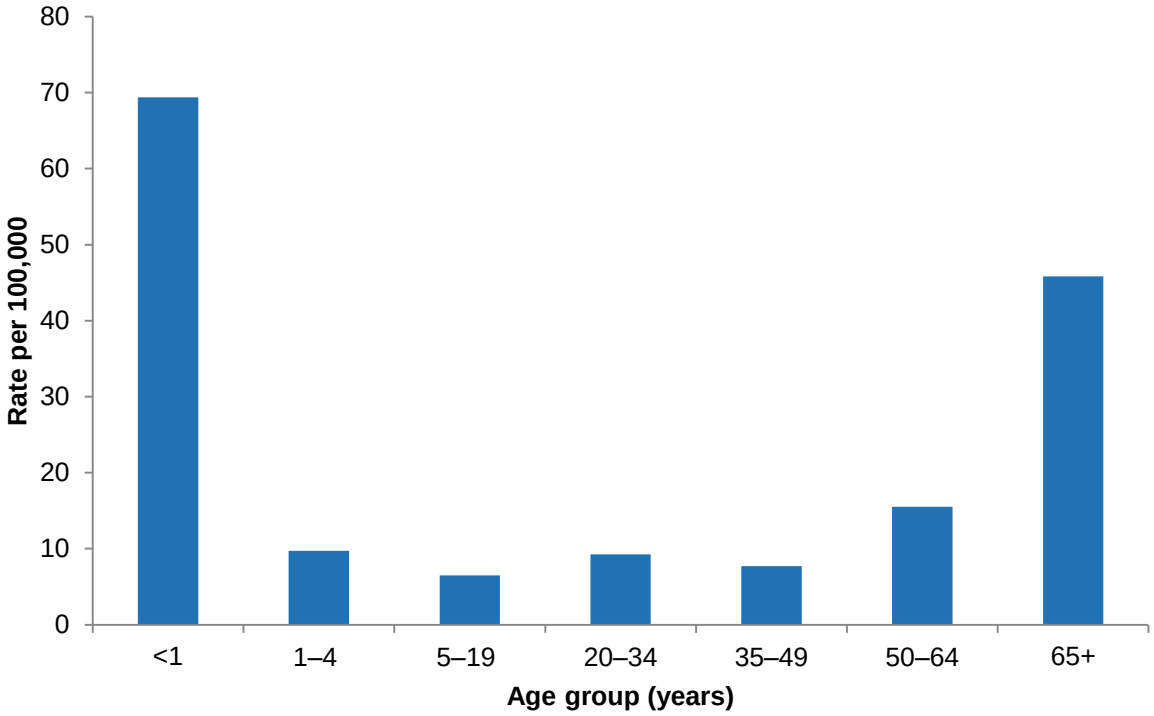


*Data from 1 Jan to 7 September only.

Source: Ministry of Health, NMDS (Hospital Events)

From 1 January to 7 September 2016, the highest influenza hospitalisation rates were recorded among young infants aged less than one year old (Figure 15), with rates of 69.4 per 100,000 age group population. This was followed by ≥65 years (45.8 per 100,000) and 50–64 years old (15.5 per 100,000).

Figure 15. Influenza hospital discharge rates by age group, 2016*



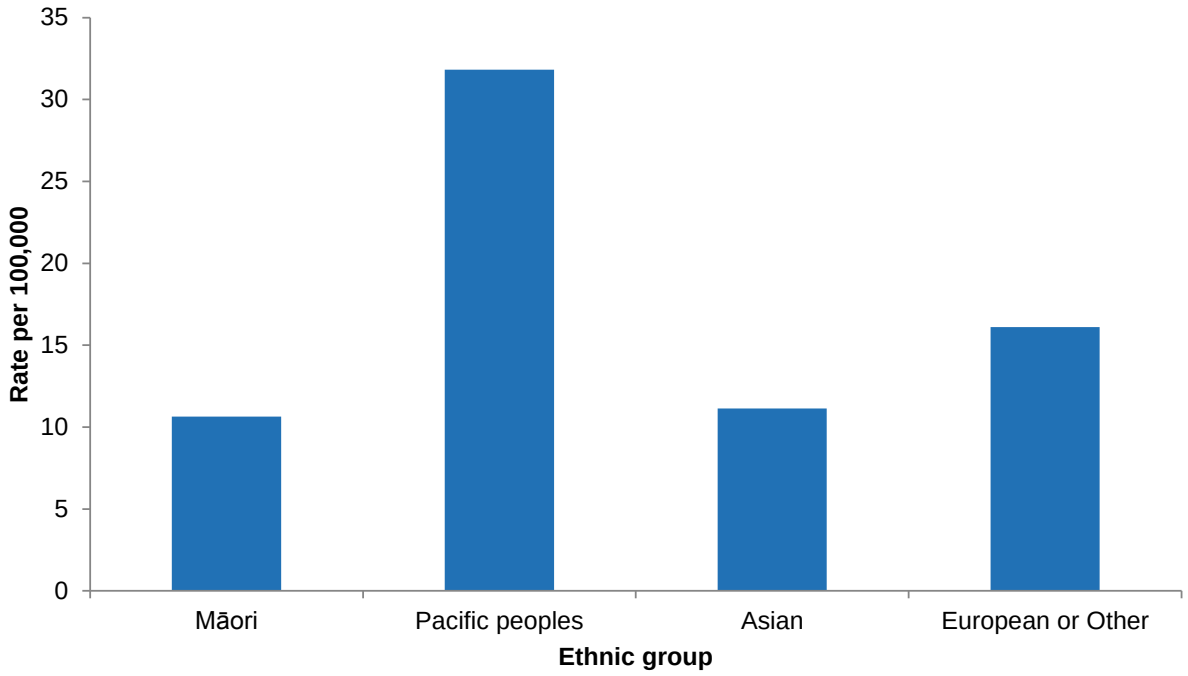
*Data from 1 Jan to 2 September only.

Source: Ministry of Health, NMDS (Hospital Events)

The ethnic distribution of influenza hospitalisations in 2016 is shown in Figure 16.

Pacific peoples had the highest hospitalisation rate (31.8 per 100,000, 90 hospitalisations) followed by European or Other (16.1 per 100,000, 499 hospitalisations). Maori (10.6 per 100,000, 73 hospitalisations) and Asian (11.1 per 100,000 populations, 58 hospitalisations) ethnic groups had the lowest rate of hospitalisations.

Figure 16. Hospital discharge rates by prioritised ethnic group, 2016*



*Data from 1 Jan to 2 September only.

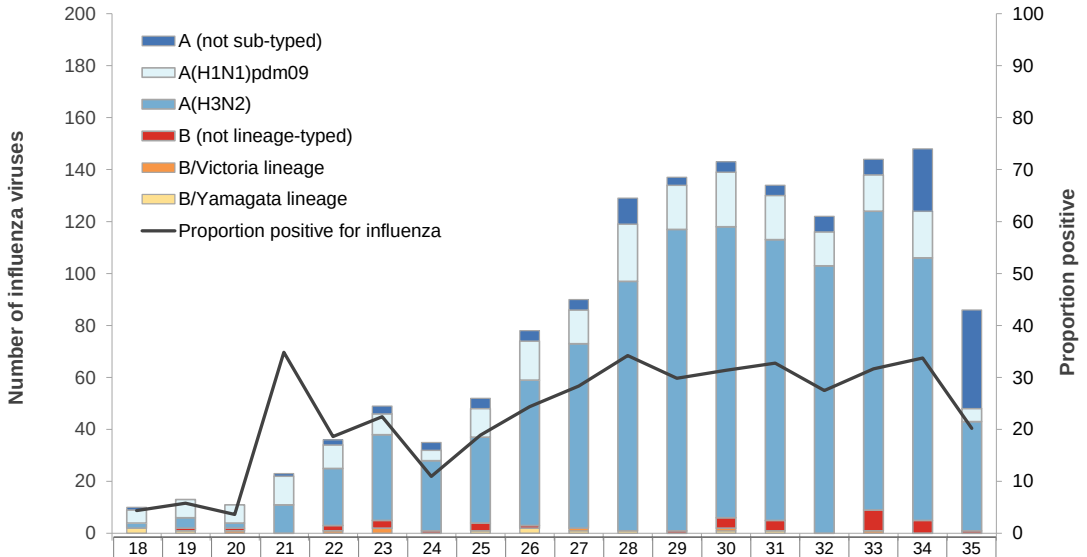
Source: Ministry of Health, NMDS (Hospital Events)

2.2.3 Laboratory-based non-sentinel surveillance – for outpatients and inpatients

Non-sentinel laboratory surveillance is conducted by the New Zealand virus laboratory network consisting of the National Influenza Centre at ESR and six hospital virology laboratories in Auckland, Waikato, Bay of Plenty, Wellington, Christchurch and Dunedin. ESR collates year-round national laboratory data on influenza from mainly hospital in-patient and outpatients during routine viral diagnosis.

A total of 8412 non-sentinel swabs were received during 1 January to 4 September 2016. Among them, 1567 influenza viruses were identified. This gave an overall detection rate of 18.6%. Among all sub-typed and lineage-typed influenza viruses, the predominant strain was influenza A(H3N2) (1067) including 56 A/Hong Kong/4801/2014 (H3N2), followed by A(H1N1)pdm09 (284) including 34 A/California/7/2009 (H1N1)-like viruses. B/Yamagata lineage (13) including 11 B/Phuket/3073/2013, B/Victoria lineage (10) including 9 B/Brisbane/60/2008-like. There were 131 A (not sub-typed) and 62 B (not lineage-typed) Figure 17). Note: one laboratory did not provide the number of swabs tested.

Figure 17. Number of influenza viruses reported by type and week from non-sentinel surveillance for weeks 18–35 in 2016



	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
A (not sub-typed)	1	0	0	1	2	3	3	4	4	4	10	3	4	4	6	6	24	38
A(H1N1)pdm09	5	7	7	11	9	8	4	11	15	13	22	17	21	17	13	14	18	5
A(H3N2)	2	4	2	11	22	33	27	33	56	71	96	116	112	108	103	115	101	42
B (not lineage-typed)	0	1	1	0	2	3	1	3	1	0	0	1	4	4	0	8	5	1
B/Victoria lineage	0	0	1	0	1	2	0	0	0	1	0	0	1	0	0	1	0	0
B/Yamagata lineage	2	1	0	0	0	0	0	1	2	1	1	0	1	1	0	0	0	0

*data shown is from week 18 only.

3. NEW ZEALAND STRAIN CHARACTERISATIONS

3.1 CIRCULATING STRAINS IN 2016

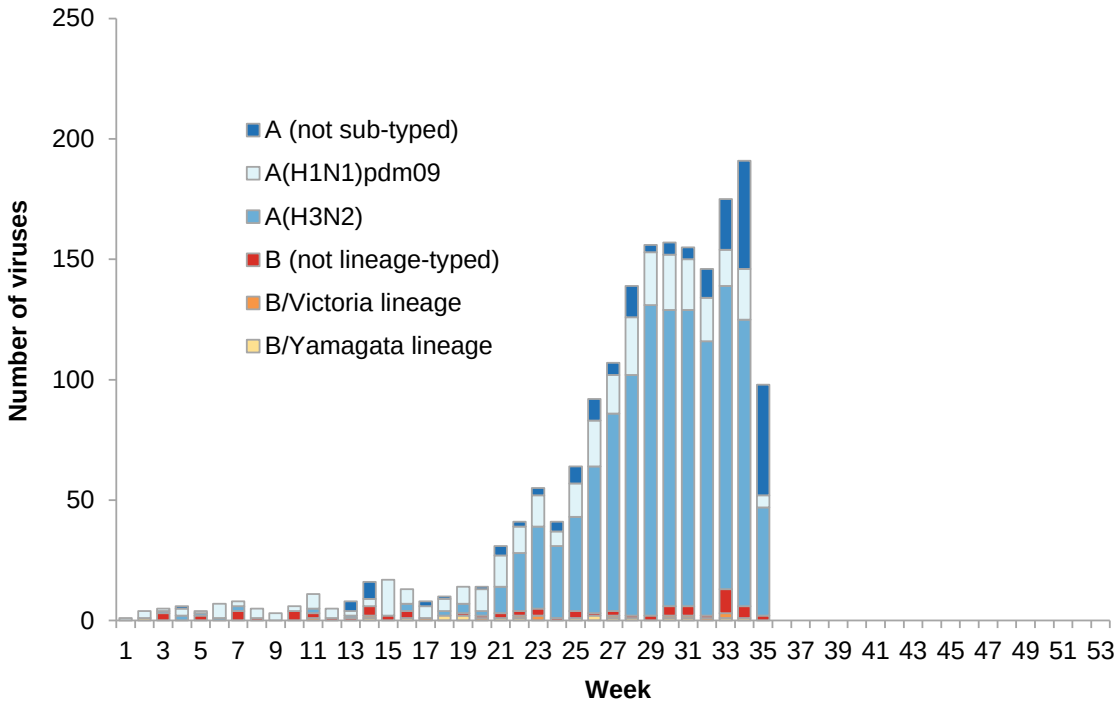
A total of 1813 influenza viruses were detected and reported through any surveillance system in 2016, with influenza A representing 94.3% (1710) and influenza B 5.7% (103) of all influenza viruses (Table 8). Among A sub-typed, 78.2% (1181/1510) were A(H3N2) virus and 21.8% (329/1510) were A(H1N1) virus. Among B lineage-typed, 58.1 % (18/31) were of Yamagata and 41.9% (13/31) Victoria.

Table 8. Influenza viruses by type and subtype for weeks 1–35, 2016

Viruses	All viruses (%)	Sub-typed and lineage-typed (%)
Influenza A	**1710 (94.3)**	**1510**
Influenza A (not sub-typed)	**200 (11.0)**	
Influenza A(H1N1)pdm09	**329 (18.1)**	**329**
A(H1N1)pdm09 by PCR	291 (16.1)	291 (88.4)
A/California/7/2009 (H1N1)-like	38 (2.1)	38 (11.6)
Influenza A(H3N2)	**1181 (65.1)**	**1181**
A(H3N2) by PCR	1109 (61.2)	1109 (93.9)
A/Hong Kong/4801/201 (H3N2)-like	72 (4.0)	72 (6.1)
Influenza B	**103 (5.7)**	**31**
Influenza B (not lineage-typed)	**72 (4.0)**	
B/Yamagata lineage	**18 (1.0)**	**18**
B/Yamagata lineage by PCR	6 (0.3)	6 (33.3)
B/Phuket/3073/2013-like	12 (0.7)	12 (66.7)
B/Victoria lineage	**13 (0.7)**	**13**
B/Brisbane/60/2008-like	10 (0.6)	10 (76.9)
B/Victoria lineage by PCR	3 (0.2)	3 (23.1)
Total	**1813 (100)**	**1541**

Figure 18 shows the influenza virus identifications by type and sub-type for each week throughout 2015. A(H3N2) was the predominant type throughout the season.

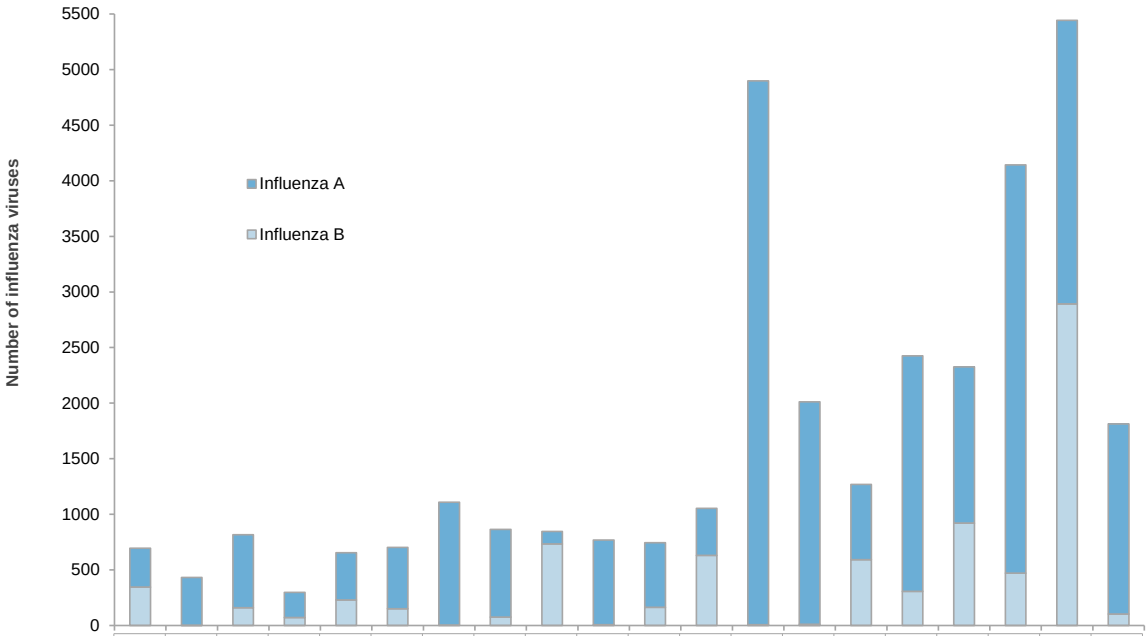
Figure 18. Total influenza viruses by type and week reported for weeks 1–35, 2016



3.2 PREDOMINANT STRAINS DURING 1997–2016

Figure 19 shows the number and percentage of typed influenza viruses from 1997 to 2016. Influenza A is the most frequent predominant influenza type. Of 20 influenza seasons during 1997–2016, influenza A predominated in 16 seasons whereas influenza B only predominated in three seasons (2005, 2008 and 2015). There was one season (1997) with equal proportion of influenza A and B circulation.

Figure 19. Influenza viruses by type, 1997–2016

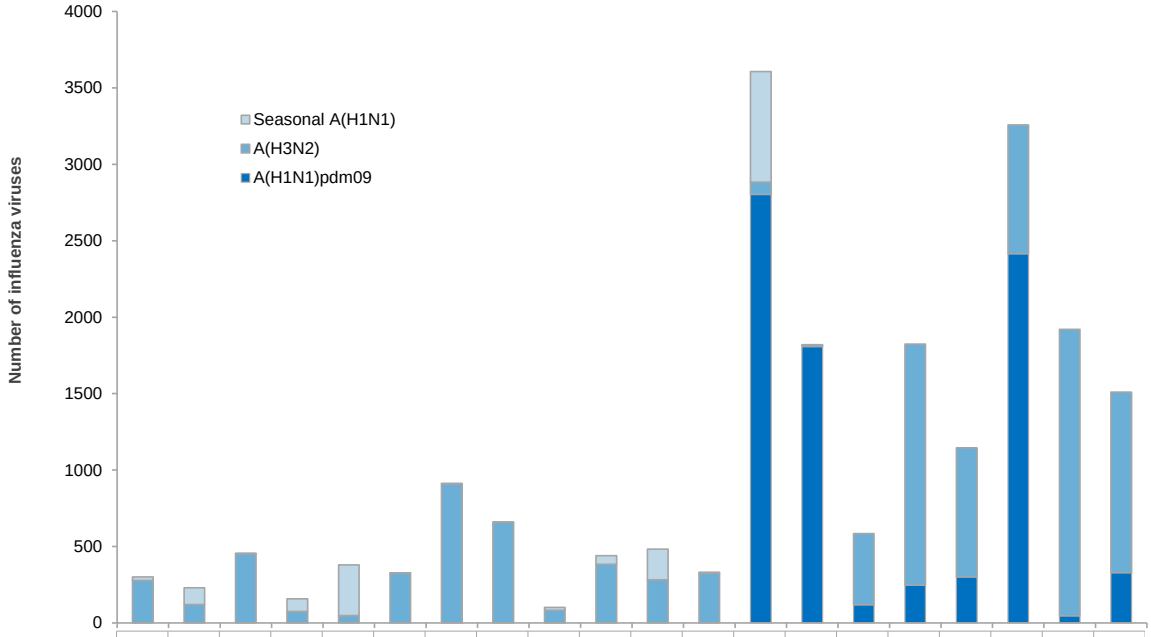


	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Influenza A (%)	50	100	80	76	65	78	100	91	13	99	78	40	100	100	53	87	60	89	47	94
Influenza B (%)	50	0	20	24	35	22	0	9	87	1	22	60	0	0	47	13	40	11	53	6

Figure 20 shows the number and percentage of all sub-typed influenza A viruses from 1997 to 2016 (excluding influenza A not sub-typed). Overall, the patterns of the predominant influenza A subtypes among all sub-typed A viruses during 1997–2016 are described below:

- Influenza A(H3N2) strain predominated for 15 seasons (1997, 1998, 1999, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2011, 2012, 2013, 2015 and 2016). A/Fujian/411/02 (H3N2)-like strain predominated in 2003 with the highest recorded hospitalisations for the period 1990–2008.
- Influenza A(H1N1)pdm09 strain has become the predominant strain for three seasons in 2009, 2010 and 2014.
- Seasonal influenza A(H1N1) strain predominated in two seasons (2000 and 2001) with associated relatively low hospitalisations (228 in 2000 and 379 in 2001). It has not been detected in New Zealand since 2010.

Figure 20. Influenza A viruses by subtypes 1997–2016



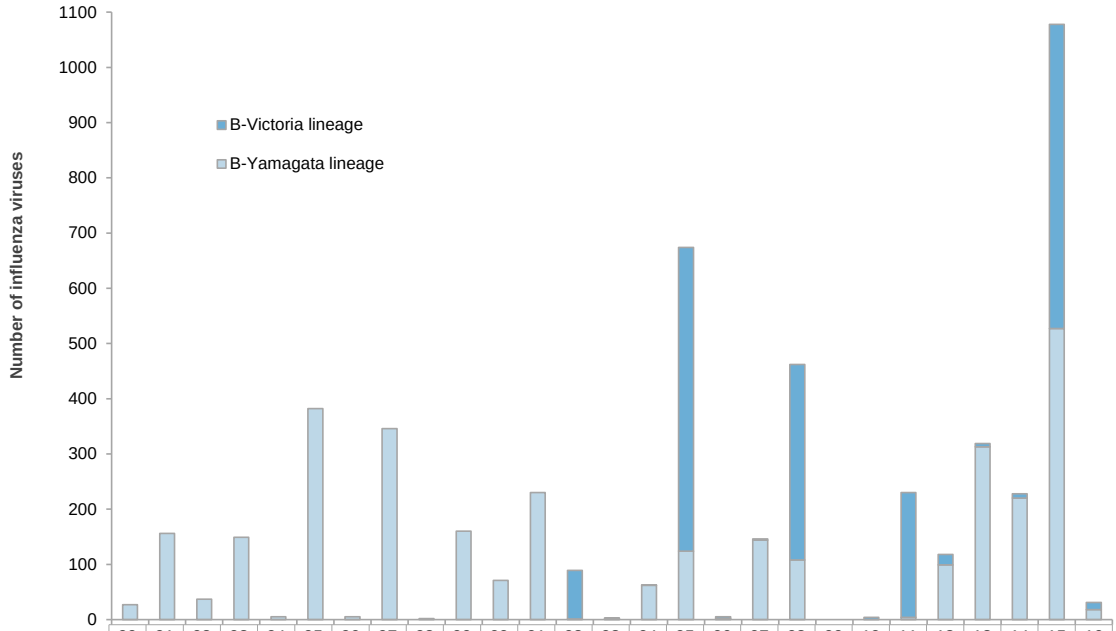
	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Seasonal A(H1N1)	8	48	0	52	87	1	0	0	18	13	42	2	20	0	0	0	0	0	0	0
A(H3N2)	92	52	100	48	13	99	100	100	82	87	58	98	2	1	80	86	74	26	98	78
A(H1N1)pdm09	0	0	0	0	0	0	0	0	0	0	0	0	78	99	20	14	26	74	2	22

* The data of influenza A not sub-typed was excluded from this graph.

Figure 21 shows the number and percentage of all B viruses from 1990 to 2016 (excluding influenza B not lineage-typed). Overall, the patterns of the predominant influenza B among all lineage-typed B viruses during 1990–2016 are described below:

- Influenza B/Yamagata lineage was the only lineage circulating in New Zealand during 1990–2001. Relatively high number of influenza B viruses were recorded in 1995 and 1997.
- Since the introduction of the B/Victoria lineage viruses into New Zealand in 2002, this lineage has co-circulated with B/Yamagata lineage viruses. During 2002–2011, B/Victoria lineage viruses predominated over the B/Yamagata lineage viruses in every three years in New Zealand (2002, 2005, 2008 and 2011). In 2005, the disease burden was high in children aged 5–19 years with associated deaths in 3 children.
- B/Yamagata lineage viruses was the predominant lineage over B/Victoria lineage virus during 2012–2014 and 2016.
- In 2015, there were almost equal proportions of B/Yamagata and B/Victoria lineage viruses.

Figure 21. Influenza B viruses by lineages, 1990–2016



	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
B/Victoria lineage (%)	0	0	0	0	0	0	0	0	0	0	0	0	99	33	2	82	60	1	77	0	100	98	16	2	4	51	42
B/Yamagata lineage (%)	100	100	100	100	100	100	100	100	100	100	100	100	1	67	98	18	40	99	23	0	0	2	84	98	96	49	58

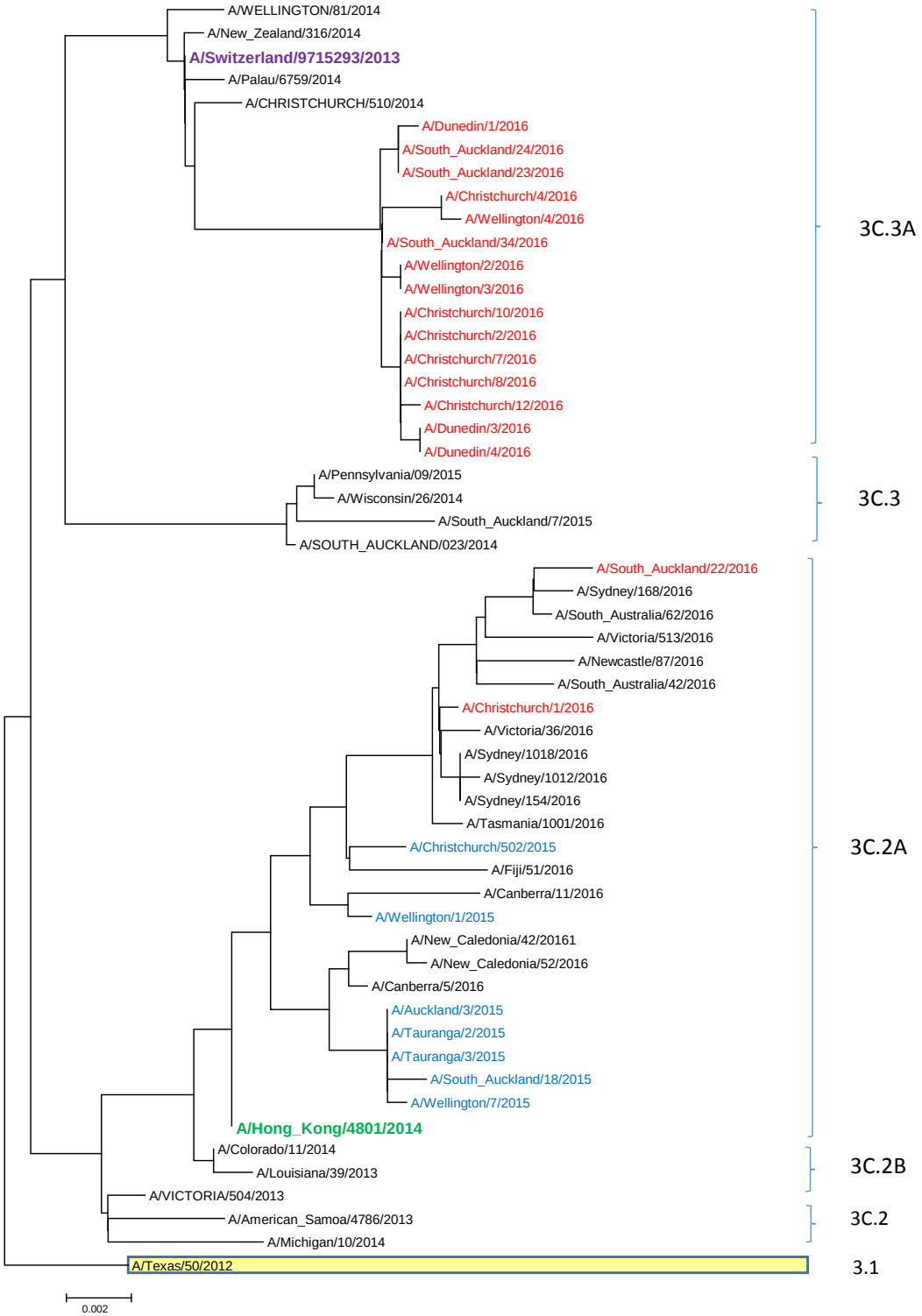
3.3 INFLUENZA A(H1N1)PDM09

Representative of influenza A(H1N1)pdm09 isolates were antigenically typed at the WHO National Influenza Centre at ESR using rabbit antisera supplied by the WHO Collaborating Centre (WHOCC) in Melbourne. Some of these isolates were also sent to WHOCC-Melbourne and CDC-Atlanta. During 1 January to 15 September 2016, a total of 8 influenza A(H1N1)pdm09 isolates were antigenically typed using antisera against A/California/7/2009 (H1N1)pdm09-like virus. Of them, 5 (62.5%, 5/8) were antigenically related to the reference strain A/California/7/2009 (H1N1)pdm09 and 3 (37.5%, 3/8) had reduced reactivity against the same reference strain.

3.4 SEASONAL INFLUENZA A(H3N2)

Representative seasonal influenza A(H3N2) isolates were antigenically typed at the WHO National Influenza Centre at ESR using HAI typing kit supplied by the WHO Collaborating Centre (WHOCC) in Melbourne. Some of these isolates were also sent to WHOCC-Melbourne and CDC-Atlanta. During 1 January to 15 September 2016, a total 135 influenza A(H3N2) isolates were antigenically typed using antisera against A/Hong Kong/480/2014 (H3N2). 109 (81%, 109/135) were antigenically related to the reference strain A/Hong Kong/480/2014. Genetically, most of NZ influenza A(H3N2) viruses in 2016 fell into group 3C.3a (CDC designations)

Figure 22. Phylogenetic relationships among influenza A(H3N2) haemagglutinin genes



Legend

New Zealand 2016 viruses

New Zealand 2015 viruses

Vaccine strain 2016 Southern Hemisphere

Vaccine strain 2015 Southern Hemisphere

3.5 INFLUENZA B

Representative influenza B/Yamagata lineage isolates and B/Victoria lineage isolates were antigenically typed at the WHO National Influenza Centre at ESR using HAI typing kit supplied by the WHO Collaborating Centre (WHOCC) in Melbourne. Some of these isolates were also sent to WHOCC-Melbourne and CDC-Atlanta.

During 1 January to 15 September 2016, a total of 13 B/Yamagata lineages isolates were antigenically typed using antisera against B/Phuket/3073/2013-like virus. Of them, 8 (61.5%, 8/13) were antigenically related to the reference strain B/Phuket/3073/2013. In addition, a total of 17 B/Victoria lineage isolates were antigenically typed using antisera against B/Brisbane/60/2008-like virus. Of them, 16 (94.1%, 16/17) were antigenically related to the reference strain B/Brisbane/60/2008.

3.6 OSELTAMIVIR RESISTANCE

The WHO National Influenza Centre at ESR employed a phenotypic method (fluorometric neuraminidase inhibition assay) for the surveillance of anti-viral drug resistance in influenza viruses. In addition, NIC at ESR employed a molecular method (PCR and sequencing) to monitor the H275Y mutation (histidine-to-tyrosine mutation at the codon of 275 in N1 numbering) which is known to confer resistance to oseltamivir.

In 2016, fluorometric neuraminidase inhibition assay was used to test a total of 85 influenza viruses against oseltamivir and zanamivir. All viruses were sensitive to both oseltamivir and zanamivir (Table 9 and Table 10).

Table 9. Antiviral susceptibility to oseltamivir for influenza viruses, 2006–2016

Influenza	NA inhibition to Oseltamivir*	Fold change in IC50 of test viruses (No. of viruses)**			
		2013	2014	2015	2016
A(H1N1)pdm09	Normal	0-4 (75)	0-9 (665)	0-2 (12)	0-2 (48)
	Reduced	-	35 (1)	-	-
	Highly reduced	-	356 (1)	-	-
A(H3N2)	Normal	0-3 (321)	0-8 (164)	0-5 (110)	0-2 (93)
	Reduced	-	-	-	-
	Highly reduced	-	-	-	-
Influenza B	Normal	0-4 (316)	0-4 (167)	0-5 (730)	0-2 (30)
	Reduced	-	-	-	-
	Highly reduced	-	-	-	-

*Neuraminidase inhibition was defined as normal inhibition, reduced inhibition and highly reduced inhibition:

Normal inhibition = IC_{50} values which are within or close to the median IC_{50} of the type/subtype matched viruses as detailed in the table above.

Reduced inhibition = IC_{50} values which are 10 to 100 fold above the median value of viruses with normal inhibition (5 to 50 fold for influenza B viruses)

Highly reduced inhibition = IC_{50} values which are greater than 100 fold above the median value of viruses with normal inhibition (above 50 fold for influenza B viruses)

**Fold change determined by dividing IC50 of test viruses by median IC50 for virus type/subtype

Table 10. Antiviral susceptibility to zanamivir for influenza viruses, 2013–2016

Influenza	NA inhibition to Zanamivir*	Fold change in IC50 of test viruses (No. of viruses)**			
		2013	2014	2015	2016
A(H1N1)pdm09	Normal	0-6 (72)	0-6 (671)	0-2 (12)	0-3 (48)
	Reduced	-	-	-	-
	Highly reduced	-	-	-	-
A(H3N2)	Normal	0-5 (324)	0-7 (157)	0-4 (110)	0-3 (93)
	Reduced	-	-	-	-
	Highly reduced	-	-	-	-
Influenza B	Normal	0-5 (313)	0-5 (168)	0-4 (735)	0-2 (30)
	Reduced	-	-	-	-
	Highly reduced	-	-	-	-

*Neuraminidase inhibition was defined as normal inhibition, reduced inhibition and highly reduced inhibition:

Normal inhibition = IC_{50} values which are within or close to the median IC_{50} of the type/subtype matched viruses as detailed in the table above.

Reduced inhibition = IC_{50} values which are 10 to 100 fold above the median value of viruses with normal inhibition (5 to 50 fold for influenza B viruses)

Highly reduced inhibition = IC_{50} values which are greater than 100 fold above the median value of viruses with normal inhibition (above 50 fold for influenza B viruses)

**Fold change determined by dividing IC50 of test viruses by median IC50 for virus type/subtype

4. INFLUENZA VACCINE EFFECTIVENESS

The SHIVERS study allowed the estimation of vaccine effectiveness (VE) against influenza illness requiring hospitalisation since 2012 and against influenza illness requiring primary care (general practice) since 2013 and VE estimates have been reported [1,2].

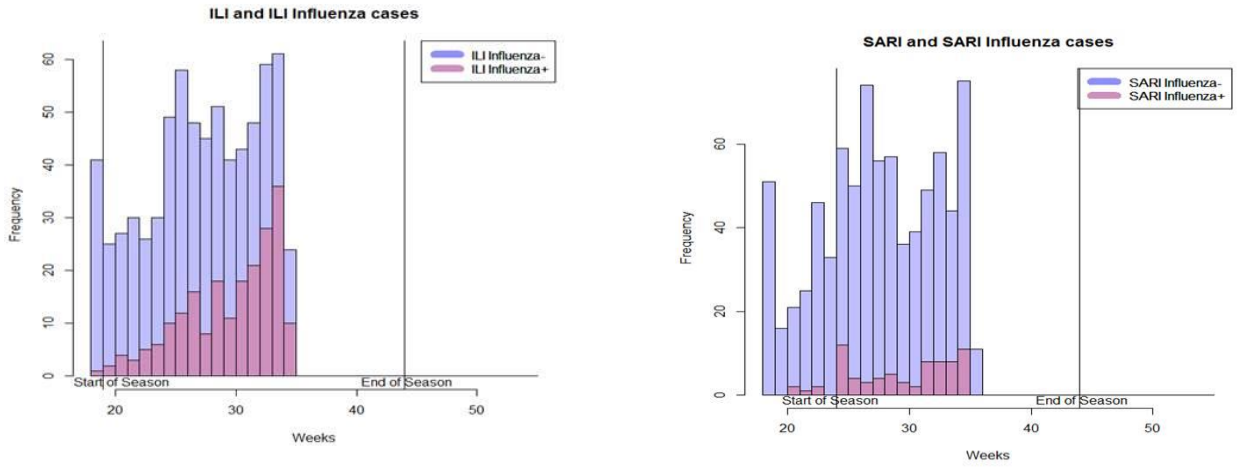
In New Zealand seasonal trivalent influenza vaccine is offered annually free of charge to all adults aged 65 years and over, pregnant women and all those over six months of age with chronic medical conditions that are likely to increase the severity of the infection. Since 2013, free influenza vaccines have been offered to children (6-months to 4-years) who have been hospitalised or have a history of significant respiratory illness. Influenza vaccines are also available on the private market for all others over six months of age. The influenza season usually occurs between March and September.

Using the case test-negative design to estimate propensity-adjusted VE as previously described [2], we estimated the effectiveness of seasonal trivalent inactivated influenza vaccine in preventing laboratory-confirmed influenza in patients hospitalised with severe acute respiratory infections (SARI) and in patients presenting to general practice with an influenza-like illness (ILI) during the influenza season. The influenza season was defined as starting when there were two consecutive weeks with two or more cases; The data is contributed to I-GIVE project for the WHO vaccine strain selection meeting in September for southern hemisphere countries.

Most ILI and SARI patients with laboratory-confirmed influenza are included except those with incomplete data for vaccination status, infants under 6 months of age, children under 9 years who were only given one dose of vaccine, those vaccinated less than 14 days before admission or presentation. For patients with multiple episodes, the first influenza virus-positive episode was used for the analysis or the first illness episode if there was no influenza virus-positive episode.

Temporal distribution of ILI and SARI cases and associated influenza cases is shown in Figure 23.

Figure 23. Number of Influenza-like illness and severe acute respiratory infection cases and associated influenza positive by calendar week, New Zealand, 2016 influenza season



VACCINE EFFECTIVENESS

The proportion vaccinated did not change throughout the season. For influenza-confirmed ILI cases, after adjustment for age, week of presentation and any underlying health condition, the estimated VE was 23% (95% CI: -24 to 52). For influenza-confirmed SARI cases, after adjustment for age, week of admission and any underlying health condition, the estimated VE was 12% (95% CI: -122 to 65) (Table 11).

Table 11. Estimated influenza vaccine effectiveness, by participant age group and by influenza virus type and subtype: crude and propensity adjusted models, New Zealand, 2016 influenza season

Age	Influenza positive			Influenza negative			Unadjusted			Adjusted		
group &	Vaccinated	Total	%	Vaccinated	Total	%	VE%	LCL	UCL	VE%	LCL	UCL
ILI												
Overall	36	205	18	101	426	24	36	0	58	23	-24	52
6m to 17y	5	53	9	14	123	11	19	-138	72	NA	NA	NA
18 to 44y	15	108	14	31	177	18	24	-48	61	24	-48	61
45 to 64y	11	36	31	33	94	35	19	-86	64	19	-86	64
65 + y	5	8	62	23	32	72	NA	NA	NA	NA	NA	NA
18 to 64y	26	144	18	64	271	24	29	-19	57	29	-19	57
A	36	191	19	101	426	24	25	-14	51	16	-35	48
A(H1N1)	5	37	14	101	426	24	50	-32	81	57	-21	85
A(H3N2)	19	102	19	101	426	24	26	-27	57	5	-75	48
B	0	14	0	101	426	24	NA	NA	NA	NA	NA	NA
SARI												
Overall	16	38	42	68	197	35	-38	-180	32	12	-122	65
6m to 17y	1	14	7	12	102	12	NA	NA	NA	NA	NA	NA
18 to 44y	2	7	29	11	29	38	NA	NA	NA	NA	NA	NA
45 to 64y	3	6	50	12	27	44	NA	NA	NA	NA	NA	NA
65 + y	10	11	91	33	39	85	NA	NA	NA	NA	NA	NA
18 to 64y	5	13	38	23	56	41	NA	NA	NA	NA	NA	NA
A	15	37	41	68	197	35	NA	NA	NA	NA	NA	NA
A(H1N1)	2	11	18	68	197	35	NA	NA	NA	NA	NA	NA
A(H3N2)	5	5	100	68	197	35	NA	NA	NA	NA	NA	NA
B	1	1	100	68	197	35	NA	NA	NA	NA	NA	NA

*Adjusted for week in season, any underlying health condition and age

N/A: not applicable as numbers to too low to reach any significance when the confidence interval spanned more than 250; CI: Confidence interval; ILI: Influenza-like illness;

SARI: severe acute respiratory infections.

5. RECENT STRAIN CHARACTERISATION FOR SOUTHERN HEMISPHERE VIRUSES AND LIKELY VACCINE CANDIDATES

5.1. INFLUENZA A(H1N1)PDM09

The influenza A(H1N1)pdm09 virus was first detected in April 2009 in the United States and was responsible for outbreaks in Mexico in March and April 2009. Outbreaks subsequently occurred in all regions of the world and, by July 2009, influenza A(H1N1)pdm09 was the predominant influenza virus circulating in many countries in the Americas, Asia, Europe and Oceania.

During the 2016 influenza season, 783 A(H1N1)pdm09 viruses were received at the Melbourne WHOCC from 13 countries with most coming from Australia and New Zealand. The virology laboratories in New Zealand use the kit supplied by the Melbourne WHOCC to analyse influenza A(H1N1)pdm09 strains. The antiserum used for antigenic typing was the rabbit/sheep antisera raised against A/California/7/2009-like strain. Of the 8 A(H1N1)pdm09 isolates tested at ESR by hemagglutination inhibition assay during the period of 1 January to 15 September 2016, 5 (62.5%, 5/8) were antigenically closely related to the reference strain A/California/7/2009 (H1N1)pdm09.

Among all of the influenza A(H1N1)pdm09 viruses analysed at the Melbourne WHOCC, most of the viruses reacted well with ferret sera to A/California/7/2009, with only 3% of A(H1N1)pdm09 viruses being classified as low reactors (≥8-fold reduction compared with the homologous titre) (Figure 3.1, Tables 3.2 in Appendix 3). Many of these low reactors had changes in the HA gene in the 153-158 amino acid region which has been shown to reduce reactivity in HI assays but as these changes were mostly not in the original clinical samples. These mutations appear to be artefacts caused by isolation in MDCK cells or in eggs because these changes were NOT in the original clinical samples.

In addition, a total of 147 influenza A(H1N1)pdm09 viruses were sequenced in the HA gene. The sequence analysis indicated that most of viruses falling into genetic clade 6B.1 (90.5%) with small proportion of 6B.2 viruses (CDC designations, Figure 3.3 in Appendix 3). The NA (N1) genes of the A(H1N1)pdm09 viruses were also sequenced, resulting in groups similar to their HA grouping (Figure 3.4 in Appendix 3).

Furthermore, HI assays were used to measure the presence of antibodies to recent virus isolates in panels of sera from children, adults and older adults who received seasonal trivalent inactivated vaccines. HI assays with ferret antisera indicated that almost all recent A(H1N1)pdm09 viruses were antigenically indistinguishable from the vaccine virus A/California/7/2009. However, representative 6B.1 and 6B.2 viruses were poorly inhibited by some post-vaccination adult human serum pools. Geometric mean post-vaccination HI titres of paediatric sera against some representative 6B.1 and 6B.2 viruses were reduced significantly compared to HI titres to the vaccine virus A/California/7/2009, although this was not consistently observed for adult and older adult serum panels (WER 91(41), and Tables 3.5, 3.10, 3.11 & 3.12 in Appendix 3). (*Abridged from the Weekly Epidemiological Record, 2016 91(41):469-484 and a report to AIVC by Dr Ian Barr, WHO Collaborating Centre for Influenza, Melbourne)*

In summary, influenza A(H1N1)pdm09 viruses have replaced seasonal A(H1N1) viruses since 2009. Influenza A(H1N1)pdm09 viruses were associated with outbreaks in many countries. Influenza A(H1N1)pdm09 viruses were antigenically indistinguishable by post-infection ferret antisera but in studies with human post-vaccination sera representative 6B.1 and 6B.2 viruses were distinguishable from the vaccine virus A/California/7/2009. Based on all of the epidemiological, antigenic, genetic and serological data, the WHO consultation recommended vaccines containing a A/Michigan/45/2015 (H1N1)pdm09-like strain. The AIVC accepted this recommendation.

5.2. SEASONAL INFLUENZA A(H3N2)

Influenza A(H3N2) has frequently been associated with severe disease and excess mortality in high-risk groups. This subtype has also shown the greatest tendency for antigenic drift as illustrated by the frequency of vaccine formulation changes recommended by the WHO and AIVC (Table 1).

During the 2016 influenza season, 952 A(H3N2) viruses were received at the Melbourne WHOCC from 10 countries with most coming from Australia and New Zealand. The virology laboratories in New Zealand use the kit supplied by the Melbourne WHOCC to analyse influenza A(H3N2) strains. The antiserum used for antigenic typing was the rabbit/sheep antisera raised against A/Hong Kong/4801/2014-like strain. Of the 135 A(H3N2) isolates tested at ESR by hemagglutination inhibition assay during the period of 1 January to 15 September, 109 (81%, 109/135) were antigenically closely related to the reference strain A/Hong Kong/4801/2014.

A(H3N2) viruses have become increasingly difficult to test with the haemagglutination inhibition assay. Particular mutations or polymorphisms in the NA of recent H3N2 viruses appear to allow some level of binding to red blood cells (RBC), thus interfering with the inhibition of viruses between HA and RBC using post-infection ferret sera. To overcome this problem a number of WHOCCs have been performing their HI assays in the presence of 20nM oseltamivir carboxylate in order to prevent this NA binding. This appears to improve the discrimination between antigenically drifted vs not-drifted viruses. However, about 35% of these viruses have a drop in HA titre to a point whereby these viruses cannot be assayed by HI anymore. Alternatively virus neutralization assays such as the microneutralization or plaque reduction assays can be used where the NA binding is not relevant. In addition, a significant proportion of viruses (approximately 25%) have low or no HA titre with guinea pig RBC even though there is ample virus present (as detected by other methods).

Among all A(H3N2) isolates analysed with oseltamivir at the Melbourne WHOCC, most of the A(H3N2) viruses tested in this period reacted well with ferret sera raised to cell propagated A/Hong Kong/4801/2014 viruses, with only 8% of viruses tested at the Melbourne CC showing ≥8 fold reduction in HI titre compared to homologous titres. This figure rose substantially (to 47.6%) when a ≥4 fold reduction was used. Egg propagation is known to introduce additional changes in HA that can affect antigenicity. Such changes have been particularly problematic for recent A(H3N2) viruses. When ferret sera raised to egg grown A/Hong Kong/4801/2014 viruses were used, marked reductions in titres compared to the homologous titres were observed, with 49% of recent viruses showing ≥8 fold reduction and 86% fold reduction in HI titre (Figure 4.1, Tables 4.6 and 4.9 in Appendix 4).

In addition, a total of 402 influenza A(H3N2) viruses were sequenced in the HA gene. The phylogenetic analysis of the influenza A(H3N2) viruses showed that all viruses fell into clade 3C. Viruses could be further distinguished into sub-clades 3C3a, 3C2a with no 3C3b viruses detected (CDC designations, Figure 4.2 in Appendix 4). The majority of viruses sequenced in this period fell into sub-clade 3C2a (84%) with a small proportion in the 3C3a sub-clade including most viruses sequenced from New Zealand. Sequence analysis of the N2 NA gene analysed showed that the most recent viruses grouped in a similar manner as their HA genes (Figure 4.3 in Appendix 4).

Furthermore, human serology studies were performed using serum panels from adults and older adults who had received seasonal quadrivalent inactivated vaccines with the composition recommended for the southern hemisphere 2016 season (A/California/7/2009 (H1N1)pdm09-like, A/Hong Kong/4801/2014 (H3N2)-like, B/Brisbane/60/2008- like and B/Phuket/3073/2013-like antigens). Geometric mean HI titres of antibodies against representative recent A(H3N2) viruses were somewhat reduced compared to HI titres against the cell-propagated vaccine virus. In microneutralisation tests with a subset of serum panels and viruses, geometric mean titres of antibodies against recent representative A(H3N2) viruses were similar to those against the cell-propagated vaccine virus. (WER 91(41), and Tables 4.13, 4.14, 4.15 and 4.16 in Appendix 4). (*Abridged from the Weekly Epidemiological Record, 2016 91(41):469-484 and a report to AIVC by Dr Ian Barr, WHO Collaborating Centre for Influenza, Melbourne)*

In summary, influenza A(H3N2) viruses were associated with outbreaks in several countries. The majority of recent circulating viruses were antigenically related to cell-propagated 3C2a A/Hong Kong/4801/2014 – like virus. Based on all of the epidemiological, antigenic, genetic and serological data, the WHO Consultative Group recommended the H3 component of the vaccines containing an A/Hong Kong/4801/2014 - like strain. AIVC accepted this recommendation.

5.3. INFLUENZA B

Two distinct lines of influenza B have co-circulated in many countries during recent years. This dates from the late 1980s when the B/Panama/45/90 variant of influenza B was first observed. This strain and its further variants of the Yamagata/16/88 lineage (most recently representative strain-B/Phuket/3073/2013) spread worldwide, whereas strains of the previous B/Victoria/2/87-like viruses continued to circulate in Asia and subsequently underwent independent evolution as an antigenically distinct lineage (most recent representative strain-B/Brisbane/60/2008). For reasons not wholly understood, these remained geographically restricted to Asia until 2001. In 2002 the B/Victoria/2/87 lineage viruses were the predominant viruses worldwide.

Both recent B/Victoria-like strains (B/Brisbane/60/2008 is the current reference strain) and B/Yamagata-like strains (B/Phuket/3073/2013 is the current reference strain) continued to be isolated worldwide in 2015. B/Yamagata lineage viruses predominated in all countries reporting influenza B infections, however, more B/Victoria lineage viruses circulated in late winter season in New Zealand and Australia.

254 influenza B isolates were received in 2016 by the Melbourne WHOCC from 11 countries. The majority of isolates (139) were typed as B/Victoria lineage with the remaining being B/Yamagata-lineage viruses (105). When B/Victoria-lineage viruses were reacted with ferret sera raised against egg grown B/Brisbane/60/2008-like virus, most of viruses showed reduced reactivity (≥8-fold reduction compared with the homologous titre). However, when ferret serum raised to cell

propagated virus was used, no low reacting viruses were detected in HI assays (Figure 5.1 in Appendix 5). The B/Yamagata-lineage viruses could be distinguished antigenically between B/Massachusetts/2/2012-like and B/Phuket/3073/2013-like viruses (Figure 5.2 in Appendix 5). The majority of recent viruses were well covered by ferret sera raised to either cell or egg propagated B/Phuket/3073/2013-like viruses. HI assays in Tables 5.3, 5.5 (Appendix 5) were performed at the Melbourne WHOCC.

In addition, sequence analysis of the HA1 gene of recent isolates showed that recent isolates fell into one of the two major lineages of B viruses (B/Victoria/2/87 or B/Yamagata/16/88) consistent with their antigenic typing. The B/Victoria lineage viruses mostly grouped in the B/Brisbane/60/2008 group (all clade 1A) with signature amino acid changes at S172P, N75K, N165K. The NA sequence analysis from viruses with a B/Brisbane/60/2008-like HA showed the same groupings as their HA genes (Figures 5.4, and 5.5 in Appendix 5). B/Yamagata lineage fell into the B/Phuket/3073/2013-like virus, with the majority of viruses falling in clade 3. B/Yamagata lineage virus NA genes matched the HA genes falling into the same pattern as their HA did (Figures 5.6 and 5.7 in Appendix 5).

Furthermore, Human serology studies were performed using serum panels from adults and older adults who had received seasonal quadrivalent inactivated vaccines of the composition recommended for the northern hemisphere 2015-2016 season (A/California/7/2009 (H1N1) pdm09-like, A/Switzerland/9715293/2013 (H3N2)-like, B/Phuket/3073/2013-like and B/Brisbane/60/2008-like antigens) or for the southern hemisphere 2016 season (A/California/7/2009 (H1N1)pdm09-like, A/Hong Kong/4801/2014 (H3N2)-like, B/Brisbane/60/2008-like and B/Phuket/3073/2013-like antigens). Geometric mean HI titres of antibodies against some representative recent B/Victoria/2/87 lineage viruses were reduced compared to HI titres against the cell-propagated vaccine virus B/Brisbane/60/2008. When tested against representative recent B/Yamagata/16/88 lineage viruses, geometric mean HI titres were reduced for some viruses compared to HI titres against the egg-propagated vaccine virus B/Phuket/ 3073/2013. (WER 91(41), Tables 5.11, 5.12, 5.13, 5.17, 5.18 and 5.19 in Appendix 5). (*Abridged from the Weekly Epidemiological Record, 2016 91(41):469-484 and a report to AIVC by Dr Ian Barr, WHO Collaborating Centre for Influenza, Melbourne)*

In summary, influenza B viruses of the B/Victoria/2/87 and B/Yamagata/16/88 lineages co-circulated, with viruses of the B/Victoria lineage predominating in many countries. Most of B/Victoria lineage viruses were antigenically and genetically closely related to B/Brisbane/60/2008-like virus. The majority of recent B/Yamagata lineage viruses were antigenically and genetically closely related to B/Phuket/3073/2013-like virus. Based on all of the epidemiological, antigenic, genetic and serological data, the WHO Consultative Group recommended the B component of the trivalent vaccines containing a B/Victoria/2/87 lineage virus (B/Brisbane/60/2008-like virus). The AIVC accepted this recommendation.

6. SUMMARY OF VACCINE COMPOSITION RECOMMENDATION

It is recommended that the influenza vaccine formulation for New Zealand for 2017 is:

- A(H1N1) an A/Michigan/45/2015 (H1N1)pdm09 - like virus
- A(H3N2) an A/Hong Kong/4801/2014 (H3N2) - like virus
- B a B/Brisbane/60/2008 - like virus (belonging to B/Victoria lineage)

Quadrivalent vaccines contain the above three viruses and plus one more vaccine component:

- B a B/Phuket/3073/2013 - like virus (belonging to B/Yamagata lineage)

6.1. EXPLANATION OF "LIKE" STRAINS SUITABLE FOR INCLUSION IN VACCINE

In the past, some strains of influenza recommended for inclusion in the vaccine formulation have been unsuitable vaccine candidates due to their poor growth potential with resulting low yields or poor serological responses in vaccinees. Under the "like" strain concession in the vaccine recommendation, an antigenically similar strain can be substituted which has the qualities that are lacking in the prototype strain.

The AIVC considered the information about international surveillance by WHO, recent data from Australia, New Zealand, South Africa and Argentina on influenza epidemiology and virus strain characterisation, and the recommendations of the WHO annual consultation on the composition of influenza vaccine for the southern hemisphere. The AIVC agreed to adopt the WHO recommendations. The influenza vaccine components for year 2017 season should contain the following:

- **A (H1N1)**: an A/Michigan/45/2015 (H1N1)**-**like strain, 15 µg HA per dose
- **A (H3N2)**: an A/Hong Kong/4801/2014 (H3N2)-like strain, 15 µg HA per dose
- **B**: a B/Brisbane/60/2008**-**like strain, 15 µg HA per dose

It is recommended that quadrivalent vaccines containing two influenza B viruses include the above three viruses and a B/Phuket/3073/2013-like virus with 15 µg HA per dose

WHO is now listing all recommended candidate viruses and potency testing reagents for development and production of vaccines for use in specific influenza seasons at the following website: http://www.who.int/influenza/vaccines/virus/candidates_reagents/home/en/

APPENDIX 1 - COMPOSITION OF THE AUSTRALIAN INFLUENZA VACCINE COMMITTEE 2016

AIVC MEMBERS 2016

The details of the Australian Influenza Vaccine Committee Members can be accessed from the website below:

https://www.tga.gov.au/committee/australian-influenza-vaccine-committee-aivc

APPENDIX 2 – ISOLATES RECEIVED FOR ANALYSIS AT THE AUSTRALIAN WHO COLLABORATING CENTRE

Table 2.1. Influenza Viruses Analysed at the Melbourne WHO CC
1 February – 22 September 2016

Country	A(H1N1) pdm09	A(H3N2)	A Un-subtyped	B Yam	B Vic	TOTAL
Australia	538	738	163	63	52	**1554**
Cambodia	48	1	0	0	0	**49**
Fiji	25	31	0	1	6	**63**
Macau	17	0	0	0	4	**21**
Malaysia	1	0	1	1	9	**12**
New Caledonia	39	95	0	11	11	**156**
New Zealand	27	29	0	0	4	**60**
Philippines	4	2	0	1	2	**9**
Singapore	44	39	1	28	26	**138**
Solomon Islands	17	0	0	0	0	**17**
South Africa	4	10	0	0	13	**27**
Sri Lanka	12	4	6	0	5	**27**
Thailand	7	3	2	0	7	**19**
TOTAL	**783**	**952**	**173**	**105**	**139**	**2152**
%	**36.38%**	**44.24%**	**8.04%**	**4.88%**	**6.46%**	**100%**

APPENDIX 3 – INFLUENZA A(H1N1)PDM09

Figure 3.1. Antigenic cartographic representation of A(H1N1)pdm09 HI analysis

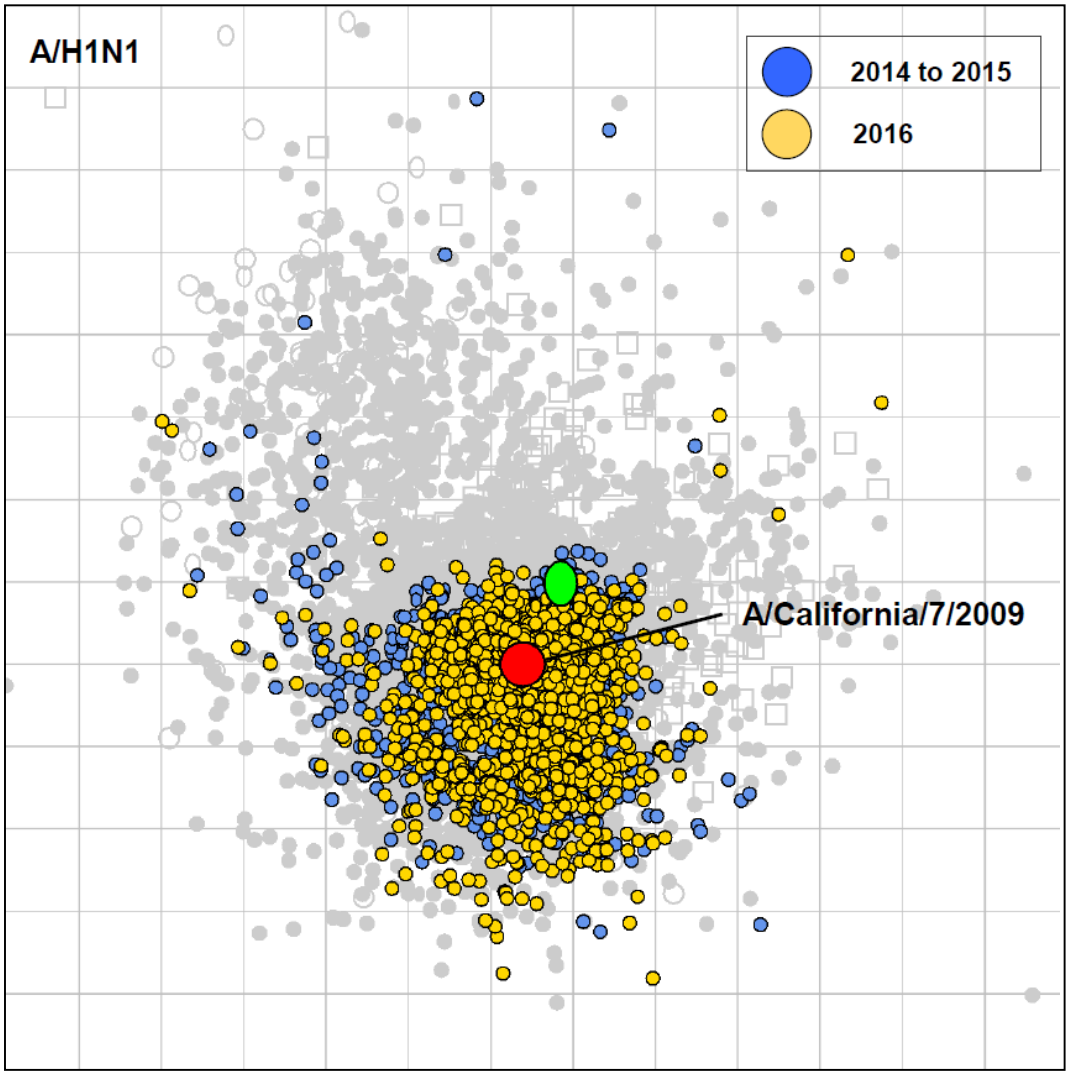


Table 3.2. – (H1N1)pdm09 viruses (1)

			Haemagglutination Inhibition Assay - WHO Influenza Centre												
			Reference Antisera												
	Phylogenetic tree		A	B	C	D	E	F	G	H	I	J	K		
	Aug 25 & Aug 30 2016		F2257	F2771	F2855	F3492	F3520	F3168	F3421	F3521	F3641	F3646	F3640	Passage	Sample
			E4	E2	MDCK1	MX,M1	E4	E3	E2	E3	E3	S1,M1	S1,M1	Details	Date
			CAL/7	CHCH/16	Dar/56	Perth/103	Mich/45	Tas/24	SA/22	Sing/GP1911	FIJI/3	FIJI/3	VIC/503		
	Reference Antigens	**Clade**		**4**	**7**	**6B.2**	**6B.1**	**6B**	**6B**	**6B.1**	**6B.1**	**6B.1**	**6B.2**		
A	A/CALIFORNIA/7/2009		**2560**	1280	1280	1280	1280	1280	2560	640	640	5120	1280	E6	
B	A/CHRISTCHURCH/16/2010	**4**	2560	**5120**	5120	1280	1280	2560	5120	1280	1280	5120	2560	E3	
C	A/DARWIN/56/2013	**7**	80	<80	**320**	<80	<80	<80	<80	<80	<80	80	<80	MDCK3	
D	A/PERTH/103/2015	**6B.2**	2560	1280	1280	**1280**	1280	2560	5120	1280	1280	2560	2560	MX,M1	
E	A/MICHIGAN/45/2015	**6B.1**	2560	2560	2560	1280	**1280**	2560	5120	1280	1280	5120	2560	E4	
F	A/TASMANIA/24/2014	**6B**	1280	640	640	640	640	**640**	2560	640	640	1280	1280	E3	
G	A/SOUTH AUSTRALIA/22/2015	**6B**	1280	1280	1280	640	640	1280	**2560**	1280	640	2560	1280	E3	
H	A/SINGAPORE/GP1911/2015	**6B.1**	640	640	640	640	640	640	2560	**1280**	640	1280	1280	E4	
I	A/FIJI/3/2016	**6B.1**	2560	2560	2560	1280	1280	1280	5120	1280	**1280**	5120	2560	E3	
J	A/FIJI/3/2016	**6B.1**	1280	1280	2560	640	1280	1280	2560	1280	640	**2560**	2560	S1,M1	
K	A/VICTORIA/503/2016	**6B.2**	1280	640	640	640	640	640	2560	640	640	2560	**1280**	S1,M1	
	Test Antigens														
1	A/SRI LANKA/18/2016		2560	2560	2560	1280	1280	2560	2560	1280	1280	2560	2560	MDCK1	12/07/2016
2	A/SRI LANKA/20/2016		2560	2560	2560	1280	1280	2560	5120	2560	1280	2560	2560	MDCK1	20/07/2016
3	A/PERTH/54/2016		2560	2560	1280	1280	2560	2560	5120	2560	1280	5120	2560	MX,M1	6/07/2016
4	A/SOUTH AUSTRALIA/74/2016		2560	2560	2560	1280	1280	2560	5120	2560	1280	5120	2560	SIAT1	3/08/2016
5	A/SOUTH AUSTRALIA/78/2016		2560	2560	2560	1280	1280	2560	5120	1280	1280	5120	2560	SIAT1	5/08/2016
6	A/TASMANIA/22/2016		2560	1280	2560	1280	1280	1280	2560	1280	1280	2560	2560	MDCK1	12/08/2016
7	A/TASMANIA/29/2016		2560	2560	2560	1280	1280	2560	5120	1280	1280	5120	1280	MDCK1	13/08/2016
8	A/PERTH/60/2016		2560	1280	1280	1280	1280	2560	2560	1280	1280	2560	1280	MX,M1	14/07/2016
9	A/PERTH/69/2016		2560	2560	1280	1280	1280	2560	5120	2560	1280	5120	2560	MX,M1	21/07/2016
10	A/SYDNEY/1034/2016		2560	2560	2560	1280	1280	2560	2560	1280	1280	2560	2560	SIAT1	2/08/2016
11	A/VICTORIA/565/2016		2560	2560	2560	1280	1280	2560	5120	1280	1280	2560	2560	SIAT1	8/08/2016
12	A/TASMANIA/26/2016		2560	2560	5120	1280	1280	2560	5120	2560	1280	5120	2560	MDCK1	11/08/2016
13	A/NEWCASTLE/103/2016		2560	1280	1280	1280	1280	2560	5120	1280	1280	5120	2560	MDCK1	3/08/2016
14	A/SRI LANKA/15/2016		2560	2560	2560	1280	1280	2560	5120	2560	1280	5120	2560	MDCK2	15/06/2016
15	A/CAMBODIA/A0625550/2016		2560	2560	2560	1280	1280	2560	2560	2560	1280	5120	2560	MDCK2	10/08/2016
16	A/VICTORIA/2087/2016		2560	1280	2560	1280	640	1280	2560	1280	640	2560	2560	SIAT1	13/08/2016
17	A/SOUTH AUCKLAND/31/2016	**6B.1**	2560	1280	2560	1280	1280	1280	2560	1280	1280	5120	2560	MX,M1	10/07/2016
18	A/SOUTH AFRICA/R4074/2016		2560	1280	2560	1280	1280	1280	2560	1280	1280	2560	2560	X,MDCK1	23/06/2016
19	A/NEW CALEDONIA/18/2016	**6B.1**	2560	1280	2560	1280	1280	2560	5120	1280	1280	5120	2560	SIAT2	8/04/2016
20	A/NEW CALEDONIA/44/2016		2560	1280	1280	1280	1280	1280	5120	1280	640	2560	2560	MDCK2	18/07/2016
21	A/SRI LANKA/10/2016		1280	1280	1280	1280	640	1280	2560	1280	640	2560	1280	MDCK1	26/05/2016
22	A/SOUTH AUSTRALIA/76/2016		1280	1280	1280	640	640	1280	2560	640	640	2560	1280	SIAT1	7/08/2016
23	A/VICTORIA/804/2016		1280	1280	1280	1280	1280	1280	2560	1280	640	2560	1280	SIAT1	13/08/2016
24	A/NEWCASTLE/94/2016		1280	640	1280	640	640	1280	2560	1280	640	2560	1280	MDCK1	3/08/2016
25	A/NEWCASTLE/106/2016		1280	1280	1280	1280	640	1280	2560	1280	640	2560	2560	MDCK1	9/08/2016
26	A/CHANTHABURI/123/16	**6B.1**	1280	1280	2560	640	1280	1280	2560	1280	1280	2560	1280	X,MDCK1	16/06/2016
27	A/CHANTHABURI/148/16		1280	1280	2560	1280	1280	1280	2560	1280	640	2560	1280	X,MDCK1	10/06/2016
28	A/PHUKET/153/16		1280	1280	2560	640	640	1280	2560	1280	640	2560	1280	X,MDCK1	26/06/2016
29	A/SOUTH AFRICA/R2533/2016		1280	640	1280	640	640	1280	2560	1280	640	1280	1280	X,MDCK1	11/06/2016
30	A/SOUTH AFRICA/R4066/2016	**6B.1**	1280	1280	2560	1280	1280	1280	2560	1280	1280	2560	2560	X,MDCK1	23/06/2016
31	A/SYDNEY/194/2016		1280	1280	1280	640	640	1280	2560	1280	640	2560	1280	MX,S1	25/07/2016
32	A/NEWCASTLE/80/2016		1280	1280	1280	640	640	1280	2560	1280	640	2560	1280	SIAT1	25/07/2016
33	A/SOUTH AUSTRALIA/81/2016		640	640	1280	640	640	1280	2560	640	640	2560	1280	SIAT1	4/08/2016
34	A/CHANTHABURI/115/16		640	1280	2560	640	640	1280	1280	640	640	2560	1280	X,MDCK1	23/05/2016

Figure 3.3. Phylogenetic relationships among influenza A(H1N1)pdm09 HA genes

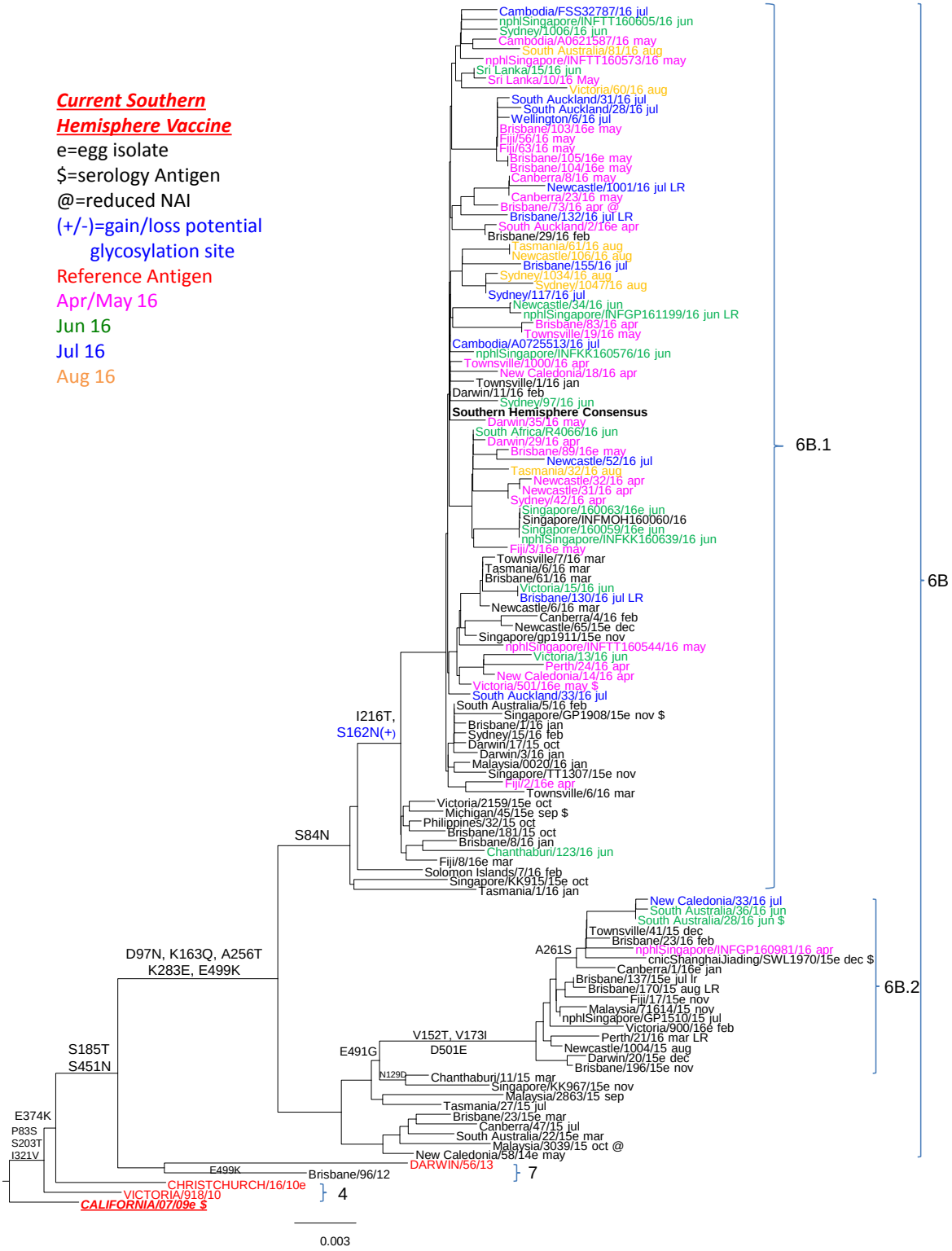


Figure 3.4. Phylogenetic relationships among influenza A(H1N1)pdm09 N1 neuraminidase genes

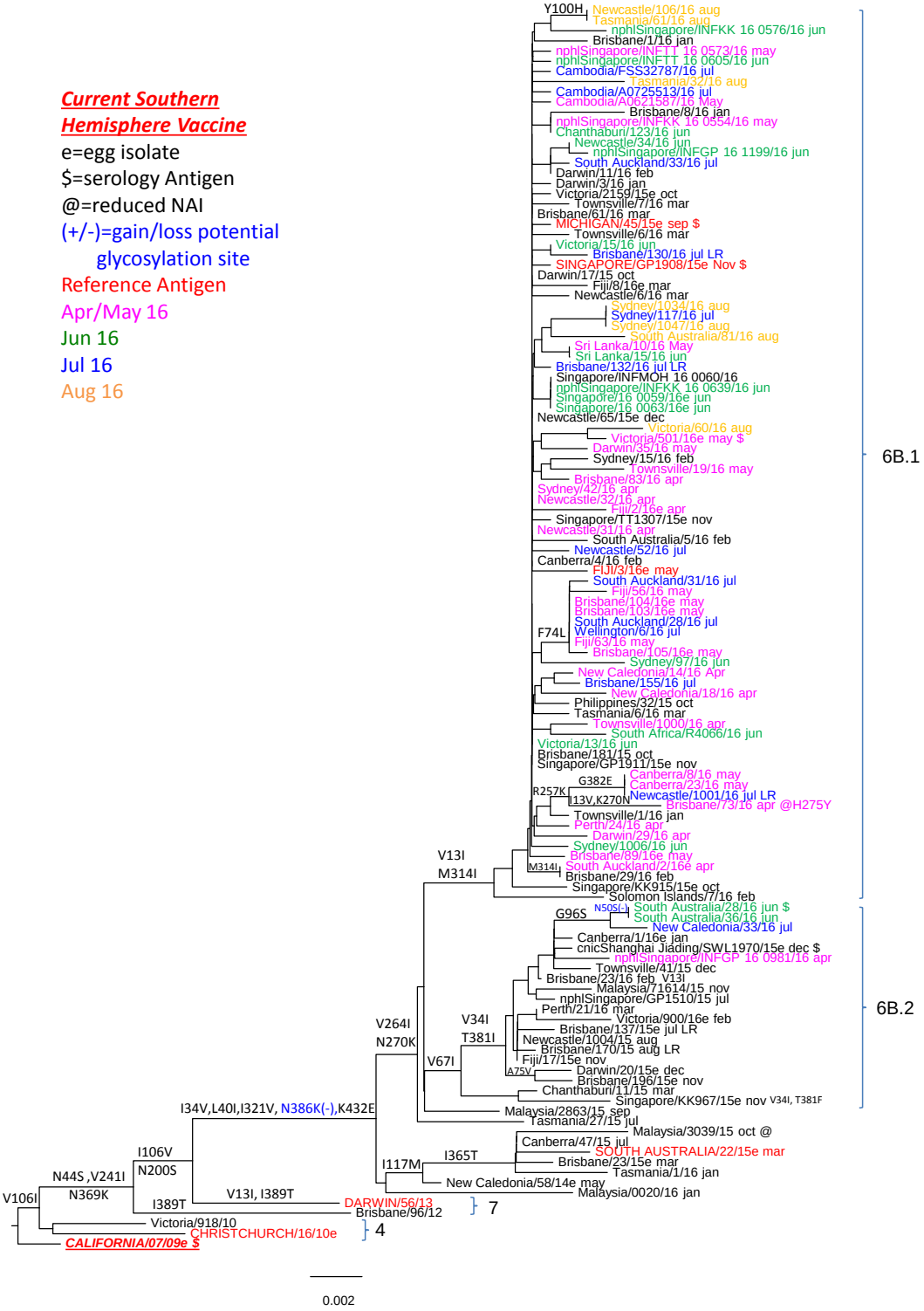


Table 3.5: Analysis of A(H1N1)pdm09 Viruses with Ferret and Human Sera – CDC

Table 1: Haemagglutination inhibition reactions of A(H1N1)pdm09 viruses

		POST-INFECTION FERRET SERA							POST VACCINATION HUMAN SERA*					
			EGG	MDCK	MDCK	MDCK	MDCK	MDCK	MDCK	2011/12	2013/14	2014/15		2015/16	
STRAIN DESIGNATION	Genetic Clade	Passage history	CA/7	CA/7	MD/13	DR/7293	BL/559	MI/45	IA/53	A	B	C	D	E	F
A/CALIFORNIA/7/2009	H1pdm09	E3	2560	2560	2560	2560	2560	2560	1280	640	640	320	640	160	640
A/CALIFORNIA/7/2009	H1pdm09	C3	2560	2560	2560	1280	1280	2560	1280	320	640	320	320	320	640
A/MARYLAND/13/2012	6A	M1/C2	5120	2560	2560	1280	1280	2560	1280	320	640	160	160	160	640
A/DOMINICAN REP./7293/2013	6C	C2	2560	2560	2560	2560	1280	2560	1280	320	1280	320	320	320	640
A/BOLIVIA/559/2013	6B	E5	2560	2560	2560	1280	1280	2560	1280	20	20	40	40	20	640
A/BOLIVIA/559/2013	6B	C2	5120	5120	5120	2560	2560	5120	1280	10	10	40	20	20	640
A/MICHIGAN/45/2015	6B.1	E3	2560	5120	5120	2560	2560	5120	2560	80	40	80	640	10	1280
A/MICHIGAN/45/2015	6B.1	M1/C3	2560	2560	2560	2560	2560	5120	2560	10	10	40	40	40	1280
A/PANAMA/318595/2016	6B.1	C2	1280	1280	2560	2560	1280	5120	1280	10	10	40	20	20	640
A/IOWA/53/2015	6B.2	E4	1280	1280	1280	1280	640	2560	1280	10	10	20	40	20	320
A/IOWA/53/2015	6B.2	C3	1280	1280	640	1280	640	2560	1280	10	10	20	10	20	160
A/MINNESOTA/32/2015	6B.2	C3	640	640	1280	1280	640	1280	1280	10	10	20	10	20	320

* Post vaccination pooled sera (A-D, F) or a single serum (E) from adults (birth years, 1961-83) vaccinated with TIV or QIV from the indicated seasons

Table 3.10. Haemagglutination inhibition antibody titres (Cell)
Influenza type A(H1N1)pdm09 vaccine component – Adult

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/California/07/2009	AUS	24	E6	1.25	29	21	49	29	83	42	17
	USA	23		2.65	57	18	111	43	96	78	52
A/Michigan/45/2015 (6B.1)	AUS	24	M1/C2/MDCK2	1.33	46	8	21	8	33	21	0
	USA	23		2.04	52	9	39	13	65	35	17
A/Singapore/GP1908/2015 (6B.1)	AUS	24	MDCK4	1.29	46	8	19	12	38	17	0
	USA	23		2.13	48	10	44	17	70	43	17
A/Shanghai-Jiading/SW1970/2015 (6B.2)	AUS	24	MDCK5	1.46	50	9	25	12	42	29	4
	USA	23		2.04	43	12	51	22	78	43	17
A/South Australia/28/2016 (6B.2)	AUS	24	SIAT1/MDCK2	1.33	38	8	20	12	33	17	8
	USA	23		2.13	43	9	40	13	65	48	22
A/Victoria/501/2016 (6B.1)	AUS	24	SIAT2/MDCK1	1.67	54	9	28	17	50	29	4
	USA	23		2.22	52	13	61	26	74	65	26

Table 3.11. Haemagglutination inhibition antibody titres (Cell)
Influenza type A(H1N1)pdm09 vaccine component – Elderly

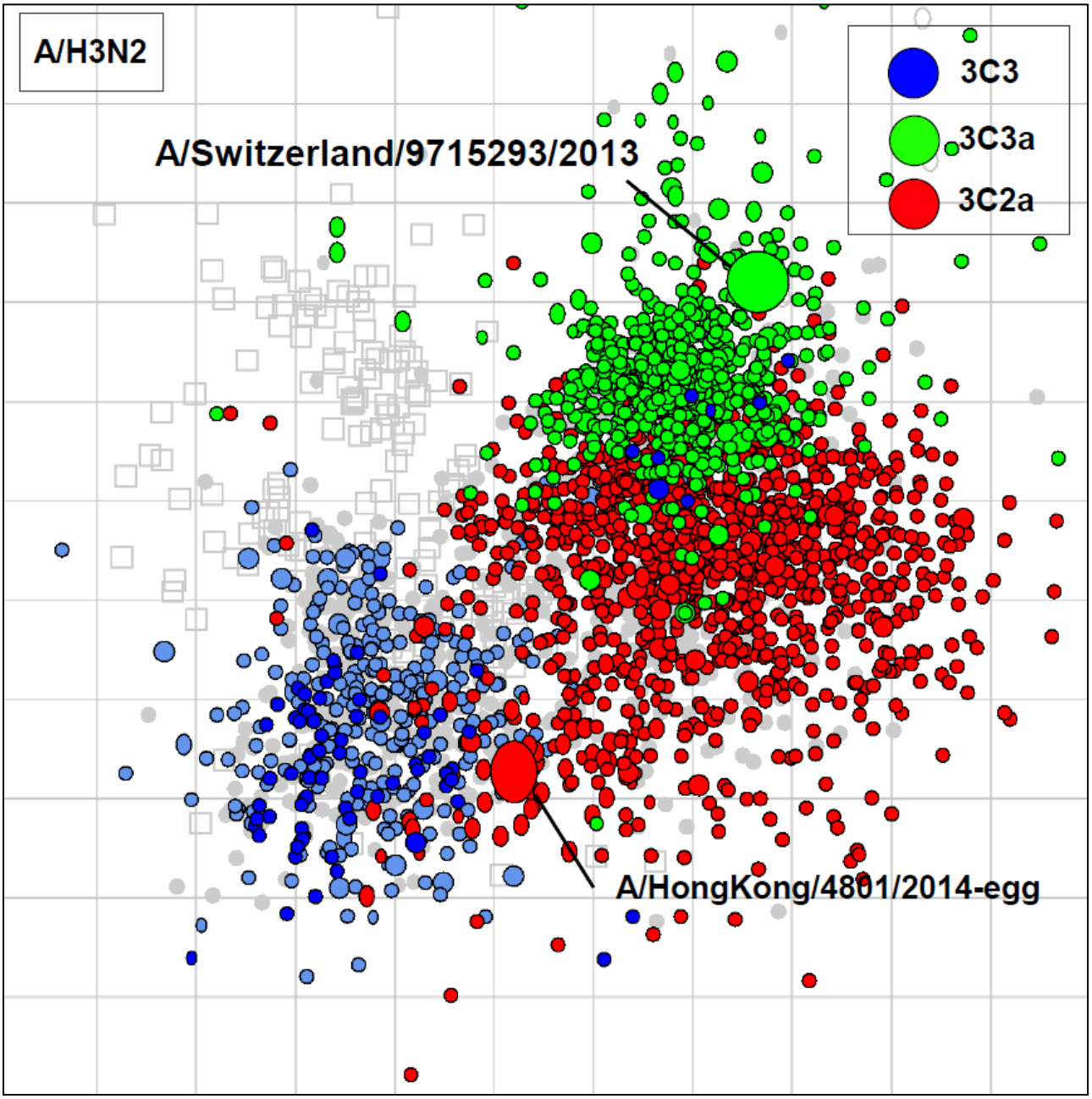
Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/Michigan/45/2015 (6B.1)	AUS	24	E6	1.08	29	17	37	29	46	38	8
	USA	24		1.96	42	22	87	50	83	75	38
A/Singapore/GP1908/2015 (6B.1)	AUS	24	M1/C2/MDCK2	0.67	21	8	12	4	21	4	0
	USA	24		1	21	13	26	33	62	25	4
A/Shanghai-Jiading/SW1970/2015 (6B.2)	AUS	24	MDCK4	1	29	7	15	4	33	8	0
	USA	24		1.12	21	12	27	25	58	25	4
A/South Australia/28/2016 (6B.2)	AUS	24	MDCK5	1.12	29	9	19	8	42	25	4
	USA	24		1.38	29	15	40	42	67	54	12
A/Victoria/501/2016 (6B.1)	AUS	24	SIAT1/MDCK2	0.83	25	8	14	4	29	4	0
	USA	24		1.08	21	15	33	42	62	50	17
A/Michigan/45/2015 (6B.1)	AUS	24	SIAT2/MDCK1	1.04	25	9	18	8	38	21	0
	USA	24		1.79	38	17	60	46	67	67	25

Table 3.12. Haemagglutination inhibition antibody titres (Cell)
Influenza type A(H1N1)pdm09 vaccine component – Paediatric

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/California/07/2009	USA	24	E6	3.08	83	9	73	17	79	58	29
A/Singapore/GP1908/2015 (6B.1)	USA	24	MDCK4	0.38	12	7	9	12	12	12	12
A/Victoria/501/2016 (6B.1)	USA	24	SIAT2/MDCK1	1.17	38	7	17	12	29	12	12

APPENDIX 4 – INFLUENZA A(H3N2)

FIGURE 4.1. HI: Antigenic cartography of A/H3N2 viruses



APPENDIX 4 - INFLUENZA A (H3N2)

Table 4.6: A(H3) viruses (3)

			Haemagglutination Inhibition Assay - WHO Influenza Centre												
	With Oseltamivir		Reference Antisera												
	Sanger tree		A	B	C	D	E	F	G	H	I	J	K		
	August 18, 2016		F3272	F3165	F3418	F3257	F3417	F3419	F3491	F3490	F3644	F3642	F3698	Passage	Sample
	N171K		M1/C2,M3	E5	S1/S4	M1,S2	M1/S1	E6	MX,M1,S1	MX,M1	S1	E5	E6	History	Date
	NGS tree		Tex/50	Switz	Switz	NewCal/104	NEWC/22	HK/4801	HK/4801	HK/7127	NEWC/30	SriLanka/61	Alsk/232		
	Reference Antigens	**Clade**	**3C.1**	**3C.3a**	**3C.3a**	**3c.2a**	**3C.3b**	**3c.2a**	**3c.2a**	**3c.2a**	**3c.2a**	**3c.2a**	**3c.2a**		
A	A/TEXAS/50/2012	**3c.1**	**640**	160	640	1280	1280	160	320	160	1280	160	2560	M1/C2,M7	
B	A/SWITZERLAND/9715293/2013	**3c.3a**	80	**640**	640	160	80	160	160	160	160	40	1280	E6	
C	A/SWITZERLAND/9715293/2013	**3c.3a**	80	80	**320**	320	80	80	80	40	640	80	1280	S1/S4	
D	A/NEW CALEDONIA/104/2014	**3c.2a**	80	160	160	**1280**	160	160	320	160	1280	160	2560	M1/S2	
E	A/NEWCASTLE/22/2014	**3c.3b**	640	320	640	640	**>5120**	320	640	320	1280	320	2560	M6/S2	
F	A/HONG KONG/4801/2014	**3c.2a**	40	40	80	2560	40	**640**	640	320	>5120	640	>5120	E7	
G	A/HONG KONG/4801/2014	**3c.2a**	320	320	320	1280	160	320	**640**	320	1280	320	2560	M1/S3	
H	A/HONG KONG/7127/2014	**3c.2a**	80	80	160	640	80	160	160	**160**	640	80	640	M1/S1	
I	A/NEWCASTLE/30/2016	**3c.2a**	40	80	160	640	80	160	160	80	**640**	80	640	S1/ST2	
J	A/SRI LANKA/61/2015	**3c.2a**	40	40	80	2560	40	640	640	160	2560	**160**	>5120	E5	
K	A/ALASKA/232/2015	**3c.2a**	<40	40	40	640	<40	320	320	80	1280	160	**>5120**	E1	
	Test Antigens														
1	A/VICTORIA/522/2016	**3c.2a**	160	160	320	1280	160	320	320	160	1280	160	1280	SIAT1	4/07/2016
2	A/SYDNEY/156/2016		160	160	320	640	80	160	320	160	640	160	1280	SIAT1	3/07/2016
3	A/NEW CALEDONIA/55/2016	**3c.2a**	80	80	320	640	80	160	320	160	640	80	640	SIAT1	26/07/2016
4	A/WELLINGTON/4/2016	**3c.3a**	160	320	1280	1280	80	320	320	80	1280	40	1280	SX,S1	19/07/2016
5	A/CHRISTCHURCH/4/2016	**3c.3a**	160	160	1280	640	80	160	320	80	640	80	1280	SX,S1	11/06/2016
6	A/DUNEDIN/5/2016		160	320	1280	640	80	160	320	80	640	80	1280	SX,S1	19/07/2016
7	A/NEW CALEDONIA/51/2016	**3c.2a**	80	80	320	640	40	160	160	80	640	80	640	SIAT1	22/07/2016
8	A/CANBERRA/13/2016	**3c.3a**	160	160	1280	640	80	160	160	80	640	40	640	SIAT1	22/07/2016
9	A/CANBERRA/26/2016		160	320	1280	640	160	160	160	80	1280	40	1280	SIAT1	30/06/2016
10	A/NEWCASTLE/67/2016	**3c.3a**	160	160	1280	640	80	160	160	80	640	80	640	SIAT1	29/07/2016
11	A/SYDNEY/153/2016	**3c.2a**	80	160	320	640	80	160	160	160	640	80	1280	SIAT2	3/07/2016
12	A/WELLINGTON/2/2016	**3c.3a**	160	160	1280	640	80	160	160	80	640	40	640	SX,S1	18/07/2016
13	A/SOUTH AUCKLAND/21/2016	**3c.3a**	160	160	640	640	40	160	160	80	640	40	640	SX,S1	30/06/2016
14	A/SOUTH AUCKLAND/22/2016	**3c.2a**	40	80	160	320	40	80	160	80	320	40	640	SX,S1	5/07/2016
15	A/SOUTH AUCKLAND/23/2016	**3c.3a**	160	160	1280	640	80	160	160	80	640	80	640	MX,S1	13/07/2016
16	A/SOUTH AUCKLAND/24/2016		160	320	640	640	80	160	160	80	640	80	640	SX,S1	14/07/2016
17	A/CHRISTCHURCH/6/2016	**3c.3a**	160	320	640	640	80	160	160	80	640	80	1280	SX,S1	7/06/2016
18	A/CHRISTCHURCH/7/2016	**3c.3a**	160	160	640	640	80	160	160	80	640	80	640	SX,S1	7/06/2016
19	A/CHRISTCHURCH/8/2016	**3c.3a**	160	320	1280	640	80	160	160	80	640	80	1280	SX,S1	9/06/2016
20	A/CHRISTCHURCH/11/2016	**3c.3a**	160	320	1280	640	80	160	160	80	640	80	1280	MX,S1	13/06/2016
21	A/CHRISTCHURCH/12/2016	**3c.3a**	160	320	1280	640	80	160	160	80	640	80	1280	MX,S1	12/06/2016
22	A/DUNEDIN/1/2016	**3c.3a**	80	160	640	640	80	160	160	80	640	40	640	SX,S1	23/06/2016
23	A/DUNEDIN/3/2016	**3c.3a**	80	160	640	320	40	160	160	80	320	40	640	SX,S1	12/07/2016
24	A/DUNEDIN/4/2016	**3c.3a**	80	160	640	320	40	160	160	40	320	40	640	SX,S1	8/07/2016
25	A/DUNEDIN/6/2016		80	160	1280	320	40	160	160	40	320	40	640	SX,S1	21/07/2016
26	A/TASMANIA/16/2016		160	160	1280	320	80	160	160	80	640	40	640	SIAT1	2/08/2016
27	A/VICTORIA/801/2016	**3c.2a**	40	40	80	160	40	80	80	80	320	40	320	SIAT1	30/07/2016
28	A/SYDNEY/171/2016	**3c.2a**	40	80	80	320	40	80	80	80	320	40	320	MX,S1	29/07/2016
29	A/NEW CALEDONIA/50/2016	**3c.2a**	40	80	160	320	40	80	80	80	320	40	320	SIAT1	20/07/2016
30	A/VICTORIA/539/2016	**3c.3a**	160	160	640	640	80	160	80	80	320	40	640	SIAT1	26/07/2016
31	A/WELLINGTON/3/2016	**3c.3a**	80	160	640	320	80	160	80	80	320	40	640	MX,S1	19/07/2016
32	A/SOUTH AUCKLAND/34/2016	**3c.3a**	40	40	40	40	40	40	40	40	40	40	40	SX,S1	22/07/2016

Table 4.9: A(H3) Focus Reduction Assay (2)

FOCUS REDUCTION ASSAY															
			Reference Antisera												
	Sanger tree		A	B	C	D	E	F	G	H	I	J			
	August 30, 2016		F3226	F3418	F3411	F3417	F3126	F3257	F3491	F3419	F3698	F3644	Passage	Sample	
	N171K		E6	S1/S6	E5	MX/S2	E4	M1,S2	MX/M1/S1	E6	E6	SIAT1	Details	Date	
	NGS tree		Tex/50	Switz	Switz	NEWC/22	NEWC/22	NewCal/104	HK/4801	HK/4801	ALSKA/232	NEWC/30			
	Reference Antigens	**Clade>**	**3C.1**	**3C.3a**	**3C.3a**	**3C.3b**	**3C.3b**	**3c.2a**	**3c.2a**	**3c.2a**	**3c.2a**	**3c.2a**			
A	A/TEXAS/50/2012	**3c.1**	**2560**	320	1280	>5120	2560	1280	320	640	2560	640	E5, E2		
B	A/SWITZERLAND/9715293/2013	**3c.3a**	<40	**640**	640	80	160	160	160	320	640	160	S1,S6		
C	A/SWITZERLAND/9715293/2013	**3c.3a**	80	1280	**2560**	320	1280	640	320	640	2560	320	E6		
D	A/NEWCASTLE/22/2014	**3c.3b**	80	80	<40	**>5120**	1280	160	320	160	320	320	M6,S3		
E	A/NEWCASTLE/22/2014	**3c.3b**	160	320	80	1280	**640**	160	80	640	320	320	E5		
F	A/NEW CALEDONIA/104/2014	**3c.2a**	<40	160	160	640	80	**1280**	320	320	640	1280	M1,S3		
G	A/HONG KONG/4801/2014	**3c.2a**	<40	80	<40	<40	<40	160	**320**	160	320	80	M4,S1		
H	A/HONG KONG/4801/2014	**3c.2a**	<40	320	160	160	80	>5120	1280	**2560**	>5120	>5120	E6		
I	A/ALASKA/232/2015	**3c.2a**	<40	160	160	<40	80	1280	320	1280	**>5120**	2560	E6		
J	A/NEWCASTLE/30/2016	**3c.2a**	<40	<40	<40	160	<40	640	160	160	1280	**640**	S1,S2		
	Test Antigens														
1	A/VICTORIA/541/2016		<40	80	<40	<40	<40	160	1280	160	1280	640	SIAT2	18/06/2016	
2	A/SOUTH AFRICA/R3334/2016	**3c.2a**	80	160	80	160	80	2560	1280	160	2560	1280	X,S1	2/06/2016	
3	A/SYDNEY/150/2016	**3c.2a**	<40	<40	<40	<40	<40	<40	640	80	640	320	SIAT1	5/07/2016	
4	A/SOUTH AFRICA/R3157/2016		<40	160	80	<40	80	1280	640	80	2560	2560	X,S1	30/05/2016	
5	A/NEW CALEDONIA/48/2016	**3c.2a**	<40	<40	<40	<40	<40	320	640	160	640	640	SIAT2	20/07/2016	
6	A/NEWCASTLE/64/2016		<40	160	<40	80	80	160	640	320	1280	1280	SIAT2	7/07/2016	
7	A/SYDNEY/121/2016		<40	80	<40	80	80	320	640	160	640	640	SIAT1	4/07/2016	
8	A/SYDNEY/131/2016		<40	<40	<40	80	80	160	640	160	1280	320	SIAT1	25/07/2016	
9	A/NEW CALEDONIA/49/2016	**3c.2a**	<40	<40	<40	<40	<40	160	320	80	160	320	SIAT2	20/07/2016	
10	A/SOUTH AUCKLAND/22/2016	**3c.2a**	<40	80	<40	80	80	1280	320	80	1280	1280	SX,S1	5/07/2016	
11	A/SINGAPORE/INFGP-16-0957/2016	**3c.2a**	<40	<40	<40	<40	<40	80	160	<40	160	<40	M1,S2	18/04/2016	
12	A/SYDNEY/154/2016	**3c.2a**	<40	<40	<40	<40	<40	160	160	80	640	160	SIAT2	4/07/2016	
13	A/SYDNEY/162/2016		<40	<40	<40	<40	<40	160	160	80	640	460	SIAT2	29/06/2016	
14	A/SYDNEY/142/2016	**3c.3a**	<40	1280	1280	160	160	320	160	320	320	320	SIAT1	30/06/2016	
15	A/WELLINGTON/2/2016	**3c.3a**	<40	640	640	<40	80	320	80	320	160	160	SX,S1	18/07/2016	
16	A/DUNEDIN/5/2016		<40	640	640	<40	80	160	80	80	160	160	SX,S1	19/07/2016	
17	A/SOUTH AFRICA/R4564/2016	**3c.2a**	<40	<40	<40	<40	<40	<40	80	<40	80	80	X,S1	6/07/2016	
18	A/CANBERRA/13/2016	**3c.3a**	<40	640	640	80	80	160	80	320	160	160	SIAT1	22/07/2016	
19	A/SOUTH AUCKLAND/24/2016		<40	320	640	80	80	320	80	320	160	80	SX,S1	14/07/2016	
20	A/PERTH/22/2016		<40	640	1280	80	80	320	80	80	160	160	MX,S1	15/04/2016	
21	A/WELLINGTON/3/2016	**3c.3a**	<40	320	320	<40	80	<40	<40	80	80	<40	MX,S1	19/07/2016	
22	A/DUNEDIN/4/2016	**3c.3a**	<40	80	160	<40	<40	<40	<40	<40	<40	<40	SX,S1	8/07/2016	
23	A/SOUTH AFRICA/R4138/2016	**3c.2a**	<40	<40	<40	<40	<40	<40	<40	<40	<40	160	X,S1	30/05/2016	
24	A/SOUTH AUCKLAND/21/2016	**3c.3a**	<40	640	640	80	80	160	<40	320	160	160	SX,S1	30/06/2016	
25	A/CHRISTCHURCH/4/2016	**3c.3a**	<40	160	320	80	80	160	<40	320	160	160	SX,S1	11/06/2016	
26	A/CHRISTCHURCH/5/2016	**3c.3a**	<40	160	320	80	80	160	<40	160	160	80	MX,S1	7/06/2016	
27	A/CHRISTCHURCH/6/2016	**3c.3a**	<40	160	640	80	80	160	<40	320	160	160	SX,S1	7/06/2016	
28	A/DUNEDIN/6/2016		<40	320	640	80	80	320	<40	320	320	160	SX,S1	21/07/2016	

Figure 4.2. Phylogenetic relationships among influenza A(H3) HA genes

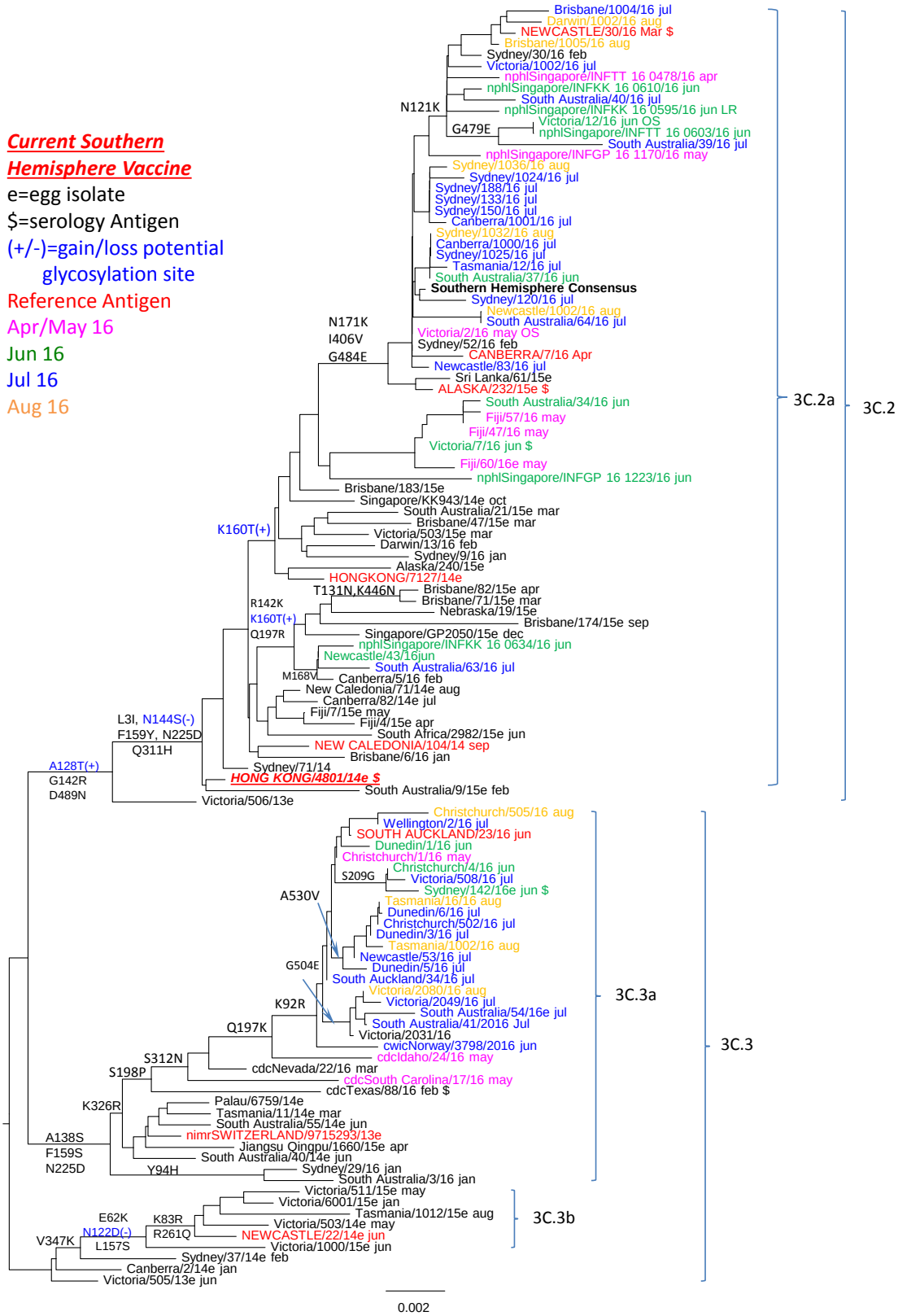


Figure 4.3. Phylogenetic relationships among influenza A(H3) N2 Neuraminidase genes

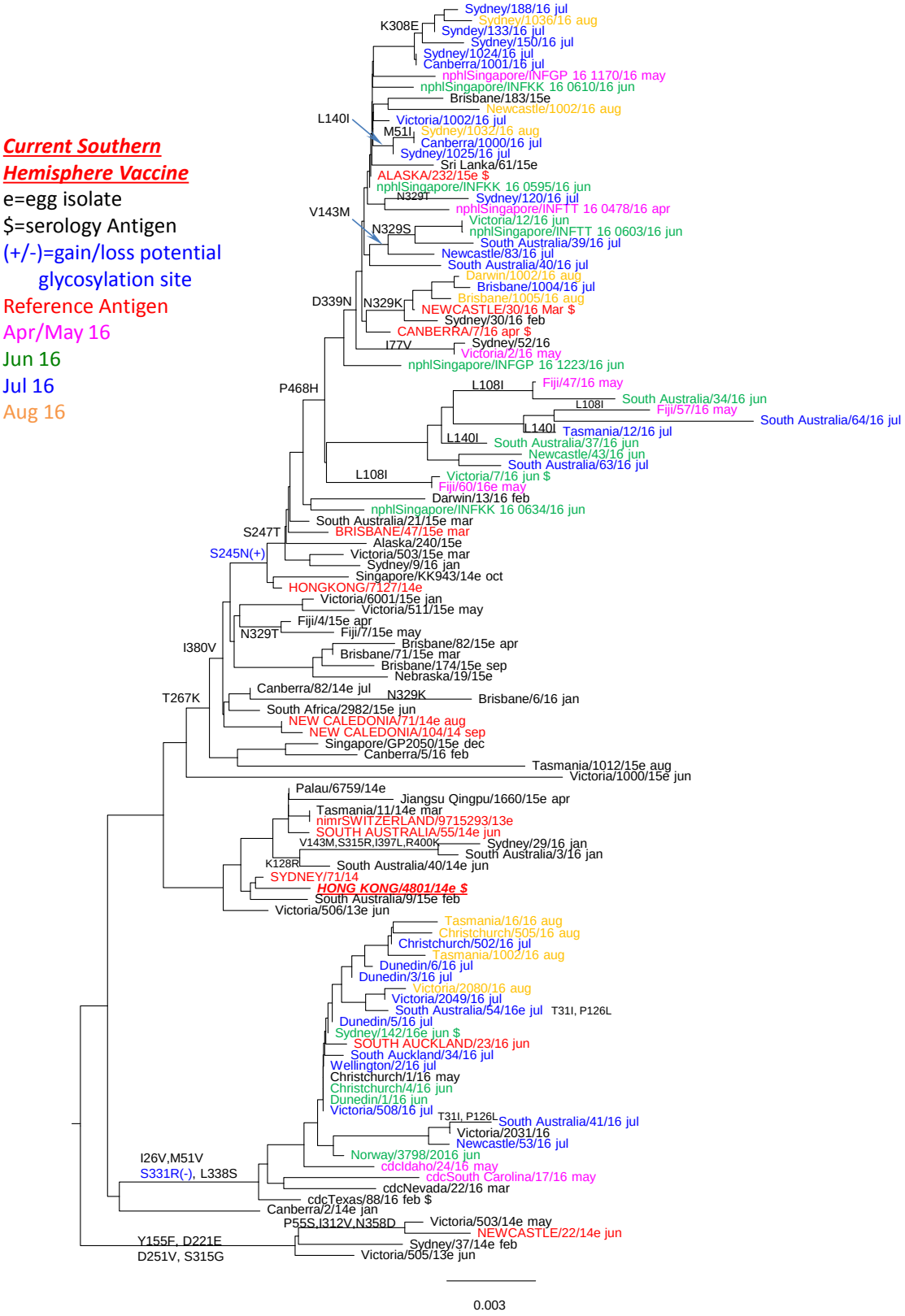


Table 4.13. Haemagglutination inhibition antibody titres (Egg)
Influenza type A(H3N2) vaccine component – Adult

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/Sydney/142/2016 (3c.3a)	AUS	24	E4 - oselt	1.38	38	55	143	88	100	79	58
A/Alaska/232/2015 (3c.2a)			E7 - oselt	0.46	8	67	92	92	88	79	29
A/Hong Kong/4801/2014 (3c.2a)			E7 - oselt	1.75	58	82	277	92	100	92	75

Table 4.14. Haemagglutination inhibition antibody titres (Egg)
Influenza type A(H3N2) vaccine component – Elderly

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/Sydney/142/2016 (3c.3a)	AUS	24	E4 - oselt	0.83	33	90	160	96	96	88	62
A/Alaska/232/2015 (3c.2a)			E7 - oselt	0.62	21	71	110	96	96	83	46
A/Hong Kong/4801/2014 (3c.2a)			E7 - oselt	1.08	33	127	269	92	100	92	75

Table 4.15. Haemagglutination inhibition antibody titres (Cell)
Influenza type A(H3N2) vaccine component – Adult

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/Hong Kong/4801/2014 (3c.2a)	AUS	24	MDCK4/SIAT1 - oselt	0.88	21	60	110	88	96	83	50
A/Texas/88/2016 (3c.3a)	AUS	24	S2/SIAT2 - oselt	1.04	33	8	22	8	50	12	4
	USA	23		1.91	70	6	40	4	74	35	0
A/Newcastle/30/2016 (3c.2a)	AUS	24	SIAT2 - oselt	0.42	8	53	71	92	88	71	21
A/Canberra/7/2016 (3c.2a)	AUS	24	SIAT3 - oselt	0.29	12	71	87	92	96	83	29
A/Sydney/142/2016 (3c.3a)	AUS	24	SIAT3 - oselt	0.67	8	63	101	92	96	88	38

TABLE 4.16. Haemagglutination inhibition antibody titres (Cell)
Influenza type A(H3N2) vaccine component – Elderly

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
A/Hong Kong/4801/2014 (3c.2a)	AUS	24	MDCK4/SIAT1 - oselt	0.21	4	254	293	100	100	100	96
A/Texas/88/2016 (3c.3a)	AUS	24	S2/SIAT2 - oselt	0.75	12	12	23	17	50	21	12
	USA	23		2.21	71	8	60	8	88	38	29
A/Newcastle/30/2016 (3c.2a)	AUS	24	SIAT2 - oselt	0.42	8	63	85	92	100	71	33
A/Canberra/7/2016 (3c.2a)	AUS	24	SIAT3 - oselt	0.17	4	78	87	96	96	67	33
A/Sydney/142/2016 (3c.3a)	AUS	24	SIAT3 - oselt	0.67	21	71	113	92	100	79	50

APPENDIX 5 - INFLUENZA B

Figure 5.1. Antigenic cartographic representation of B/Victoria viruses

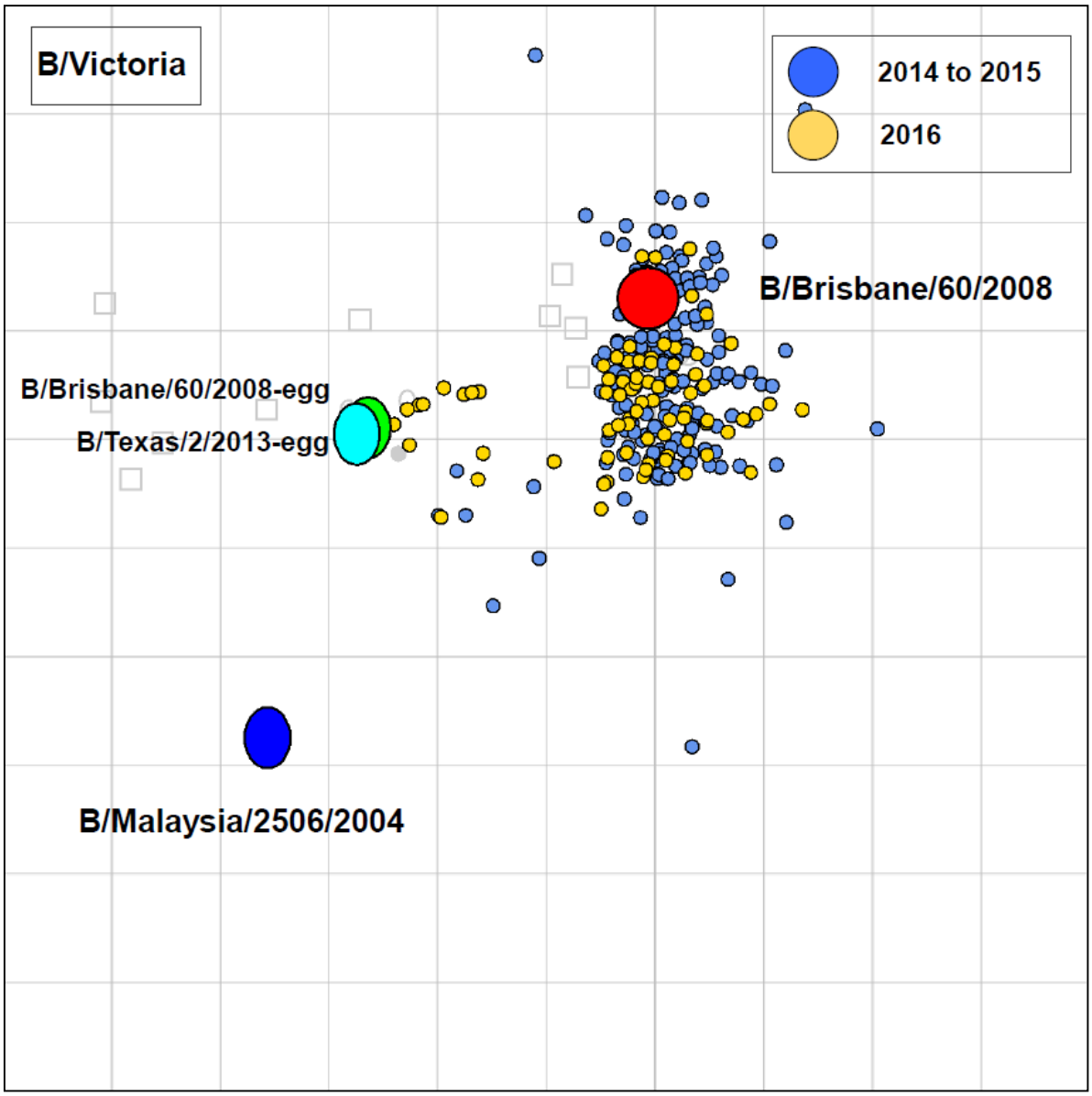


Figure 5.2. Antigenic cartographic representation of B/Yamagata HI

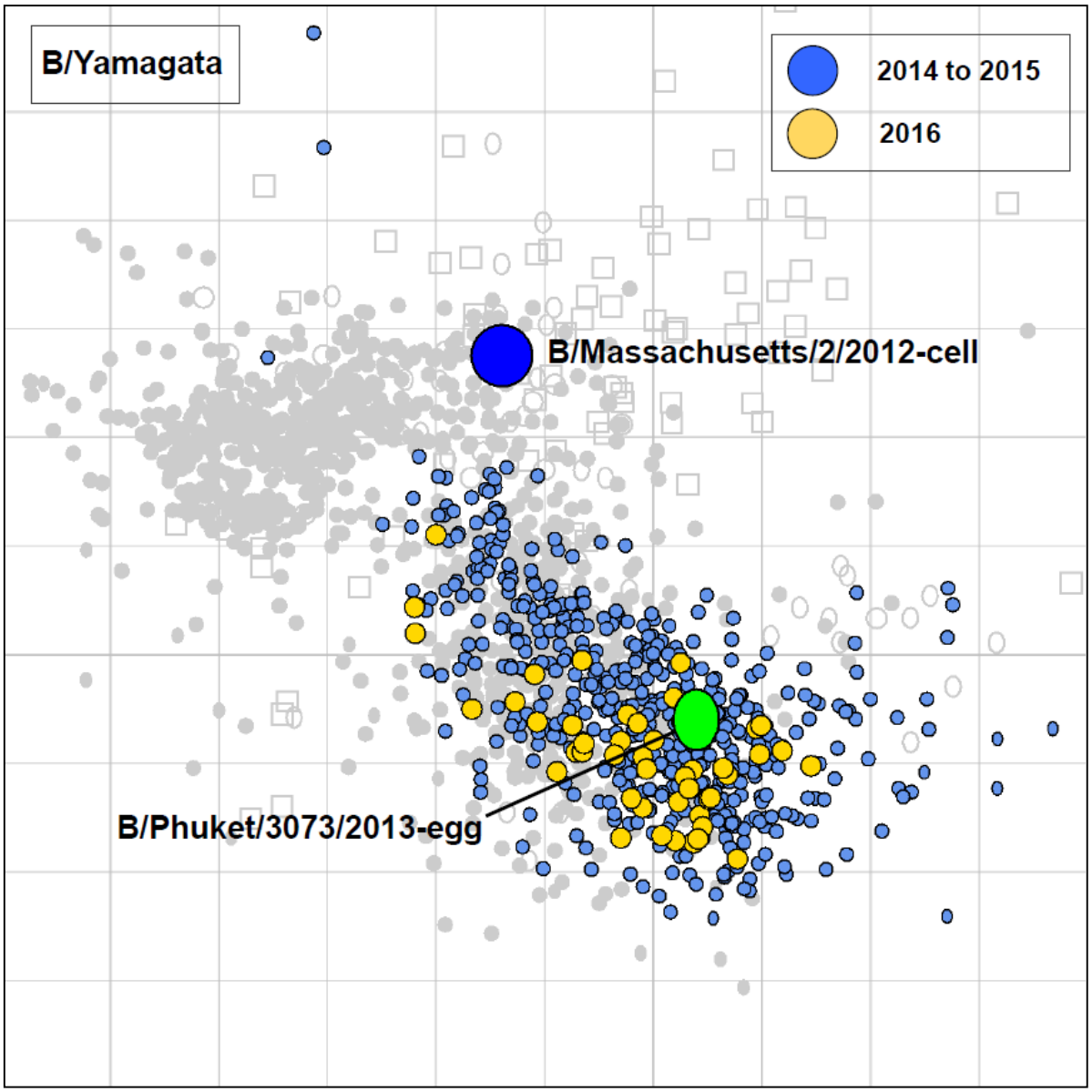


Table 5.2: B viruses (B/Victoria lineage) (1)

Haemagglutination Inhibition Assay - WHO Influenza Centre															
			Reference Antisera												
	Sanger tree		A	B	C	D	E	F	G	H	I	J	K		
	September 6, 2016		F2256	F2425	F2253	F2315	F2574	F2897	F3228	F3414	F3366	F3413	F3643		
			MX,M1	E4	E2	M1	E4	M2	E6	E3	E4	M2	M3	Passage	Sample
			BRIS/60	BRIS/60	SYD/508	DAR/40	S.Aust/81	BRIS/18	TEX/02	Vic/502	Bris/46	Bris/46	Town/8	History	Date
	Reference Antigens	**Clade**	**V1A**	**V1A**	**V1B**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**			
A	B/BRISBANE/60/2008	**V1A**	**320**	160	160	640	640	640	320	80	160	320	160	MX,M6	
B	B/BRISBANE/60/2008	**V1A**	160	**1280**	640	320	1280	320	>2560	1280	1280	80	160	E6	
C	B/SYDNEY/508/2010	**V1B**	320	1280	**1280**	320	1280	320	>2560	1280	1280	160	160	E3	
D	B/DARWIN/40/2012	**V1A**	320	320	160	**640**	1280	640	640	160	320	320	160	M4	
E	B/SOUTH AUSTRALIA/81/2012	**V1A**	160	1280	640	320	**1280**	320	>2560	640	640	80	160	E5	
F	B/BRISBANE/18/2013	**V1A**	320	320	160	640	1280	**640**	640	160	160	320	160	M3	
G	B/TEXAS/02/2013	**V1A**	160	1280	640	320	1280	320	**>2560**	640	640	80	160	E7	
H	B/VICTORIA/502/2015	**V1A**	320	1280	1280	320	1280	320	>2560	**1280**	1280	160	160	E4	
I	B/BRISBANE/46/2015	**V1A**	320	>2560	1280	640	>2560	640	>2560	1280	**>2560**	320	320	E4	
J	B/BRISBANE/46/2015	**V1A**	320	320	160	640	640	640	320	160	320	**320**	160	M3	
K	B/TOWNSVILLE/8/2016	**V1A**	320	320	160	640	1280	640	640	160	320	320	**160**	M3	
	Test Antigens														
1	B/CAMBODIA/A0621589/2016		640	320	160	640	1280	640	640	160	320	320	320	MDCK,S1,M1	6/05/2016
2	B/CAMBODIA/AD07019/2016		640	320	160	640	640	640	640	160	320	320	320	MDCK1	25/07/2016
3	B/SINGAPORE/INFKK-16-0290/2016		320	320	160	640	640	320	320	160	320	320	160	M3	3/03/2016
4	B/PERTH/31/2016		320	160	160	640	640	320	320	80	160	160	160	MX,M1	5/07/2016
5	B/VICTORIA/504/2016		320	320	160	640	640	640	320	80	160	320	160	M1	11/08/2016
6	B/VICTORIA/901/2016		320	160	160	640	640	320	320	160	160	160	160	M1	30/06/2016
7	B/SYDNEY/14/2016		320	320	160	640	640	640	640	160	320	320	160	MX,M1	26/06/2016
8	B/SYDNEY/15/2016		320	320	160	640	1280	640	640	160	320	320	320	MX,M1	27/06/2016
9	B/SRI LANKA/15/2016		320	320	160	640	1280	640	640	160	320	320	320	M2	25/07/2016
10	B/CAMBODIA/A0621570/2016		320	320	160	640	640	640	320	160	160	320	160	MDCK,S1,M1	30/03/2016
11	B/CAMBODIA/A0621595/2016		320	320	160	640	640	640	320	160	320	320	160	MDCK,S1,M1	11/05/2016
12	B/CAMBODIA/FSS32772/2016		320	320	160	640	640	640	320	80	160	320	320	MDCK1	6/07/2016
13	B/CAMBODIA/FSS33131/2016		320	320	160	640	640	640	320	160	160	320	320	MDCK1	7/07/2016
14	B/CAMBODIA/A0212501/2016		320	160	160	640	640	640	320	80	160	320	160	MDCK,S1,M1	4/02/2016
15	B/CAMBODIA/A0526503/2016		320	320	160	640	640	640	320	160	320	320	160	MDCK,S1,M1	19/05/2016
16	B/CAMBODIA/A0621508/2016		320	320	160	640	640	640	320	160	160	320	160	MDCK,S1,M1	6/01/2016
17	B/CAMBODIA/AD07197/2016	**V1A**	320	160	160	320	640	320	320	80	160	320	160	M1	21/07/2016
18	B/VICTORIA/506/2016	**V1A**	160	160	80	320	640	320	320	80	160	160	160	SIAT1	17/08/2016

Table 5.3: B viruses (B/Victoria lineage) (2)

Haemagglutination Inhibition Assay - WHO Influenza Centre															
			Reference Antisera												
	Sanger tree		A	B	C	D	E	F	G	H	I	J	K		
	August 23, 2016		F2256	F2425	F2253	F2315	F2574	F2897	F3228	F3414	F3366	F3413	F3643		
			MX,M1	E4	E2	MDCK1	E4	MDCK2	E6	E3	E4	M2	M3	Passage	Date
			BRIS/60	BRIS/60	SYD/508	DAR/40	S.Aus/81	BRIS/18	TEX/02	Vic/502	Bris/46	Bris/46	Towns/8	History	
	Reference Antigens	**Clade**	**V1A**	**V1A**	**V1B**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**	**V1A**		
A	B/BRISBANE/60/2008	**V1A**	**160**	160	160	640	640	640	320	160	320	320	160	MX,M6	
B	B/BRISBANE/60/2008	**V1A**	160	**1280**	1280	320	1280	320	>2560	1280	1280	160	160	E6	
C	B/SYDNEY/508/2010	**V1B**	160	1280	**1280**	320	1280	320	>2560	1280	1280	160	160	E3	
D	B/DARWIN/40/2012	**V1A**	320	160	160	**640**	1280	640	320	160	320	320	160	MDCK4	
E	B/SOUTH AUSTRALIA/81/2012	**V1A**	160	1280	640	320	**1280**	320	>2560	640	1280	80	160	E5	
F	B/BRISBANE/18/2013	**V1A**	320	320	160	640	1280	**640**	640	160	160	320	160	MDCK3	
G	B/TEXAS/02/2013	**V1A**	160	640	640	320	640	320	**>2560**	640	640	80	160	E7	
H	B/VICTORIA/502/2015	**V1A**	160	1280	640	320	1280	320	>2560	**1280**	1280	160	160	E4	
I	B/BRISBANE/46/2015	**V1A**	320	1280	1280	320	1280	640	>2560	1280	**>2560**	160	320	E4	
J	B/BRISBANE/46/2015	**V1A**	320	160	160	640	640	640	320	160	320	**320**	160	MDCK3	
K	B/TOWNSVILLE/8/2016	**V1A**	320	320	160	640	640	640	640	160	320	640	**160**	MDCK3	
	Test Antigens														
1	B/SINGAPORE/INFKK-16-0604/2016		320	160	80	320	640	320	320	80	160	160	160	MDCK2	13/06/2016
2	B/SINGAPORE/INFKK-16-0626/2016		320	160	160	640	640	320	320	80	160	160	160	MDCK2	21/06/2016
3	B/SINGAPORE/INFKK-16-0624/2016		320	160	160	640	640	320	320	160	320	320	160	MDCK2	20/06/2016
4	B/SINGAPORE/INFKK-16-0509/2016		320	160	160	320	640	320	320	80	160	160	160	MDCK3	28/04/2016
5	B/SOUTH AUSTRALIA/20/2016		320	160	80	640	640	320	320	80	160	160	160	MDCK1	13/07/2016
6	B/SYDNEY/1005/2016		320	160	160	320	640	320	320	80	160	160	160	MDCK1	18/07/2016
7	B/VICTORIA/501/2016		320	160	160	320	640	320	640	80	160	160	160	MDCK1	3/06/2016
8	B/NEW CALEDONIA/8/2016		320	160	160	320	640	320	320	80	320	160	160	MDCK1	3/06/2016
9	B/NEW CALEDONIA/3/2016		320	160	160	320	640	320	320	80	320	160	160	MDCK1	26/01/2016
10	B/NEW CALEDONIA/7/2016		320	160	160	320	640	320	320	160	320	160	160	MDCK1	9/03/2016
11	B/VICTORIA/502/2016		320	160	80	640	640	320	320	80	160	320	160	MDCK1	1/08/2016
12	B/SOUTH AUCKLAND/9/2016		320	160	160	320	640	320	320	80	320	320	160	SX,M1	4/06/2016
13	B/SOUTH AUCKLAND/11/2016		320	160	160	320	640	320	320	80	160	160	160	MX,M1	8/06/2016
14	B/SOUTH AUCKLAND/10/2016		320	320	160	320	640	320	640	160	320	320	160	MX,M1	8/06/2016
15	B/AYUTTHAYA/118/16		320	320	160	320	640	320	640	160	320	160	160	X,M1	24/03/2016
16	B/NONTHABURI/139/16		320	160	160	320	640	320	320	80	160	160	160	X,M1	28/05/2016
17	B/SOUTH AFRICA/R2363/2016		320	320	160	320	640	640	640	160	320	320	160	X,M1	4/05/2016
18	B/SOUTH AFRICA/R2614/2016		320	160	160	640	640	640	640	160	320	320	320	X,M1	16/05/2016
19	B/SOUTH AFRICA/R3226/2016		320	160	160	320	640	320	320	160	320	320	160	X,M1	1/06/2016
20	B/SOUTH AFRICA/R3269/2016		320	160	160	640	640	320	320	80	320	320	160	X,M1	31/05/2016
21	B/SOUTH AFRICA/R3315/2016	**V1A**	320	320	160	640	1280	640	640	160	320	320	320	X,M1	2/06/2016
22	B/SOUTH AFRICA/R3326/2016		320	320	160	640	640	640	640	160	320	320	320	X,M1	1/06/2016
23	B/SOUTH AFRICA/R3387/2016		320	160	160	640	640	640	640	80	160	160	160	X,M1	6/06/2016
24	B/SRI LANKA/21/2016		320	160	160	320	640	320	320	80	160	160	160	MDCK1	3/08/2016
25	B/SRI LANKA/22/2016	**V1A**	320	160	160	640	640	640	320	160	160	160	160	MDCK1	4/08/2016
26	B/NAKHONRATCHASIMA/853/16		320	160	80	320	640	320	320	80	320	320	160	MDCK1	26/06/2016
27	B/PRACHUAPKHIRIKHAN/346/16	**V1A**	320	160	160	320	640	320	640	80	320	160	160	MDCK1	12/07/2016
28	B/SINGAPORE/INFKK-16-0548/2016	**V1A**	160	160	80	320	640	320	320	80	160	160	160	MDCK2	20/05/2016
29	B/PHILIPPINES/5/2016	**V1A**	160	640	640	160	1280	320	>2560	640	640	80	80	MDCK2	30/06/2016
30	B/SOUTH AFRICA/R4623/2016		160	160	80	320	640	320	320	80	160	160	160	X,M1	5/06/2016
31	B/SOUTH AFRICA/R4706/2016	**V1A**	160	160	160	320	640	320	320	80	160	160	160	X,M1	11/06/2016
32	B/SRI LANKA/13/2016		160	320	160	320	640	320	640	160	320	320	160	MDCK1	9/07/2016

Table 5.5: B viruses (B/Yamagata lineage) (2)

Haemagglutination Inhibition Assay - WHO Influenza Centre													
Reference Antisera													
			A	B	C	D	E	F	G	H	I		
	Mar 8, Jun 21, Jul 21, Aug 11, 2016		F3184	F3186	F3308	F3187	F3227	F3273	F3067	F3128	F3196		
	Sanger tree		E4	E4	MX,M2	E3/E1	M1/C2,M1	E4	MDCK1	E4	MDCK1	Passage	Date
	Sequenced by submitting lab		HBEI/158	WISC/1	MAL/412	MASS/2	MASS/2	PHK/3073	PHK/3073	BRIS/9	SYD/39	History	
	Reference Antigens	**Clade**	Y3		Y2	Y2	Y2	Y3		Y3	Y3		
A	B/HUBEI WUJIAGANG/158/2009	Y3	**320**	40	80	320	320	640	80	160	320	E7	
B	B/WISCONSIN/1/2010		320	**80**	80	320	160	640	80	160	160	E5	
C	B/MALAYSIA/412/2012	Y2	40	20	**640**	160	320	160	80	80	160	MX,M4	
D	B/MASSACHUSETTS/02/2012	Y2	320	40	80	**640**	320	320	20	40	80	E3.E2	
E	B/MASSACHUSETTS/02/2012	Y2	80	20	320	320	**640**	320	40	40	160	M1/C2,M4	
F	B/PHUKET/3073/2013	Y3	640	160	160	640	640	**1280**	160	320	320	E5	
G	B/PHUKET/3073/2013		160	40	160	160	320	320	**160**	160	320	MDCK3	
H	B/BRISBANE/9/2014	Y3	160	40	80	160	160	640	80	**80**	160	E5	
I	B/SYDNEY/39/2014	Y3	40	40	160	40	160	160	160	160	**320**	MDCK6	
	Test Antigens												
1	B/BRISBANE/15/2016	Y3	160	80	320	80	320	320	640	320	640	MDCK2	13/04/2016
2	B/PERTH/2/2016		80	40	320	40	320	320	320	320	640	MX,M1	3/02/2016
3	B/PERTH/9/2016	Y3	80	40	160	40	320	320	320	320	640	MX,M1	1/04/2016
4	B/PERTH/8/2016	Y3	80	40	320	40	320	160	320	320	640	MX,M1	28/03/2016
5	B/SYDNEY/5/2016	Y3	80	40	160	40	160	160	160	320	640	MX,M1	3/02/2016
6	B/TOWNSVILLE/3/2016	Y3	40	<20	80	<20	160	80	160	160	320	MDCK2	16/02/2016
7	B/TOWNSVILLE/4/2016	Y3	80	20	80	20	160	80	160	160	320	MDCK2	17/02/2016
8	B/TOWNSVILLE/5/2016		80	<20	80	20	160	80	160	160	320	MDCK2	16/02/2016
9	B/TOWNSVILLE/6/2016	Y3	80	<20	80	20	160	80	160	160	320	MDCK2	17/02/2016
10	B/PERTH/5/2016		80	20	160	20	160	80	160	640	640	MX,M1	26/02/2016
11	B/BRISBANE/10/2016	Y3	80	20	160	40	320	160	160	320	320	MDCK2	13/03/2016
12	B/BRISBANE/12/2016	Y3	80	20	160	40	640	160	160	160	640	MDCK2	19/03/2016
13	B/NEWCASTLE/4/2016	Y3	80	20	160	40	160	160	160	160	320	MDCK1	13/04/2016
14	B/SOUTH AUCKLAND/1/2016		80	20	160	80	160	160	160	160	320	MX,M1	16/01/2016
15	B/SOUTH AUCKLAND/5/2016	Y3	80	40	160	80	320	160	160	160	320	SX,M1	22/04/2016
16	B/SOUTH AUCKLAND/6/2016	Y3	80	20	160	40	160	160	160	160	320	SX,M1	4/05/2016
17	B/SOUTH AUCKLAND/7/2016	Y3	80	20	160	80	320	160	160	160	320	SX,M1	7/05/2016
18	B/BRISBANE/17/2016		80	20	160	80	320	160	160	160	320	MDCK2	17/05/2016
19	B/BRISBANE/18/2016	Y3	80	20	160	80	320	160	160	160	320	MDCK2	25/05/2016
20	B/SOUTH AUSTRALIA/18/2016	Y3	80	20	160	40	160	160	160	160	320	MDCK1	7/06/2016
21	B/SINGAPORE/INFTT-16-0493/2016	Y3	80	20	80	40	160	160	160	160	320	MDCK2	14/04/2016
22	B/SINGAPORE/INFEN-16-0307/2016	Y3	40	20	80	40	160	80	160	160	320	MDCK2	6/04/2016
23	B/SINGAPORE/INFGP-16-1054/2016	Y3	80	20	80	40	160	160	160	160	320	MDCK3	9/05/2016
24	B/SINGAPORE/INFTT-16-0610/2016	Y3	80	20	80	40	160	160	160	80	320	MDCK2	2/06/2016
25	B/TOWNSVILLE/2/2016	Y3	40	<20	80	<20	80	80	80	80	160	MDCK2	16/02/2016
26	B/CANBERRA/4A/2016		80	20	160	40	160	80	80	160	320	MDCK1	15/05/2016
27	B/SOUTH AUSTRALIA/19/2016	Y3	40	20	80	20	160	80	80	160	320	MDCK1	9/06/2016
28	B/VICTORIA/2/2016	Y3	40	20	80	20	80	80	80	160	320	MDCK1	20/05/2016
29	B/VICTORIA/3/2016		40	20	80	20	160	80	80	160	320	MDCK1	22/06/2016
30	B/NEWCASTLE/6/2016		20	20	40	20	80	80	80	80	160	MDCK1	13/07/2016
31	B/SINGAPORE/INFGP-16-0982/2016	Y3	40	20	40	20	80	80	80	160	160	MDCK2	22/04/2016
32	B/SINGAPORE/INFKK-16-0448/2016	Y3	40	20	40	40	80	80	80	80	160	MDCK2	5/04/2016
33	B/SINGAPORE/INFKK-16-0504/2016	Y3	40	20	80	20	80	80	80	160	160	MDCK2	25/04/2016
34	B/SINGAPORE/INFGP-16-1079/2016	Y3	40	20	80	20	160	80	80	160	320	MDCK2	12/05/2016
35	B/SINGAPORE/INFNTF-16-0004/2016	Y3	40	20	80	20	80	80	80	80	160	MDCK2	10/06/2016
36	B/SINGAPORE/INFGP-16-1190/2016	Y3	40	20	80	40	160	160	80	160	320	MDCK2	2/06/2016

Figure 5.4. Phylogenetic relationships among influenza B HA genes B/Victoria Lineage

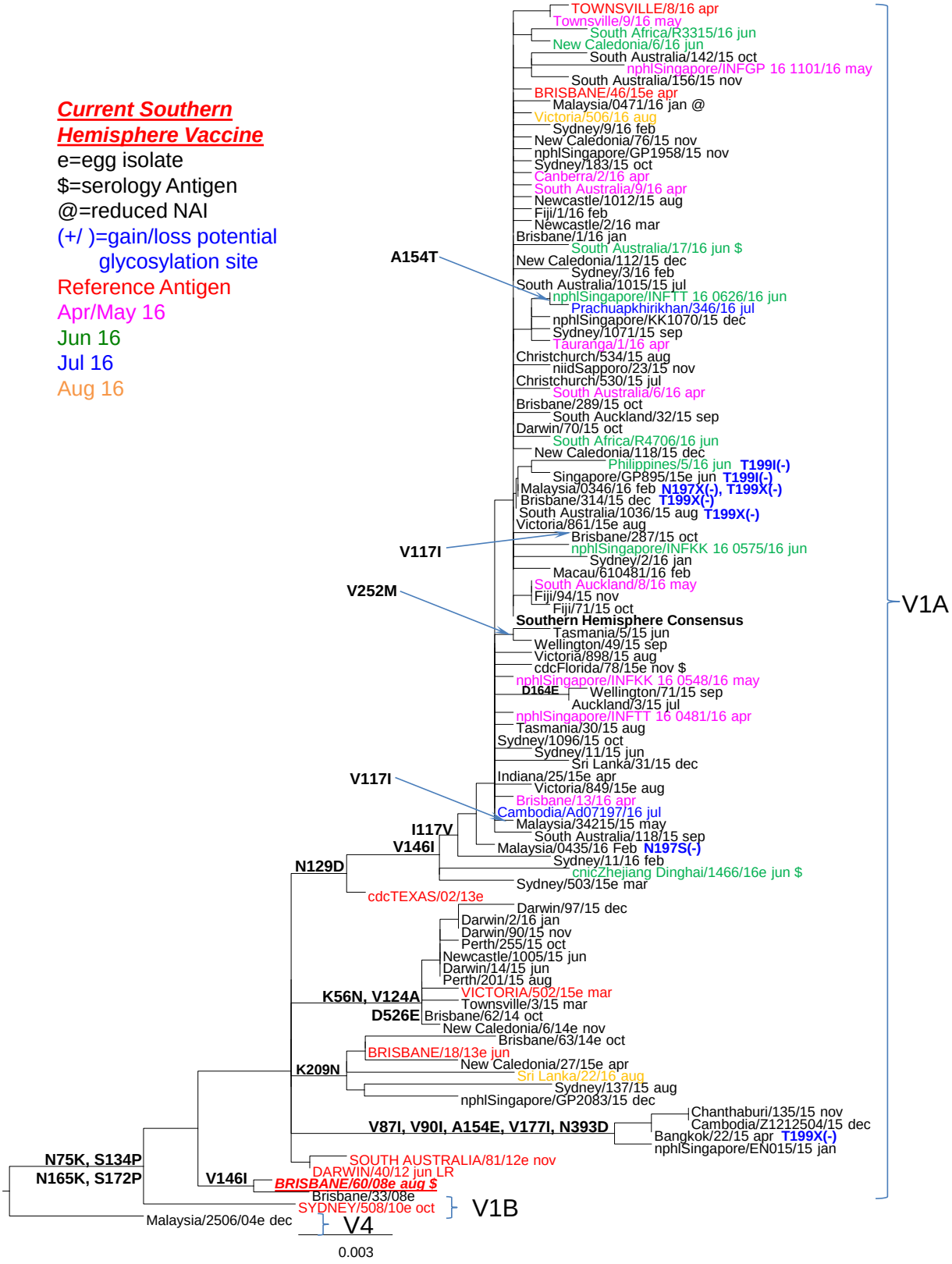


Figure 5.5. Phylogenetic relationships among influenza B neuraminidase genes B/Victoria Lineage

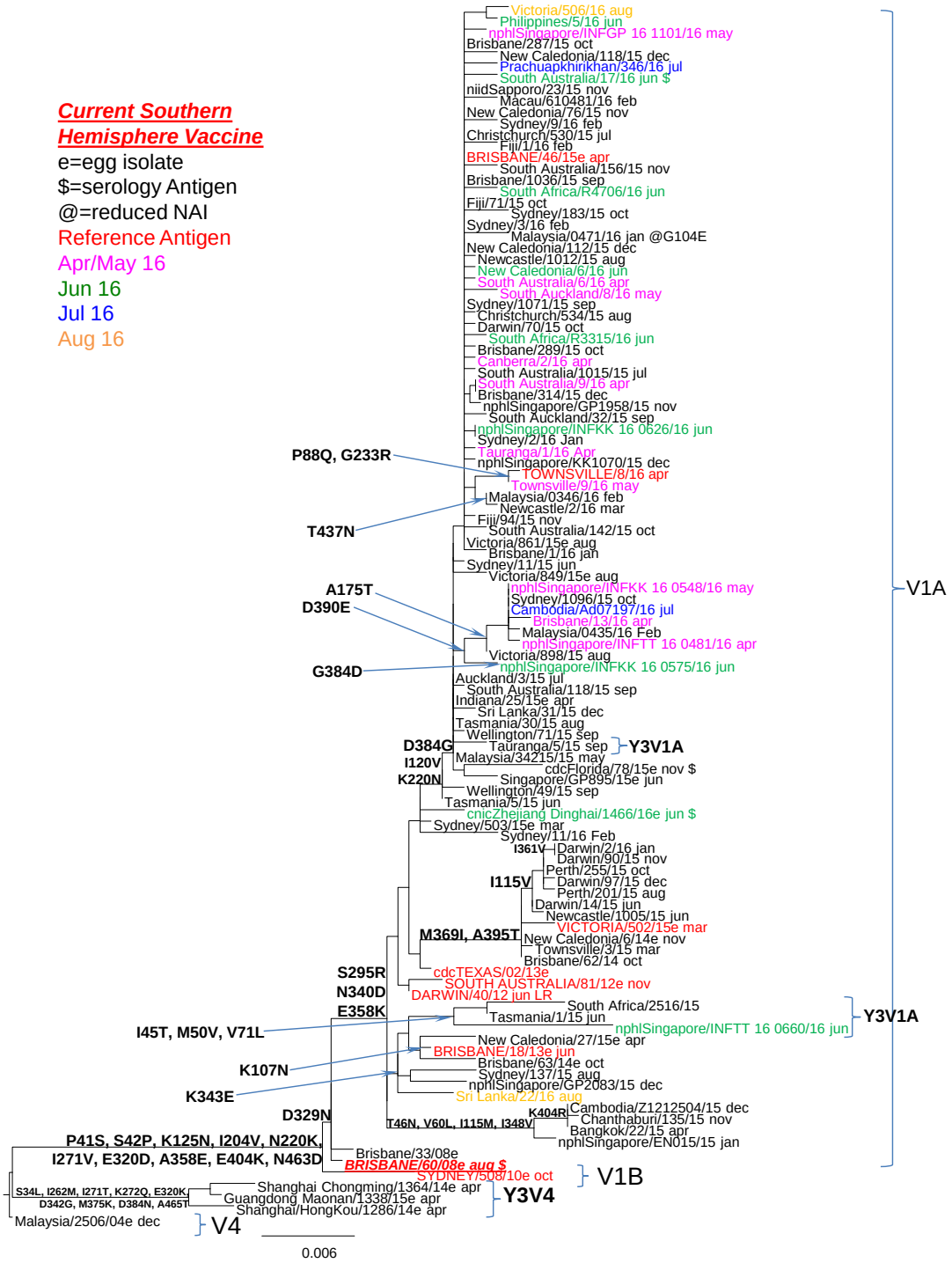


Figure 5.6. Phylogenetic relationships among influenza B HA genes B/Yamagata Lineage

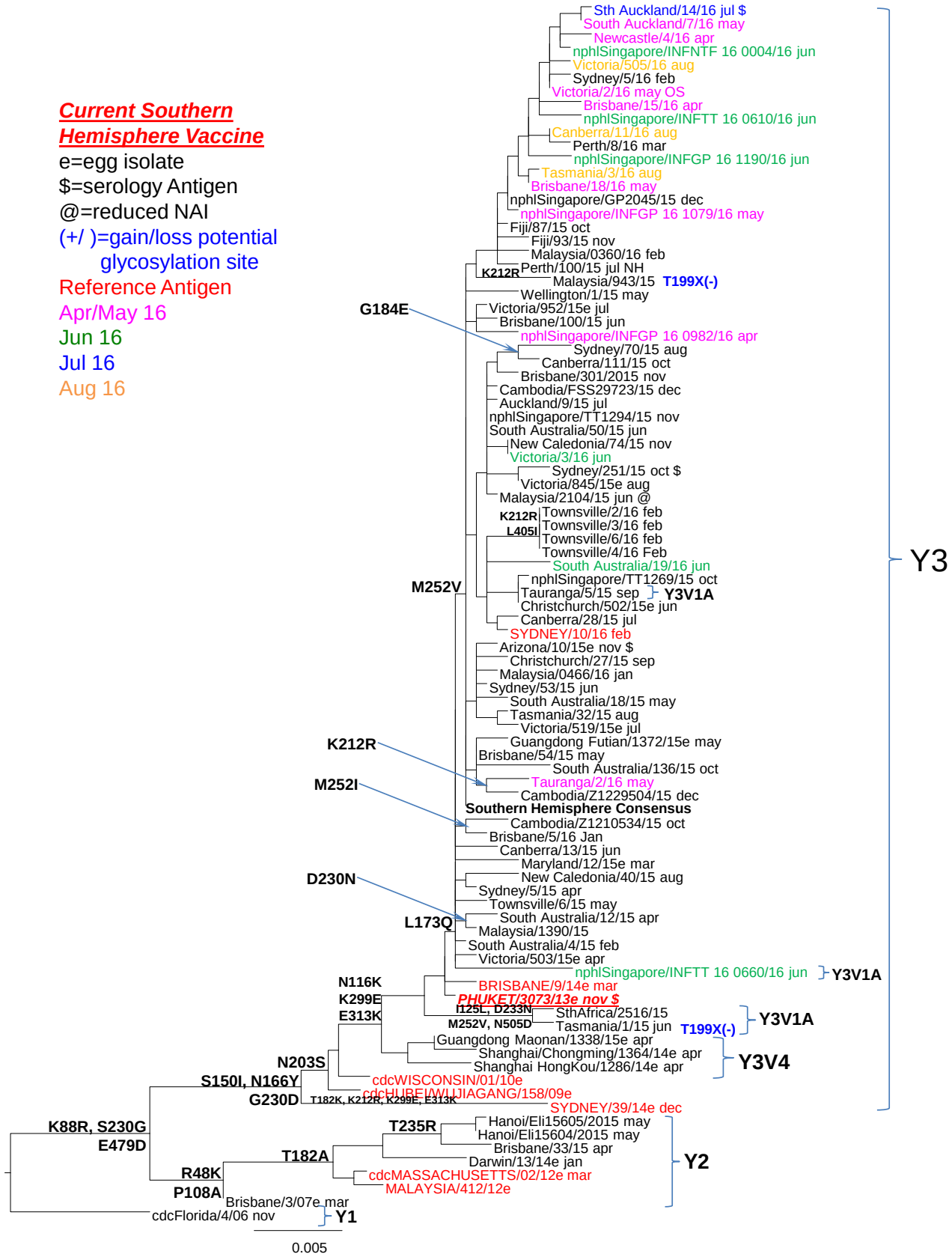


Figure 5.7. Phylogenetic relationships among influenza B neuraminidase genes B/Yamagata Lineage

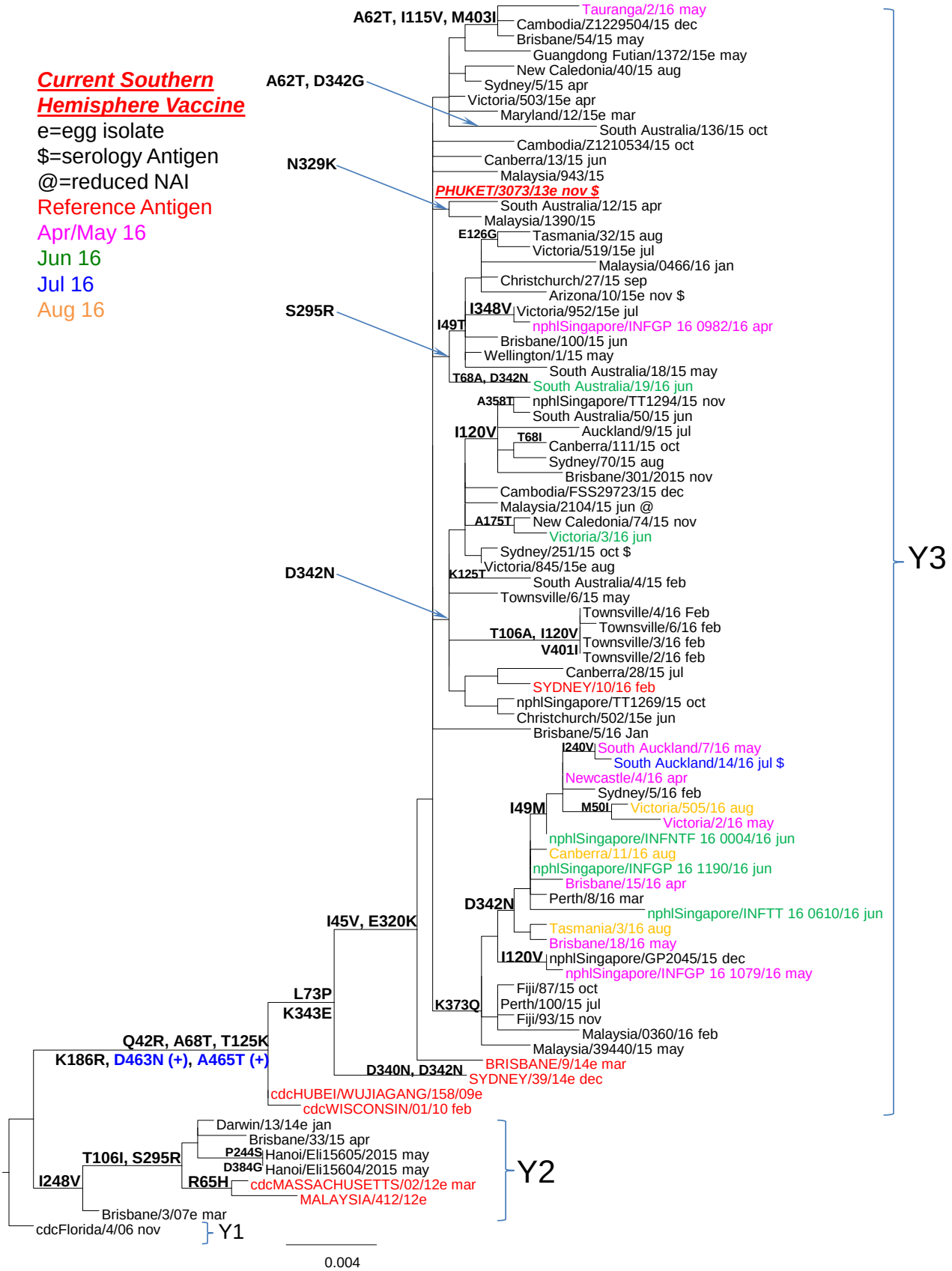


Table 5.11. Haemagglutination inhibition antibody titres (Egg) Influenza type B Victoria vaccine component – Paediatric

Antigen		n	Passage History	Mean Rise	% Rise	GMT Post	GMT Pre	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/Brisbane/60/2008	USA	24	E8	4.04	100	6	92	0	96	79	38

Table 5.11. Haemagglutination inhibition antibody titres (Cell) Influenza type B Victoria vaccine component – Adult

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/South Australia/17/2016	AUS	24	MDCK2	1.54	42	6	18	0	29	17	8
	USA	23		1.09	30	5	11	0	13	4	4
B/Townsville/7/2016	AUS	24	MDCK3	2.33	67	9	48	8	71	46	25
	USA	23		1.91	52	7	25	0	48	17	9

Table 5.12. Haemagglutination inhibition antibody titres (Cell) Influenza type B Victoria vaccine component – Elderly

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/South Australia/17/2016	AUS	24	MDCK2	1.04	29	7	15	8	33	12	4
	USA	24		1.08	25	7	16	0	33	8	8
B/Townsville/7/2016	AUS	24	MDCK3	1.46	38	9	26	21	46	21	17
	USA	24		1.42	42	13	35	25	62	38	12

Table 5.13 Haemagglutination inhibition antibody titres (Cell) Influenza type B Victoria vaccine component – Paediatric

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/Townsville/7/2016	USA	24	MDCK3	0.33	12	5	6	0	4	0	0

Table 5.17. Haemagglutination inhibition antibody titres (Cell)
Influenza type B Yamagata vaccine component – Adult

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/Arizona/10/2015 (Y3)	AUS	24	M/MDCK1	1.71	38	27	90	50	75	71	42
B/South Auckland/14/2016 (Y3)	AUS	24	MX/MDCK2	1.5	42	12	34	21	58	38	17
B/Sydney/5/2016 (Y3)	AUS	24	MX/MDCK2	1.79	46	22	78	33	75	58	42
	USA	23		2.83	70	18	126	43	91	74	65

Table 5.18. Haemagglutination inhibition antibody titres (Cell)
Influenza type B Yamagata vaccine component – Elderly

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/Arizona/10/2015 (Y3)	AUS	24	M/MDCK1	1.25	46	13	32	8	58	17	4
B/South Auckland/14/2016 (Y3)	AUS	24	MX/MDCK2	1	33	9	17	4	21	4	4
B/Sydney/5/2016 (Y3)	AUS	24	MX/MDCK2	1.21	33	11	25	8	33	17	4
	USA	24		1.42	38	17	46	29	71	50	29

Table 5.19. Haemagglutination inhibition antibody titres (Cell)
Influenza type B Yamagata vaccine component – Paediatric

Antigen		n	Passage History	Mean Rise	% Rise	GMT Pre	GMT Post	% 40 Pre	% 40 Post	% 80 post	% 160 post
B/Sydney/5/2016 (Y3)	USA	24	MDCKX/MDCK2	1.54	50	5	16	4	33	12	4

APPENDIX 6 - WHO RECOMMENDATION FOR INFLUENZA VACCINES

World Health Organization
Organisation mondiale de la Santé

Weekly epidemiological record
Relevé épidémiologique hebdomadaire

14 OCTOBER 2016, 91th YEAR / 14 OCTOBRE 2016, 91e ANNÉE
No 41, 2016, 91, 469–484
http://www.who.int/wer

Contents

Sommaire

Recommended composition of influenza virus vaccines for use in the 2017 southern hemisphere influenza season

September 2016

WHO convenes technical consultations[1] in February and September each year to recommend viruses for inclusion in influenza vaccines[2] for the northern and southern hemisphere influenza seasons, respectively. This recommendation relates to the influenza vaccines for use in the forthcoming southern hemisphere 2017 influenza season. A recommendation will be made in February 2017 relating to vaccines that will be used for the northern hemisphere 2017–2018 influenza season. For countries in equatorial regions, epidemiological considerations influence which recommendation (February or September) individual national and regional authorities consider appropriate.

Seasonal influenza activity, January 2016 – August 2016

Between January and August 2016, low to widespread influenza activity was reported in Africa, the Americas, Asia, Europe and Oceania predominantly due to the circulation of influenza A(H1N1)pdm09 and B with some outbreaks of A(H3N2) viruses. In the northern hemisphere, influenza activity was high from January until April/May and declined thereafter with the exception of several countries in the Americas and Asia. In the southern hemisphere, activity remained low until March after which moderate to high activity was reported by a number of countries (*Map 1*).

[1] See http://www.who.int/influenza/vaccines/virus/en/

[2] The description of the process of influenza vaccine virus selection and development available at: http://www.who.int/gb/pip/pdf_files/Fluvaccvirusselection.pdf

Composition recommandée pour les vaccins antigrippaux devant être utilisés pendant la saison grippale 2017 dans l'hémisphère Sud

Février 2016

L'OMS convoque chaque année des consultations techniques[1] en février et en septembre pour recommander les virus devant entrer dans la composition des vaccins contre la grippe[2] qui seront utilisés pendant les saisons grippales dans l'hémisphère Nord et l'hémisphère Sud, respectivement. La présente recommandation s'applique aux vaccins contre la grippe à utiliser pendant la prochaine saison grippale dans l'hémisphère Sud (2017). Une recommandation concernant les vaccins devant servir pendant la saison grippale dans l'hémisphère Nord (2017-2018) sera formulée en février 2017. Pour les pays des régions équatoriales, les autorités nationales et régionales s'appuieront sur des considérations d'ordre épidémiologique pour déterminer individuellement la recommandation qu'il convient d'appliquer (février ou septembre).

Activité grippale saisonnière, janvier 2016-août 2016

De janvier à août 2016, une activité grippale faible à étendue a été signalée en Afrique, dans les Amériques, en Asie, en Europe et en Océanie, en raison principalement de la circulation des virus grippaux A(H1N1)pdm09 et B, avec quelque flambées d'infections par le virus A(H3N2). Dans l'hémisphère Nord, l'activité grippale a été forte de janvier jusqu'en avril/mai puis a diminué sauf dans plusieurs pays des Amériques et d'Asie. Dans l'hémisphère Sud, l'activité est restée faible jusqu'en mars, après quoi une activité modérée à forte a été rapportée par un certain nombre de pays (*Carte 1*).

[1] Voir http://www.who.int/influenza/vaccines/virus/en

[2] La description des processus de sélection et de mise au point des virus grippaux est disponible à l'adresse http://www.who.int/gb/pip/pdf_files/Fluvaccvirusselection.pdf

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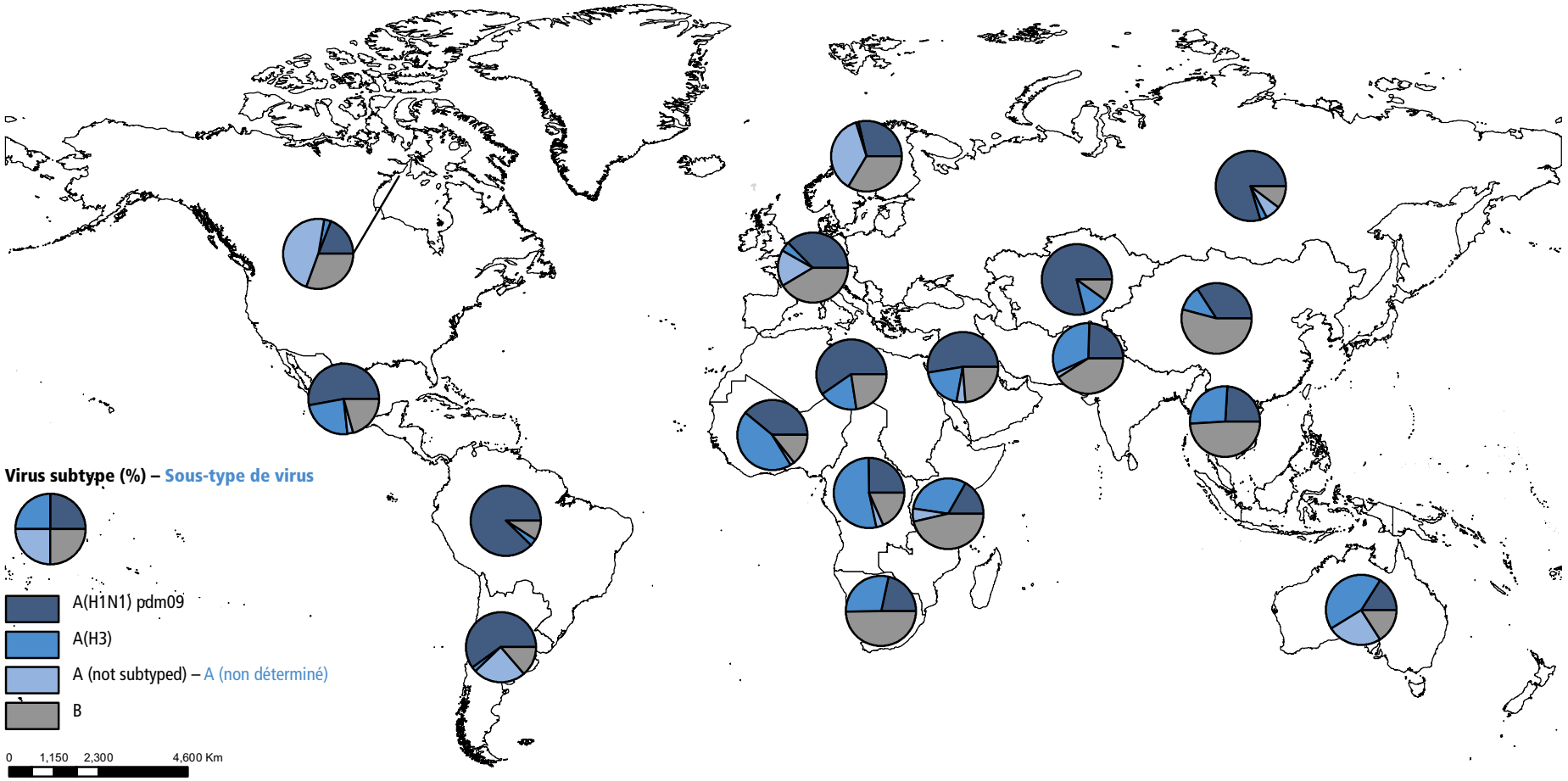
Map 1 **Distribution of influenza-virus subtypes by influenza transmission zone, January to September 2016**
Carte 1 **Répartition des sous-types de virus grippaux par zone de transmission de la grippe, janvier-septembre 2016**



Note: The available country data were joined in larger geographical areas with similar influenza transmission patterns to be able to give an overview (www.who.int/influenza/surveillance_monitoring/updates/EN_GIP_Influenza_transmission_zones.pdf). – **Note:** on a regroupé les données par pays disponibles à l'intérieur de zones géographiques plus larges caractérisées par des schémas similaires de transmission de la grippe en vue d'en donner une présentation plus générale (www.who.int/influenza/surveillance_monitoring/updates/EN_GIP_Influenza_transmission_zones.pdf).

Northern hemisphere temperate region

Regional and widespread influenza activity was reported until April/May with influenza A(H1N1)pdm09 and B viruses co-circulating in most countries of Europe and several countries in Asia. In addition, a few countries in Europe and Asia, including China, reported regional outbreaks of A(H3N2) influenza virus in the early part of the year. North America reported high influenza activity caused by A(H1N1)pdm09 from January until May, type B viruses from January until June and A(H3N2) from March until May.

Southern hemisphere temperate region

Influenza activity was low in the early part of the year. Regional and widespread activity was reported from May onwards in southern Africa with early predominance of influenza B viruses, followed by the circulation of influenza A(H3N2) and A(H1N1)pdm09 viruses. Regional to widespread activity was reported in the southern cone of the Americas from March onwards with influenza B virus co-circulating with A(H1N1) pdm09 and regional A(H3N2) activity was reported in May. Oceania reported low circulation of viruses until March. High A(H1N1)pdm09 activity was reported in Papua New Guinea in March and in Fiji A(H3N2) activity was high in May. Australia reported high activity of A(H3N2) with co-circulation of influenza B virus from June to September.

Tropical and subtropical regions

Influenza activity was variable but low overall in the tropical and subtropical regions of Africa. In Egypt there was an influenza B virus outbreak from March to May. In West Africa there was low influenza activity; however Ghana reported local to regional A(H3N2) activity from April to July. In Central Africa widespread activity was reported by the Democratic Republic of Congo from April to July and the Central African Republic from July to September. Influenza activity was variable in tropical America with a few countries reporting regional A(H1N1)pdm09 activity between March and June. Influenza activity was variable in tropical and subtropical Asia with regional outbreaks of A(H1N1)pdm09 followed by co-circulation of A(H3N2) and B viruses reported by several countries in tropical Asia and some countries in the Middle East from January until April.

Detailed information by country of the extent and type of seasonal influenza activity worldwide are summarized in *Table 1*.

Zoonotic influenza infections caused by A(H5), A(H7N9), A(H9N2), A(H1N2)v and A(H3N2)v viruses

From 23 February 2016 to 26 September 2016, 4 human cases of A(H5N6) infection were reported by China and 10 human cases of A(H5N1) infection were reported by Egypt. The disease onset date for 2 of the cases from Egypt predated this reporting period. Highly pathogenic avian influenza A(H5) is present in poultry in both countries. Since December 2003, a total of

Région tempérée de l'hémisphère Nord

Une activité grippale régionale et étendue a été signalée jusqu'en avril/mai, avec une cocirculation des virus A(H1N1)pdm09 et B dans la plupart des pays d'Europe et dans plusieurs pays d'Asie. En outre, quelques pays d'Europe et d'Asie, dont la Chine, ont rapporté des flambées régionales d'infection par des virus grippaux A(H3N2) dans la première partie de l'année. L'Amérique du Nord a notifié une forte activité grippale due à la souche A(H1N1)pdm09 de janvier à mai, à des virus de type B de janvier à juin et à des virus A(H3N2) de mars à mai.

Région tempérée de l'hémisphère Sud

L'activité grippale a été faible dans la première partie de l'année. Une activité régionale et étendue a été rapportée à partir du mois de mai dans le sud de l'Afrique, avec une prédominance précoce des virus grippaux B, suivie de la circulation des virus grippaux A(H3N2) et A(H1N1)pdm09. Une activité régionale à étendue a été signalée dans le cône Sud des Amériques à partir du mois de mars, avec une cocirculation de virus grippaux B et A(H1N1)pdm09 et une activité régionale de la grippe A(H3N2) a été signalée en mai. L'Océanie a rapporté une faible circulation virale jusqu'en mars. Une forte activité de la grippe A(H1N1) pdm09 a été signalée en Papouasie-Nouvelle-Guinée en mars et aux Fidji, l'activité de la grippe A(H3N2) a été intense en mai. L'Australie a indiqué une forte activité des virus A(H3N2), avec une cocirculation de virus grippaux B de juin à septembre.

Régions tropicales et subtropicales

L'activité grippale a été variable, mais globalement faible, dans les régions tropicales et subtropicales d'Afrique. En Égypte, une flambée de grippe B s'est déroulée de mars à mai. En Afrique de l'Ouest, l'activité grippale a été faible, avec néanmoins une activité locale à régionale de la grippe A(H3N2), d'avril à juillet au Ghana. En Afrique centrale, la République démocratique du Congo a fait état d'une activité grippale étendue d'avril à juillet et la République centrafricaine de juillet à septembre. L'activité grippale a été variable dans l'Amérique tropicale, avec la notification par quelque pays d'une activité régionale des virus A(H1N1)pdm09 entre mars et juin. L'activité grippale a également été variable en Asie tropicale et subtropicale, avec des flambées régionales de virus A(H1N1)pdm09, suivies de la cocirculation de virus A(H3N2) et B, signalée par plusieurs pays d'Asie tropicale et par certains pays du Moyen-Orient de janvier à avril.

Des informations détaillées par pays sur l'ampleur et le type de l'activité grippale saisonnière dans le monde sont récapitulées dans le *Tableau 1*.

Infections grippales zoonotiques causées par les virus A(H5), A(H7N9), A(H9N2), A(H1N2)v et A(H3N2)v

Du 23 février 2016 au 26 septembre 2016, 4 cas humains d'infection par un virus A(H5N6) ont été notifiés par la Chine et 10 cas humains d'infection par un virus A(H5N1) ont été signalés par l'Égypte. Pour 2 des cas égyptiens, la date d'apparition de la maladie était antérieure à la période de rapport. La grippe aviaire A(H5) hautement pathogène est présente chez les volailles dans les 2 pays. Depuis décembre 2003, 870 cas humains

Table 1 **Extent and type of influenza activity worldwide, January–early September 2016**
Tableau 1 **Etendue et type d'activité grippale saisonnière dans le monde, janvier-début septembre 2016**

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Africa – Afrique									
Algeria – Algérie	•H1(pdm09), •H3, •B	•••H1(pdm09), •H3	••H1(pdm09), •H3						
Burkina Faso			•H1(pdm09), •B	•H3	•B	•H3			
Cameroon – Cameroun	•H1(pdm09), •H3, •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B	•H1(pdm09), ••H3, ••B	•••H3, •B	•H3		
Central African Republic – République centrafricaine						•H1(pdm09), •H3	•H1(pdm09), ••••H3	•H1(pdm09), ••••H3, •B	•H1(pdm09), ••••H3, •B
Côte d'Ivoire	•A	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3		
Democratic Republic of the Congo – République démocratique du Congo	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B	••••H1(pdm09), •H3, ••••B	••••H1(pdm09), ••••B	••••H1(pdm09), ••••H3	••••H3		
Egypt – Egypte	•••H1(pdm09), •H3, •B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H3, •B	•H3, •B	•H3, •B	•H3, •B
Ethiopia – Ethiopie	••H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B			
Ghana		•H1(pdm09), •H3	•H1(pdm09), •H3	••H1(pdm09), ••H3	•H1(pdm09), •••H3, ••B	•H1(pdm09), •••H3, •B	•H1(pdm09), ••H3, •B	0	0
Kenya	•H1(pdm09), •B	•H1(pdm09), •H3, ••B	••B	••B	•H3, •B	•H3, •B	•H1(pdm09), •H3, ••B	•H1(pdm09), •••H3, •B	
Madagascar	•H1(pdm09)	••H1(pdm09), •H3, •B	•H1(pdm09), ••H3, •B	•H1(pdm09), ••H3	•H3, •B	•H3, ••B	••B	••B	••B
Mali	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	H1(pdm09), B	•B			
Mauritania – Mauritanie		•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09)	•B				
Mauritius – Maurice	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3, •B	0	0	0	0
Morocco – Maroc	••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, •B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•B	•H3		0
Mozambique			•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09)
Niger	•H1(pdm09), •H3, •B	••H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•B	•H3	•H3		
Nigeria – Nigéria	•H1(pdm09), •B	••H1(pdm09)	•H1(pdm09)	•B					
Rwanda		•H3	•H1(pdm09)	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B			
Senegal – Sénégal	•H3	•A	•H1(pdm09)	•H1(pdm09)	•H1(pdm09)	•A			
South Africa – Afrique du Sud	•H3, •B	•H1(pdm09), •B	•H1(pdm09), •B	H1(pdm09), •B	•H1(pdm09), •H3, •••B	•H1(pdm09), ••H3, •••B	••H1(pdm09), •••H3, •••B	••H1(pdm09), •••H3, ••B	••H1(pdm09), •H3, •B
Togo	•H1(pdm09)		•H1(pdm09)	•H1(pdm09), •H3	•H1(pdm09), ••H3	•H1(pdm09), •H3			
Tunisia – Tunisie	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), •••H3	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •B			
Uganda – Ouganda	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B			
United Republic of Tanzania – République-Unie de Tanzanie	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3, •B	•H3, •B	•H3, •B
Zambia – Zambie	•B	•H3, •B	•H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3, •B	•B	•B	0

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Americas – Amériques									
Argentina – Argentine	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	••••H1(pdm09), •••H3, •••B	••••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •B	
Bahamas				•H1(pdm09)					
Barbados – Barbade	•B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•B	•B	•B		
Belize		••••H1(pdm09), ••H3, ••B	••••H1(pdm09), •••H3, B	•••H1(pdm09), H3, •••B,	•••H1(pdm09), •••B	••••H1(pdm09), •••H3, •••B	••••H1(pdm09), H3, ••••B	••••H1(pdm09) ••••B	
Bolivia (Plurinational State of) – Bolivie (Etat plurinational de)	•H1(pdm09), ••H3	•H1(pdm09), ••H3	•H1(pdm09)	•H1(pdm09), •B	•••H1(pdm09), •H3, •B	•H3, ••B	••H1(pdm09), •H3, •B	•H1(pdm09)	•B
Brazil – Brésil	•••H1(pdm09), •H3, ••B	••••H1(pdm09), ••H3, ••B	•H1(pdm09), ••H3	••••H1(pdm09), •H3, •••B	••••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), ••B	•H1(pdm09), •B	•B
Canada	••••H1(pdm09), ••H3, •••B	••••H1(pdm09), •H3, ••••B	••••H1(pdm09), •••H3, ••••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •••H3, •••B	•H1(pdm09), •H3, •••B			
Chile – Chili	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	••••H1(pdm09), ••H3, •••B	•••H1(pdm09), ••H3, •••B	••H1(pdm09), ••H3, •B
Colombia – Colombie	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	•••H1(pdm09), •B	•••H1(pdm09), •B	••••H1(pdm09), •H3, ••••B	••••H1(pdm09), ••••H3, ••••B	••H1(pdm09)
Costa Rica	••••H1(pdm09), ••••H3	•H1(pdm09), •H3	•H1(pdm09), •B	•H1(pdm09)	•H1(pdm09)	•H1(pdm09)	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B
Cuba	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3, •B	•H3, •B	•H3, •B	•H1(pdm09), ••B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), ••B
Dominica – Dominique					•H1(pdm09)				
Dominican Republic – République dominicaine			•B	•H1(pdm09), •B	H1(pdm09), •B	•B	•B	•B	•B
Ecuador – Equateur	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), ••H3, ••B	•••H1(pdm09), ••H3, ••B	•••H1(pdm09), ••H3, •B	•••H1(pdm09), ••H3, ••B	••H1(pdm09), •H3, •B	•H1(pdm09)	
El Salvador	•H1(pdm09)	•••H1(pdm09)	•H1(pdm09)	•••H1(pdm09)	•H1(pdm09)	•••H1(pdm09)	•H1(pdm09), •B	•B	
France, French Guiana – France, Guyane française		•H1(pdm09), •B	•H1(pdm09), •B	H1(pdm09), B,	H1(pdm09), B	H1(pdm09), B	H1(pdm09)		
France, Martinique	••H1(pdm09), •H3, •B	•••H1(pdm09), •B	•H1(pdm09), •B	B	H1(pdm09), H3, B				
France, Guadeloupe	•H1(pdm09), •H3, •B	•H1(pdm09)	•H1(pdm09), •B	H1(pdm09), H3					
Grenada – Grenade	•H1(pdm09)								
Guatemala	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3	•H3, •B	•B	•B	•B
Honduras	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •B	•H1(pdm09), •B		•B	•B
Jamaica – Jamaïque	••••H1(pdm09), •H3	••••H1(pdm09), •H3	••••H1(pdm09), •H3, •B	•H1(pdm09)	••H1(pdm09), ••B	•B	•H3, •B	•B	•B
Mexico – Mexique	••H1(pdm09), ••H3, ••B	••H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	
Nicaragua	•H1(pdm09)	•H1(pdm09)				•H1(pdm09)			
Panama	••H1(pdm09), •H3, •B	•H1(pdm09), •B	•H1(pdm09)	•H1(pdm09)	•••H1(pdm09)	••••H1(pdm09)	•H1(pdm09)		
Paraguay	•H3, •B	•H1(pdm09), •B	•H1(pdm09), •B	••••H1(pdm09), •H3, ••••B	•••H1(pdm09), •H3, •••B	••••H1(pdm09), •H3, •••B	•••H1(pdm09), ••B	•H1(pdm09), •B	
Peru – Pérou	•H1(pdm09), •B	••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Saint Kitts and Nevis – Saint-Kitts-et-Nevis		•H1(pdm09)							
Saint Lucia – Sainte-Lucie				•H1(pdm09)					
Saint Vincent and the Grenadines – Saint-Vincent-et-les-Grenadines					•H1(pdm09)				
Suriname	•H1(pdm09)	•H1(pdm09)	•H1(pdm09)	•H1(pdm09), •B	•H1(pdm09), •B	•H3	•H1(pdm09), •H3, •B	•H3, •B	•H3
Trinidad and Tobago – Trinité-et-Tobago	•H3, •B	•H1(pdm09)		•H1(pdm09)					
United Kingdom of Great Britain and Northern Ireland, Bermuda – Royaume-Uni et Irlande du Nord, Bermudes				•H1(pdm09)					
United Kingdom of Great Britain and Northern Ireland, British Virgin Islands – Royaume-Uni et Irlande du Nord, Îles Vierges britanniques				•H1(pdm09)					
United Kingdom of Great Britain and Northern Ireland, Montserrat – Royaume-Uni et Irlande du Nord, Montserrat				•H1(pdm09)					
United States of America – Etats-Unis d'Amérique	•••H1(pdm09), ••H3, •••B	••••H1(pdm09), ••H3, ••••B	•••H1(pdm09), •••H3, ••••B	•••H1(pdm09), ••H3, ••••B	•••H1(pdm09), ••H3, ••••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B
Uruguay	•B			•H1(pdm09)	••••H1(pdm09)	••••H1(pdm09)	••••H1(pdm09)	0	0
Venezuela (Bolivarian Republic of) – Venezuela (République bolivarienne du)		•B	•B						
Asia – Asie									
Afghanistan	•H1(pdm09), •H3, •B	•B			•H3	•H1(pdm09), •H3			
Bahrain – Bahreïn	••H1(pdm09), •B	•H1(pdm09), ••B	••B	••H1(pdm09), ••B	••B	•B			
Bangladesh	•H1(pdm09), •H3, •B	••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •••H3, •••B	•••H3, ••B	•H3,••B	•B	•B
Bhutan – Bhoutan	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), ••H3, •B	•H3	•H3			
Cambodia – Cambodge	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	••H1(pdm09), ••B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B
China – Chine	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), ••H3, •••B	••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B
China, Hong Kong SAR – Chine, Hong Kong, RAS	••••H1(pdm09), •••H3, •••B	•••H1(pdm09), ••H3, •••B	•••H1(pdm09), ••H3, •••B	•••H1(pdm09), ••H3, •••B	•••H1(pdm09), ••H3, •••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), •••H3, •••B	••H1(pdm09), ••H3, ••B
India – Inde	•H1(pdm09), •H3, •B	•••H1(pdm09), •••H3, •B	•••H1(pdm09)	•H1(pdm09), •H3, •B	•H1(pdm09), •H3	•H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	0

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Indonesia – Indonésie	•••H1(pdm09), ••H3, ••B	••H1(pdm09), ••H3, •••B	•H1(pdm09), •••H3, •••B	•••H1(pdm09), •••H3, •••B	•H1(pdm09), •H3, •B				
Iran (Islamic Republic of) – Iran (République islamique d')	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •••H3, •••B	•H1(pdm09), •H3, ••B	•H3, •B	•H1(pdm09), •H3, •B				
Iraq	•••H1(pdm09), •H3, ••B	•H1(pdm09), •B	•B	•H3	•H1(pdm09)				
Israel – Israël	•••H1(pdm09), •••B	•••H1(pdm09), •H3, •••B	••H1(pdm09), •B	•H1(pdm09), •B					
Japan – Japon	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), ••H3, ••••B	••••H1(pdm09), ••H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09)	H1(pdm09),H3, B		
Jordan – Jordanie	•••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	•H1(pdm09), •H3, ••B	•H3, •B	•H3, •B			
Kazakhstan	••••H1(pdm09), •••H3	•••H1(pdm09), •••H3, •B	•H1(pdm09), •H3, •B	•H3, •B	•B	B			
Kyrgyzstan – Kirghizistan	•••H1(pdm09), •B	••H1(pdm09), •H3							
Lao People's Democratic Republic – République démocratique populaire lao	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, ••B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B
Lebanon – Liban	•H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	•H3, •B	•H3, •B	•B				
Malaysia – Malaisie	•H1, •B	••H1(pdm09), •H3, ••B	•H1(pdm09), •••B	••H1(pdm09), •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B	•H1(pdm09), ••H3, •B		
Maldives	no activity	no activity							
Myanmar	•H3			•B	•B	•B	•B	••B	••B
Mongolia – Mongolie	•H1(pdm09), •B	•H1(pdm09), ••B	•H1(pdm09), ••B	•B	•B	no activity	no activity	no activity	no activity
Nepal – Népal	••H1(pdm09), •••H3, •••B	••H1(pdm09), •••H3, •••B	•H1(pdm09), ••H3, ••B	•H3, •B	•H1(pdm09), ••B	•H3, •••B	•••H3, •••B	••H3, •••B	•H3, •B
Oman	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •••H3, •••B	•••H1(pdm09), •••H3, •••B	••H1(pdm09), ••H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B		
Pakistan	••••H1(pdm09), ••H3, •B	••H1(pdm09), ••H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), •B	•B				
Philippines	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •H3, ••B	•H1(pdm09), ••H3, ••B	•H3, •B
Qatar	•••H1(pdm09), •••B	•••H1(pdm09), •••B	••H1(pdm09), •••B	•H1(pdm09), •••B	•H1(pdm09), •••B	•H1(pdm09), •B	•B	•H1(pdm09), •B	
Republic of Korea – République de Corée	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B	•B		•H3, •B	•H3
Singapore – Singapour	••H1(pdm09), ••H3, ••B	••H1(pdm09), ••H3, •••B	••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, ••B	•H1(pdm09), •••H3, •B	•H1(pdm09), •••H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B
Sri Lanka	•H1(pdm09), ••H3, •B	•B	•B	•H1(pdm09), •B	•H1(pdm09), •H3,•B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3	•H3	•H3
Tajikistan – Tadjikistan	H1(pdm09) H3, B	•H1(pdm09), •H3		•H3, •B					
Thailand – Thaïlande	•H1(pdm09), •H3, •B	••H1(pdm09), ••H3, •••B	••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	••H1(pdm09), ••H3, ••B	•H1(pdm09), •H3, •B
Turkey – Turquie	••••H1(pdm09), ••••H3, •••B	••••H1(pdm09), ••••H3, •••B	•H1(pdm09), •••H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •B				
Turkmenistan – Turkménistan	no activity – pas d'activité	no activity – pas d'activité	no activity – pas d'activité						

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Uzbekistan – Ouzbékistan	•H1(pdm09)	•••H1(pdm09), •B	•H1(pdm09), •H3, •B	•B	•B				
Viet Nam	•B	•H1(pdm09), •H3, •B	•H1(pdm09) , •B	•H1(pdm09), •B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H1(pdm09), ••H3, •B	•H1(pdm09), •H3, •B	
West Bank and Gaza Strip – Cisjordanie et bande de Gaza		•H1(pdm09)	•H1(pdm09), B						
Europe									
Albania – Albanie	•H1(pdm09), •B	•••H1(pdm09), •H3, ••B	•H1(pdm09), ••B						
Armenia – Arménie	••••H1(pdm09)	••H1(pdm09)	•H1(pdm09)	•H1(pdm09)	H1(pdm09)				
Austria – Autriche	•••H1(pdm09), ••H3, •••B	•••H1(pdm09), ••H3, ••••B	••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B					
Belarus – Bélarus	•••H1(pdm09)	••••H1(pdm09), •B	•••H1(pdm09), ••B	••H1(pdm09), ••B	•B	•B			
Belgium – Belgique	•H1(pdm09), ••B	•••H1(pdm09), •••B	•••H1(pdm09), •H3, ••B	•H1(pdm09), •B	•B				
Bosnia and Herzegovina – Bosnie-Herzégovine	•H1(pdm09), •B	•H1(pdm09), •H3							
Bulgaria – Bulgarie	•H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B					
Croatia – Croatie	•••H1(pdm09), •H3, •B	•••H1(pdm09), ••H3, •••B	•••H1(pdm09), •••H3, •••B	•••H1(pdm09), ••H3, •••B	•H1(pdm09), •H3, •B				
Cyprus – Chypre	H1(pdm09) H3, B	•H1(pdm09), •B							
Czech Republic – République tchèque	••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	•B				
Denmark – Danemark	••••H1(pdm09), •H3, •••B	••••H1(pdm09), ••H3, ••••B	•••H1(pdm09), ••H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B				
Estonia – Estonie	•H1(pdm09), •B	•••H1(pdm09), •••B	••H1(pdm09), ••B	•H1(pdm09), •B			•H3		
Finland – Finlande	•••H1(pdm09), •H3, ••B	••H1(pdm09), •H3, •B	•H1(pdm09), •B	•B					
France	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, ••••B	•••H1(pdm09), •H3, ••••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •B		•H1(pdm09), •H3		
Georgia – Géorgie	•••H1(pdm09), •H3	•••H1(pdm09), •H3	•H1(pdm09), •H3, •B	H1(pdm09), •H3, •B,	H1(pdm09), H3, •B	H1(pdm09), •B	H1(pdm09)		
Germany – Allemagne	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •B	•H3	•H3		
Greece – Grèce	••••H1(pdm09), •B	••••H1(pdm09), •H3, ••B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	•B				
Hungary – Hongrie	•H1(pdm09), •B	•••H1(pdm09), •••B	•H1(pdm09), •••B	•H1(pdm09), •B	•H1(pdm09)				
Iceland – Islande	•H1(pdm09), •B	•••H1(pdm09), ••B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H3, •B	•H3, •B			
Ireland – Irlande	•••H1(pdm09), •H3, •••B	••••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B	•H3, •B			
Italy – Italie	•••H1(pdm09), •••H3, •••B	•••H1(pdm09), •••H3, ••••B	•••H1(pdm09), •••H3, •••B	•H1(pdm09), ••H3, •••B					

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Kosovo (in accordance with Security Council resolution 1244 (1999)) – Kosovo (selon la résolution 1244 votée en 1999 par le Conseil de sécurité)	•H3, •B	••B	••B	•B					
Latvia – Lettonie	•••H1(pdm09), •B	•••H1(pdm09), •••B	•••B	•••B	•••B	•B	•H3		
Lithuania – Lituanie	•••H1(pdm09), •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), ••B	•H1(pdm09)				
Luxembourg	•H1(pdm09), •B	••H1(pdm09), •••B	••H1(pdm09), •••B	•H1(pdm09), •H3, •B					
Malta – Malte	•••H1(pdm09), •B	•••H1(pdm09), •••B	••H1(pdm09), •••B	•H1(pdm09), ••B					
Montenegro – Monténégro	•H1(pdm09)	•••H1(pdm09), •H3, •B	•••H1(pdm09), •H3 , •B	•H1(pdm09), •H3, •B					
Netherlands – Pays-Bas	••••H1(pdm09), •H3, ••B	••••H1(pdm09), •H3, ••••B	•••H1(pdm09), •H3, ••••B	••H1(pdm09), •H3, •••B	•H3, •B	•H3			
Norway – Norvège	••••H1(pdm09), ••H3, •••B	••••H1(pdm09), ••H3, ••••B	••••H1(pdm09), ••H3, ••••B	••••H1(pdm09), ••H3, •••B	••H1(pdm09), ••H3, •••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •H3, •B		
Poland – Pologne	•••H1(pdm09), •B	••••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •••B	•H1(pdm09), •B	•H1(pdm09)	•B		
Portugal	•••H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H3, •B	•B		
Republic of Moldova – République de Moldavie	••H1(pdm09), •B	•••H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3					
Romania – Roumanie	•••H1(pdm09), •H3	•••H1(pdm09), ••H3, •B	•••H1(pdm09), •H3, ••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •B	•B			
Russian Federation – Fédération de Russie	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), •••H3, ••••B	••••H1(pdm09), •••H3, •••B	••••H1(pdm09), •••H3, •••B	•••H1(pdm09), ••H3, •••B	•H1(pdm09), •H3, ••B	•H1(pdm09), •B		
Serbia – Serbie	••H1(pdm09), •B	•••H1(pdm09), •H3, ••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, ••B	•B	•B			
Slovakia – Slovaquie	••H1(pdm09)	•••H1(pdm09), •H3, ••B	•H1(pdm09), •••B	•H1(pdm09), ••B	•B				
Slovenia – Slovénie	•H1(pdm09), •••H3, •B	•••H1(pdm09), •••H3, •••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B			
Spain – Espagne	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •B			
Sweden – Suède	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•••H1(pdm09), •H3, ••••B	•H1(pdm09), •H3, •••B	•••B	•B			
Switzerland – Suisse	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B					
The former Yugoslav Republic of Macedonia– Ex-République Yougoslave de Macédoine	•H1(pdm09)	•H1(pdm09), •H3, •B	•H1(pdm09), H3, •B	•H1(pdm09), •H3, •••B					
Ukraine	••••H1(pdm09), •H3, •B	••••H1(pdm09), ••H3, •B	•••H1(pdm09), •H3	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B				
United Kingdom of Great Britain and Northern Ireland – United Kingdom of Great Britain and Northern Ireland – Royaume-Uni et Irlande du Nord	••••H1(pdm09), •H3, ••B	••••H1(pdm09), •H3, •••B	••••H1(pdm09), •H3, •••B	•••H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •••B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B

Table 1 *(continued)* – Tableau 1 *(suite)*

Country, area or territory by geographical region – Pays, région ou territoire par région géographique	January Week 1-4 – Janvier semaine 1-4	February Week 5-8 – Février semaine 5-8	March Week 9-13 – Mars semaine 9-13	April Week 14-17 – Avril semaine 14-17	May Week 18-22 – Mai semaine 18-22	June Week 23-26 – Juin semaine 23-26	July Week 27-30 Juillet semaine 27-30	August Week 31-34 – Août semaine 31-34	September Week 35-36 – Septembre semaine 35-36
Oceania – Océanie									
Australia – Australie	•H1(pdm09), •H3	•H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	••H1(pdm09), •H3, •B	••H1(pdm09), •••H3, •B	•H1(pdm09), ••••H3, •••B	•H1(pdm09), ••••H3, •••B	•H1(pdm09), ••••H3, •••B
Fiji – Fidji	•H1(pdm09), •B	•H1(pdm09), •B	•H1(pdm09), •H3, •B	•H1(pdm09), •H3, •B	•H1(pdm09), •••H3, •B	•H3, •B			
France, New Caledonia – Nouvelle Calédonie	•B	•H1(pdm09), •B	••H1(pdm09), •H3, •B	••H1(pdm09), •H3	•H1(pdm09), •H3, •B	•H1(pdm09), •H3	•H1(pdm09), ••H3		
New Zealand – Nouvelle Zélande					•H3, •B	•H3	•H1(pdm09), ••H3, •B	•H1(pdm09), ••H3, •B	•H1(pdm09), ••H3, •B
Papua New Guinea – Papouasie Nouvelle-Guinée		•H1(pdm09), •H3, •B	••••H1(pdm09), •H3, ••B	••H1(pdm09), •H3, •B					

Data in above table were provided by the Global Influenza Surveillance and Response System and other partners. –

• = Sporadic activity – Activité sporadique
•• = Local activity – Activité locale
••• = Regional activity – Activité régionale
•••• = Widespread activity – Activité étendue

A = Influenza A (not subtyped) – Grippe A (sous-type non déterminé)
B = Influenza B – Grippe B
H1(pdm09) = Influenza A(H1N1)pdm09 – H1(pdm09) = Grippe A (H1N1)pdm09
H3 = Influenza A(H3N2) – H3 = Grippe A(H3N2)
0 = All negative – Tout négatif

870 human cases of A(H5) infection with 458 deaths have been confirmed in 16 countries. To date there has been no evidence of sustained human-to-human transmission.

During this period 77 additional human cases of avian influenza A(H7N9) virus infection have been reported to WHO by China. Since February 2013, a total of 798 cases with 320 deaths have been reported.

Nine A(H9N2) human cases were reported during this period, 8 in China and 1 in Egypt. Three of the cases from China, including a fatal case, had disease onset dates that predated the reporting period. Viruses from cases in China belong to the A/chicken/Hong Kong/Y280/97 genetic lineage. No data are available for the virus from Egypt where A/quail/Hong Kong/G1/97 lineage viruses circulate in poultry.

During this period, 4 cases of A(H1N2)v, 3 in the United States of America (USA) and 1 retrospective case in Brazil, and 19 cases of A(H3N2)v, 18 in the USA and 1 retrospective case in Viet Nam, were reported.

Antigenic and genetic characteristics of recent seasonal influenza viruses

Influenza A(H1N1)pdm09 viruses

The vast majority of A(H1N1)pdm09 viruses collected from February 2016 to August 2016 fell into the phylogenetic clade 6B. Most recently circulating viruses

au total d'infection par la grippe A(H5), accompagnés de 458 décès, ont été confirmés dans 16 pays. À ce jour, il n'existe aucune preuve d'une transmission interhumaine soutenue de la maladie.

Durant cette même période, 77 cas humains supplémentaires de grippe aviaire A(H7N9) ont été notifiés à l'OMS par la Chine. Depuis février 2013, 798 cas au total, dont 320 décès, ont été rapportés.

Neuf cas humains de grippe A(H9N2) ont été notifiés pendant cette période, 8 en Chine et 1 en Égypte. Pour 3 des cas survenus en Chine, parmi lesquels un mortel, la maladie est apparue à une date antérieure à la période de rapport. Les virus à l'origine des cas chinois appartiennent à la lignée génétique A/chicken/Hong Kong/Y280/97. Aucune donnée n'est disponible pour le virus responsable du cas survenu en Égypte, où des virus de la lignée A/quail/Hong Kong/G1/97 circulent chez les volailles.

Pendant cette même période encore, 4 cas d'infection par un virus A(H1N2)v, dont 3 aux États-Unis d'Amérique (USA) et un cas rétrospectif au Brésil, et 19 cas d'infection par un virus A(H3N2)v, dont 18 aux USA et 1 cas rétrospectif au Viet Nam, ont été notifiés.

Caractéristiques antigéniques et génétiques des virus grippaux saisonniers récents

Virus grippaux A(H1N1)pdm09

La grande majorité des virus A(H1N1)pdm09 collectés de février 2016 à août 2016 appartenaient au clade phylogénétique 6B. La plupart des virus récemment en circulation appartenaient au

belonged to genetic subclade 6B.1. A small proportion of viruses circulating globally belonged to subclade 6B.2. Subclade 6B.2 viruses were detected most frequently in China, although 6B.1 viruses predominated. Antigenic characteristics of A(H1N1)pdm09 viruses were assessed with panels of post-infection ferret antisera and human paediatric, adult and older adult pre- and post-vaccination sera in haemagglutination inhibition (HI) assays. HI assays with ferret antisera indicated that almost all recent A(H1N1)pdm09 viruses were antigenically indistinguishable from the vaccine virus A/California/7/2009. However, representative 6B.1 and 6B.2 viruses were poorly inhibited by some post-vaccination adult human serum pools (*Table 2*). Furthermore, geometric mean post-vaccination HI titres of paediatric sera against some representative 6B.1 and 6B.2 A(H1N1)pdm09 viruses were reduced significantly compared to HI titres to the A/California/7/2009 vaccine virus, although this was not consistently observed for adult and older adult serum panels.

Influenza A(H3N2) viruses

A(H3N2) viruses collected from February to August 2016 fell into the phylogenetic clades 3C.2 and 3C.3. Viruses in subclade 3C.2a predominated in most regions

sous-clade génétique 6B.1. Une faible proportion des virus circulants dans le monde appartenait au sous-clade 6.B2. Les virus de ce sous-clade ont été détectés plus fréquemment en Chine, même si les virus 6B.1 y sont prédominants. Les caractéristiques antigéniques des virus A(H1N1)pdm09 ont été évaluées à l'aide de batteries d'antisérums de furet postinfection et de sérums humains d'enfants, d'adultes et d'adultes âgés pré- et postvaccination dans le cadre d'épreuves d'inhibition de l'hémagglutination (IH). Les épreuves d'IH réalisées avec les antisérums de furet ont indiqué que presque tous les virus A(H1N1)pdm09 récents étaient impossibles à distinguer sur le plan antigénique de la souche A/California/7/2009. Cependant, des virus représentatifs des clades 6B.1 et 6B.2 ont été médiocrement inhibés par certains pools de sérums humains d'adultes postvaccination (*Tableau 2*). En outre, en moyenne géométrique, les titres d'IH obtenus en faisant réagir des sérums pédiatriques postvaccination avec certains virus A(H1N1)pdm09 représentatifs des clades 6B.1 et 6B.2 avaient baissé significativement par rapport aux titres d'IH obtenus contre le virus vaccinal A/California/7/2009, même si ce phénomène n'était pas observé de manière cohérente pour les batteries de sérums d'adultes et d'adultes âgés.

Virus grippaux A(H3N2)

Les virus A(H3N2) collectés de février à août 2016 se classaient dans les clades phylogénétiques 3C.2 et 3C.3. Les virus du sous-clade 3C.2a prédominaient dans la plupart des régions du

Table 2 **Haemagglutination inhibition assays of A(H1N1)pdm09 viruses**
Tableau 2 **Épreuves d'inhibition de l'hémagglutination par des virus A(H1N1)pdm09**

Strain designation – Dénomination de la souche	Genetic clade – Clade génétique	Passage history– Historique des passages	Post-infection ferret sera – Sérums de furet postinfection							Post-vaccination human sera[a] – Sérums humains postvacination[a]					
			EGG	MDCK	MDCK	MDCK	MDCK	MDCK	MDCK	2011/2012		2013/2014	2014/2015	2015/2016	
			CA/7	CA/7	MD/13	DR/7293	BL/559	MI/45	IA/53	A	B	C	D	E	F
A/California/7/2009	H1pdm09	E3	**2560**	2560	2560	2560	2560	2560	1280	640	640	320	640	160	640
A/California/7/2009	H1pdm09	C3	2560	**2560**	2560	1280	1280	2560	1280	320	640	320	320	320	640
A/Maryland/13/2012	6A	M1/C2	5120	2560	**2560**	1280	1280	2560	1280	320	640	160	160	160	640
A/Dominican Rep/7293/2013	6C	C2	2560	2560	2560	**2560**	1280	2560	1280	320	1280	320	320	320	640
A/Bolivia/559/2013	6B	E5	2560	2560	2560	1280	1280	2560	1280	20	20	40	40	20	640
A/Bolivia/559/2013	6B	C2	5120	5120	5120	2560	**2560**	5120	1280	10	10	40	20	20	640
A/Michigan/45/2015	6B.1	E3	2560	5120	5120	2560	2560	5120	2560	80	40	80	640	10	1280
A/Michigan/45/2015	6B.1	M1/C3	2560	2560	2560	2560	2560	**5120**	2560	10	10	40	40	40	1280
A/Panama/318595/2016	6B.1	C2	1280	1280	2560	2560	1280	5120	1280	10	10	40	20	20	640
A/Iowa/53/2015	6B.2	E4	1280	1280	1280	1280	640	2560	1280	10	10	20	40	20	320
A/Iowa/53/2015	6B.2	C3	1280	1280	640	1280	640	2560	**1280**	10	10	20	10	20	160
A/Minnesota/32/2015	6B.2	C3	640	640	1280	1280	640	1280	1280	10	10	20	10	20	320

Madin-Darby canine kidney (MDCK) cells – MDCK, cellules rénales canines Madin-Darby (MDCK)

[a] Post-vaccination pooled sera (A-D, F) or a single serum (E) from adults (years of birth, 1961–1983) vaccinated with trivalent inactivated vaccines or quadrivalent inactivated vaccines from the indicated seasons. – Pool d'immunsérums postvaccination (A-D, F) ou sérum isolé (E) recueillis chez des adultes nés entre 1961 et 1983 et ayant reçu le vaccin antigrippal trivalent inactivé ou quadrivalent inactivé.

of the world with the majority of these viruses having further changes in the haemagglutinin (HA) (N171K, I406V, G484E), now referred to as subclade 3C.2a1. Subclade 3C.3a has continued to circulate but represented a lower proportion of viruses circulating during this reporting period except in the USA where they predominated. Viruses in genetic subclade 3C.3b were rarely detected.

Antigenic characteristics of A(H3N2) viruses were assessed with panels of post-infection ferret antisera in HI and virus neutralisation assays. Antigenic characterization of 3C.2a viruses continued to be technically challenging because many viruses had low or undetectable haemagglutination activity in the presence of oseltamivir carboxylate, added to circumvent agglutination by the virus neuraminidase. Virus neutralisation assays supplemented HI assays for the antigenic characterization of viruses. Most recent A(H3N2) 3C.2a viruses were well inhibited by ferret antisera raised against cell culture-propagated reference viruses in subclade 3C.2a including A/Hong Kong/4801/2014 or A/Michigan/15/2014. These antisera also inhibited a majority of viruses in subclades 3C.2a1 (including those with an additional N121K HA substitution), 3C.3a and 3C.3b.

Egg propagation is known to introduce additional changes in HA that can affect antigenicity. Such changes have been particularly problematic for recent A(H3N2) viruses. Ferret antisera raised against egg-propagated 3C.2a viruses, including A/Hong Kong/4801/2014, generally inhibited recently circulating viruses better than antisera raised against egg-propagated A/Switzerland/9715293/2013 virus or other recent egg-propagated viruses.

Human serology studies were performed using serum panels from adults and older adults who had received seasonal quadrivalent inactivated vaccines with the composition recommended for the southern hemisphere 2016 season (A/California/7/2009 (H1N1)pdm09-like, A/Hong Kong/4801/2014 (H3N2)-like, B/Brisbane/60/2008-like and B/Phuket/3073/2013-like antigens). Geometric mean HI titres of antibodies against representative recent A(H3N2) viruses were somewhat reduced compared to HI titres against the cell-propagated vaccine virus. In microneutralisation tests with a subset of serum panels and viruses, geometric mean titres of antibodies against recent representative A(H3N2) viruses were similar to those against the cell-propagated vaccine virus.

Influenza B viruses

Influenza B viruses of the B/Victoria/2/87 and the B/Yamagata/16/88 lineages co-circulated at equivalent levels in some countries, while viruses of the B/Victoria/2/87 lineage predominated in many countries.

Almost all of the HA gene sequences of B/Victoria/2/87 lineage viruses fell into genetic clade 1A. In HI assays, recent viruses were well inhibited by post-infection ferret antisera raised against either B/Brisbane/60/2008

monde, la majorité d'entre eux étant porteurs de modifications supplémentaires de l'hémagglutinine (HA) (N171K, I406V, G484E) et maintenant désignés comme appartenant au sous-clade 3C.2a1. Les virus du sous-clade 3C.3a ont continué de circuler, mais ils représentaient une plus faible proportion des virus circulants pendant cette période de rapport, sauf aux USA, où ils étaient prédominants. Les virus du sous-clade génétique 3C.3b ont rarement été détectés.

Les caractéristiques antigéniques des virus A(H3N2) ont été évaluées au moyen de batteries d'antisérums de furet post-infection dans le cadre d'épreuves d'inhibition de l'hémagglutination et de neutralisation virale. La caractérisation antigénique des virus 3C.2a a continué d'être techniquement difficile car nombre d'entre eux présentaient une activité d'hémagglutination faible ou indétectable en présence de carboxylate d'oseltamivir, ajouté pour éviter l'agglutination par la neuraminidase virale. Des épreuves de neutralisation virale ont complété les épreuves d'IH pour caractériser les virus sur le plan antigénique. La plupart des virus A(H3N2) du sous-clade 3C.2a récents étaient bien inhibés par les antisérums de furet dirigés contre des virus de référence du sous-clade 3C.2a, propagés en culture cellulaire, et notamment les virus A/Hong Kong/4801/2014 ou A/Michigan/15/2014. Ces antisérums inhibaient aussi la majorité de virus appartenant aux sous-clades 3C.2a1 (y compris ceux porteurs d'une substitution supplémentaire N121K de l'HA); 3C.3a et 3C.3b.

On sait que chaque propagation sur œufs introduit des modifications supplémentaires au niveau de l'HA, susceptibles d'influer sur l'antigénicité. Ces modifications ont été particulièrement problématiques pour les virus A(H3N2) récents. Les antisérums de furet dirigés contre des virus du sous-clade 3C.2a propagés sur œufs, y compris le virus A/Hong Kong/4801/2014, inhibaient généralement mieux les virus récemment en circulation que des antisérums de furet dirigés contre le virus A/Switzerland/9715293/2013 ou d'autres virus récents propagés sur œufs.

Des études sérologiques chez l'homme ont été effectuées à l'aide de batteries de sérums provenant d'adultes et d'adultes âgés ayant reçu des vaccins saisonniers quadrivalents inactivés ayant la composition recommandée pour la saison grippale 2016 dans l'hémisphère Sud (antigènes des souches A/California/7/2009 (H1N1)pdm09, A/Hong Kong/4801/2014 (H3N2), B/Brisbane/60/2008 et B/Phuket/3073/2013). En moyenne géométrique, les titres d'IH d'anticorps dirigés contre des virus A(H3N2) représentatifs récents avaient quelque peu diminué par rapport aux titres d'IH contre les virus vaccinaux propagés en culture cellulaire. Dans des tests de microneutralisation portant sur un sous-ensemble de batteries de sérums et de virus, les moyennes géométriques des titres d'anticorps dirigés contre des virus A(H3N2) représentatifs récents étaient similaires à celles obtenues contre les virus vaccinaux propagés en culture cellulaire.

Virus de la grippe B

Des virus de la grippe B appartenant aux lignées B/Victoria/2/87 et B/Yamagata/16/88 ont circulé conjointement en quantités équivalentes dans certains pays, tandis que les virus de la lignée B/Victoria/2/87 prédominaient dans de nombreux autres pays.

Presque toutes les séquences de gènes de l'hémagglutinine des virus de la lignée B/Victoria/2/87 classaient ces virus dans le clade génétique 1A. Dans le cadre d'épreuves d'IH, les virus récents étaient bien inhibés par des antisérums de furet postin-

or B/Texas/2/2013 cell culture-propagated viruses. B/Brisbane/60/2008 was recommended for use in vaccines for the 2016-2017 northern hemisphere influenza season.

The HA gene sequences of the vast majority of B/Yamagata/16/88 lineage viruses fell into genetic clade 3. In HI assays, recently circulating B/Yamagata/16/88 lineage viruses were well inhibited by post-infection ferret antisera raised against the cell culture-propagated B/Phuket/3073/2013 virus (clade 3). B/Phuket/3073/2013 was recommended for use in quadrivalent vaccines for the 2016-2017 northern hemisphere influenza season.

Human serology studies were performed using serum panels from adults and older adults who had received seasonal quadrivalent inactivated vaccines of the composition recommended for the northern hemisphere 2015-2016 season (A/California/7/2009 (H1N1) pdm09-like, A/Switzerland/9715293/2013 (H3N2)-like, B/Phuket/3073/2013-like and B/Brisbane/60/2008-like antigens) or for the southern hemisphere 2016 season (A/California/7/2009 (H1N1)pdm09-like, A/Hong Kong/4801/2014 (H3N2)-like, B/Brisbane/60/2008-like and B/Phuket/3073/2013-like antigens). Geometric mean HI titres of antibodies against some representative recent B/Victoria/2/87 lineage viruses were reduced compared to HI titres against the cell-propagated vaccine virus B/Brisbane/60/2008. When tested against representative recent B/Yamagata/16/88 lineage viruses, geometric mean HI titres were reduced for some viruses compared to HI titres against the egg-propagated vaccine virus B/Phuket/3073/2013.

Resistance to influenza antiviral drugs

Neuraminidase inhibitors

The detection of viruses with reduced susceptibility to the neuraminidase inhibitors was very rare among the >9000 viruses tested during this reporting period.

Of >4000 influenza A(H1N1)pdm09 viruses tested for susceptibility to the neuraminidase inhibitors, 69 carried an H275Y amino acid substitution in neuraminidase which conferred highly reduced inhibition by oseltamivir and peramivir. Forty-one of these viruses were detected in Japan (41/1467; 2.8%) and 16 were detected in the USA (16/2331; 0.7%). The majority of A(H1N1)pdm09 viruses carrying H275Y amino acid substitutions were from patients receiving oseltamivir treatment.

All of the A(H3N2) viruses tested were sensitive to neuraminidase inhibitors.

All but 2 influenza B/Yamagata/16/88 lineage viruses were sensitive to neuraminidase inhibitors. One virus carried an I221V amino acid substitution in neuraminidase that resulted in reduced peramivir inhibition, while the other contained an I348T amino acid substitution in neuraminidase that conferred reduced oseltamivir inhibition.

fection dirigés contre les souches B/Brisbane/60/2008 ou B/Texas/2/2013, propagées en culture cellulaire. Il a été recommandé que la souche B/Brisbane/60/2008 entre dans la composition des vaccins contre la grippe saisonnière 2016-2017 dans l'hémisphère Nord.

Les séquences de gènes de l'hémagglutinine de la grande majorité des virus de la lignée B/Yamagata/16/88 classaient ces virus dans le clade génétique 3. Dans le cadre d'épreuves d'IH, les virus de cette lignée récemment en circulation étaient bien inhibés par des antisérums de furet dirigés contre le virus B/Phuket/3073/2013 (clade 3), propagé en culture cellulaire, lequel virus a été recommandé pour entrer dans la composition des vaccins quadrivalents contre la grippe saisonnière 2016-2017 dans l'hémisphère Nord.

Des études sérologiques chez l'homme ont été effectuées avec des batteries de sérums provenant d'adultes et d'adultes âgés ayant reçu des vaccins saisonniers quadrivalents inactivés ayant la composition recommandée pour la saison grippale 2015-2016 dans l'hémisphère Nord (antigènes des souches A/California/7/2009(H1N1)pdm09, A/Switzerland/9715293/2013 (H3N2), B/Phuket/3073/2013 et B/Brisbane/60/2008) ou pour la saison grippale 2016 dans l'hémisphère Sud (antigènes des souches California/7/2009 (H1N1)pdm09, A/Hong Kong/4801/2014 (H3N2), B/Brisbane/60/2008 et B/Phuket/3073/2013). Les moyennes géométriques des titres d'IH d'anticorps dirigés contre certains virus représentatifs récents de la lignée B/Victoria/2/87 avaient diminué par rapport aux titres d'IH dirigés contre les virus vaccinaux B/Brisbane/60/2008 propagés en culture cellulaire. Dans le cadre de tests contre des virus représentatifs récents de la lignée B/Yamagata/16/88, on obtenait des titres d'IH plus bas en moyenne géométrique pour certains virus que ceux dirigés contre le virus vaccinal B/Phuket/3073/2013 propagé sur œufs.

Résistance aux antiviraux utilisés contre la grippe

Inhibiteurs de la neuraminidase

Pendant la période couverte par ce rapport, la détection de virus présentant une sensibilité diminuée aux inhibiteurs de la neuraminidase a été très rare parmi les plus de 9000 virus testés.

Parmi plus de 4000 virus grippaux A(H1N1)pdm09 testés pour évaluer leur sensibilité aux inhibiteurs de la neuraminidase, 69 étaient porteurs d'une substitution d'acides aminés H275Y de la neuraminidase, qui entraînait une forte réduction de leur inhibition par l'oseltamivir et le péramivir. Quarante-et-un de ces virus ont été détectés au Japon (41/1467; 2,8 %) et 16 aux USA (16/2331; 0,7 %). La majorité des virus A(H1N1)pdm09 porteurs de substitutions d'acide aminé H275Y provenaient de patients recevant un traitement par l'oseltamivir.

Tous les virus A(H3N2) testés étaient sensibles aux inhibiteurs de la neuraminidase.

Tous les virus grippaux de la lignée B/Yamagata/16/88 testés étaient sensibles aux inhibiteurs de la neuraminidase, sauf 2. L'un de ces 2 virus comportait une substitution d'acides aminés I221V de la neuraminidase, entrainant une diminution de son inhibition par le péramivir, tandis que l'autre contenait une substitution d'acides aminés I348T de la neuraminidase, qui lui conférait l'aptitude à être moins inhibé par l'oseltamivir.

All but 4 of the influenza B/Victoria/2/87 lineage viruses were sensitive to neuraminidase inhibitors. Three viruses from Lao People's Democratic Republic carried an H134N amino acid substitution in neuraminidase and 1 virus from Malaysia carried a G104E amino acid substitution in neuraminidase. Both substitutions conferred reduced or highly reduced inhibition by all 4 neuraminidase inhibitors – oseltamivir, zanamivir, peramivir and laninamivir.

Tous les virus grippaux de la lignée B/Victoria/2/87 testés étaient sensibles aux inhibiteurs de la neuraminidase, sauf 4. Trois de ces derniers virus provenant de la République démocratique populaire lao étaient porteurs d'une substitution d'acides aminés H134N de la neuraminidase et le dernier, originaire de Malaisie, portait une substitution d'acides aminés G104F de la neuraminidase. Ces 2 substitutions entraînaient une baisse plus ou moins forte de l'inhibition par les 4 inhibiteurs de la neuraminidase suivants: oseltamivir, zanamivir, péramivir et laninamivir.

M2 inhibitors

M gene sequencing of A(H1N1)pdm09 and A(H3N2) viruses revealed that all viruses analysed had S31N amino acid substitutions in their M2 proteins which is known to confer resistance to the M2 inhibitors, amantadine and rimantadine.

Inhibiteurs de la protéine M2

Le séquençage du gène M des virus A(H1N1)pdm09 et A(H3N2) a révélé que tous les virus analysés présentaient une substitution d'acides aminés S31N dans la protéine M2, dont on sait qu'elle confère une résistance aux inhibiteurs de la protéine M2 que sont l'amantadine et la rimantadine.

Recommended composition of influenza virus vaccines for use in the 2017 southern hemisphere influenza season

Influenza A(H1N1)pdm09 viruses, which predominated in many countries, co-circulated with A(H3N2) and influenza B viruses during the period February 2016 – August 2016.

Influenza A(H1N1)pdm09 viruses were associated with outbreaks in many countries. Influenza A(H1N1)pdm09 viruses were antigentically indistinguishable by post-infection ferret antisera but in studies with human post-vaccination sera representative 6B.1 and 6B.2 viruses were distinguishable from the A/California/7/2009 vaccine virus.

Influenza A(H3N2) viruses were associated with outbreaks in many countries. The majority of recent viruses were antigenically related to cell culture-propagated 3C.2a A/Hong Kong/4801/2014-like viruses.

Influenza B viruses of the B/Victoria/2/87 and the B/Yamagata/16/88 lineages co-circulated, with viruses of the B/Victoria/2/87 lineage predominating in many countries. Most B/Victoria/2/87 lineage viruses were antigenically and genetically closely related to B/Brisbane/60/2008 and B/Texas/2/2013. The majority of recent B/Yamagata/16/88 lineage viruses were antigenically and genetically closely related to B/Phuket/3073/2013.

It is recommended that trivalent vaccines for use in the 2017 southern hemisphere influenza season contain the following:

– an A/Michigan/45/2015 (H1N1)pdm09-like virus;

– an A/Hong Kong/4801/2014 (H3N2)-like virus; and

– a B/Brisbane/60/2008-like virus.

It is recommended that quadrivalent vaccines containing 2 influenza B viruses contain the above 3 viruses and a B/Phuket/3073/2013-like virus.

Composition recommandée pour les vaccins antigrippaux devant être utilisés pendant la saison grippale 2017 dans l'hémisphère Sud

Des virus de la grippe A(H1N1)pdm09, prédominants dans de nombreux pays, ont circulé conjointement avec des virus des grippes A(H3N2) et B de février 2016 à août 2016.

Des virus grippaux A(H1N1)pdm09 ont été associés à des flambées dans de nombreux pays. Ces virus étaient impossibles à différencier sur le plan antigénique en utilisant des antisérums de furet postinfection, mais dans le cadre d'études menées avec des sérums humains postvaccination, des virus représentatifs des clades 6B.1 et 6B.2 ont pu être distingués de la souche A/California/7/2009.

Des virus A(H3N2) ont été associés à des flambées dans de nombreux pays. La majorité des virus récents étaient apparentés sur le plan antigénique à la souche A/Hong Kong/4801/2014, appartenant au sous-clade 3C.2a, propagée en culture cellulaire.

Des virus de la grippe B appartenant aux lignées B/Victoria/2/87 et B/Yamagata/16/88 ont circulé conjointement, avec une prédominance des virus de la lignée B/Victoria/2/87, dans de nombreux pays. La plupart des virus de la lignée B/Victoria/2/87 étaient étroitement apparentés sur les plans antigénique et génétique aux souches B/Brisbane/60/2008 et B/Texas/2/2013. La majorité des virus de la lignée B/Yamagata/16/88 récents étaient étroitement apparentés sur les plans antigénique et génétique à la souche B/Phuket/3073/2013.

Il est recommandé que les vaccins trivalents destinés à être utilisés pendant la saison grippale 2017 dans l'hémisphère Sud contiennent:

– un virus de la souche A/Michigan/45/2015 (H1N1)pdm09;

– un virus de la souche A/Hong Kong/4801/2014 (H3N2); et

– un virus de la souche B/Brisbane/60/2008.

Il est recommandé que les vaccins quadrivalents contenant 2 virus de la grippe B renferment aussi les 3 virus ci-dessus et un virus de la souche B/Phuket/3073/2013.

Lists of egg propagated candidate vaccine viruses (CVVs) suitable for use in vaccines produced in either eggs or cell culture, as well as cell culture-propagated CVVs suitable for use in vaccines produced in cell culture are available on the WHO website.[3] A list of reagents for vaccine standardization, including those for this recommendation, can also be found on the WHO website. CVVs for zoonotic influenza viruses are updated on the same website.

As in previous years, national or regional authorities approve the composition and formulation of vaccines used in each country. National public health authorities are responsible for making recommendations regarding the use of the vaccine. WHO has published recommendations on the prevention of influenza.[4]

Candidate vaccine viruses (including reassortants) and reagents for use in the laboratory standardization of inactivated vaccine may be obtained from:

(i) Immunobiology, Laboratories Branch, Medical Devices and Product Quality Division, Therapeutic Goods Administration, P.O. Box 100, Woden ACT, 2606 Australia (fax: +61 2 6232 8564, email: influenza.reagents@tga.gov.au; website: http://www.tga.gov.au);

(ii) Division of Virology, National Institute for Biological Standards and Control, a centre of the Medicines and Healthcare products Regulatory Agency (MHRA), Blanche Lane, South Mimms, Potters Bar, Hertfordshire, EN6 3QG, UK (fax: +44 1707 641050, email: enquiries@nibsc.org; Website: http://www.nibsc.org/science_and_research/virology/influenza_resource_.aspx;

(iii) Division of Product Biological Standards and Quality Control, Center for Biologics Evaluation and Research, Food and Drug Administration, 10903 New Hampshire Avenue, Silver Spring, Maryland, 20993, USA (fax: +1 301 480 9748), email: cbershippingrequests@fda.hhs.gov);

(iv) Influenza Virus Research Center, National Institute of Infectious Diseases, Gakuen 4-7-1, Musashi-Murayama, Tokyo 208-0011, Japan (fax: +81 42 561 6156); email: flu-vaccine@nih.go.jp).

Requests for reference viruses should be addressed to:

(i) WHO Collaborating Centre for Reference and Research on Influenza, VIDRL, Peter Doherty Institute, 792 Elizabeth Street, Melbourne, Victoria 3000, Australia (fax: +61 393 429 329, website: http://www.influenzacentre.org, email: whoflu@influenzacentre.org);

(ii) WHO Collaborating Centre for Reference and Research on Influenza, National Institute of Infectious Diseases, Gakuen 4-7-1, Musashi-Murayama, Tokyo 208- 0011, Japan (fax: +81 42 561 6149 or +81 42 565 2498, email: whocc-flu@nih.go.jp);

[3] See http://www.who.int/influenza/vaccines/virus/candidates_reagents/home

[4] See http://www.who.int/wer/2012/wer8747.pdf

La liste des virus vaccinaux candidats propagés sur œufs se prêtant à la préparation de vaccins produits sur des œufs ou en culture cellulaire, ainsi que celle des virus vaccinaux candidats propagés en culture cellulaire se prêtant à la préparation de vaccins produits en culture cellulaire sont consultables sur le site Web de l'OMS.[3] Une liste des réactifs pour la standardisation des vaccins, y compris ceux sur lesquels porte cette recommandation, est aussi disponible sur ce site. Les virus vaccinaux candidats pour les virus grippaux zoonotiques sont mis à jour sur le même site.

Comme les années précédentes, les autorités nationales ou régionales approuvent la composition et la formulation des vaccins utilisés dans chaque pays. Les autorités nationales de santé publique sont chargées de formuler des recommandations concernant l'utilisation de ces vaccins. L'OMS a publié des recommandations sur la prévention de la grippe.[4]

Les virus vaccinaux candidats (y compris réassortis) et les réactifs nécessaires à la standardisation en laboratoire du vaccin inactivé peuvent être obtenus auprès des organismes suivants:

i) Immunobiology, Laboratories Branch, Medical Devices and Product Quality Division, Therapeutic Goods Administration, P.O. Box 100, Woden ACT, 2606 Australie (télécopie: +61 2 6232 8564, courriel: influenza.reagents@tga.gov.au, site Web: http://www.tga.gov.au);

ii) Division of Virology, National Institute for Biological Standards and Control, a centre of the Medecine and Healthcare products Regulatory Agency (MHRA), Blanche Lane, South Mimms, Potters Bar, Hertfordshire, EN6 3QG, Royaume-Uni (télécopie: +44 1707 641050, courriel: enquiries@nibsc.hpa.org.uk, site Web: http://www.nibsc.org/science_and_research/virology/influenza_resource_.aspx;

iii) Division of Product Biological Standards and Quality Control, Center for Biologics Evaluation and Research, Food and Drug Administration, 10903 New Hampshire Avenue, Silver Spring, Maryland, 20993, États-Unis d'Amérique (télécopie: +1 301 480 9748), courriel: cbershippingrequests@fda.hhs.gov);

iv) Centre de recherche sur le virus grippal, Institut national des maladies infectieuses, Gakuen 4-7-1, Musashi-Murayama, Tokyo 208-0011, Japon (télécopie: +81 42 561 6156); courriel: flu-vaccine@nih.go.jp).

Les souches de référence peuvent être obtenues en s'adressant au:

i) WHO Collaborating Centre for Reference and Research on Influenza, VIDRL, Peter Doherty Institute, 792 Elizabeth Street, Melbourne, Victoria 3000, Australie (télécopie: +61 393 429 329, site Web: http://www.influenzacentre.org, courriel: whoflu@influenzacentre.org);

ii) Centre collaborateur OMS de référence et de recherche pour la grippe, Institut national des maladies infectieuses, Gakuen 4-7-1, Musashi-Murayama, Tokyo 208-0011, Japon (télécopie: +81 42 561 6149 ou +81 42 565 2498, courriel: whocc-flu@nih.go.jp);

[3] See http://www.who.int/influenza/vaccines/virus/candidates_reagents/home

[4] See http://www.who.int/wer/2012/wer8747.pdf

(iii) WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza, Centers for Disease Control and Prevention, 1600 Clifton Road, Mail Stop G16, Atlanta, GA 30329, USA (fax: +1 404 639 0080, web site: http://www.cdc.gov/flu/, email: influenzavirussurveillance@cdc.gov);

(iv) WHO Collaborating Centre for Reference and Research on Influenza, The Francis Crick Institute, 1 Midland Road, London NW1 1AT, UK (tel: +44 203 796 1520 or +44 203 796 2444); website: http://www.crick.ac.uk/research/worldwide-influenza-centre; email: whocc@crick.ac.uk);

(v) WHO Collaborating Centre for Reference and Research on Influenza, National Institute for Viral Disease Control and Prevention, China CDC, 155 Changbai Road, Changping District, 102206, Beijing, P.R. China. (tel:+8610 5890 0851, fax: +8610 5890 0851; email: whocc-china@cnic.org.cn; website: http://www.cnic.org.cn/eng/).

WHO provides fortnightly updates[5] of the global influenza activity. Other information of influenza surveillance can be found on the WHO Global Influenza Programme website.[6] ■

iii) WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza, Centers for Disease Control and Prevention, 1600 Clifton Road, Mail Stop G16, Atlanta, GA 30329, États-Unis d'Amérique (télécopie: +1 404 639 0080, site Web: http://www.cdc.gov/flu/, courriel: influenzavirus-surveillance@cdc.gov);

iv) WHO Collaborating Centre for Reference and Research on Influenza, The Francis Crick Institute, 1 Midland Road, London NW1 1AT, Royaume Uni (téléphone: +44 203 796 1520 ou +44 203 796 2444), site Web: http://www.crick.ac.uk/research/worldwide-influenza-centre,courriel: whocc@crick.ac.uk);

v) au centre collaborateur OMS de référence et de recherche pour la grippe, Institut national de lutte contre les maladies virales, Chine CDC, 155 route de Changbai, district de Changping, 102206, Beijing, République populaire de Chine (téléphone: +8610 5890 0851, télécopie: +8610 5890 0851, courriel: whocc-china@cnic.org, site Web: http://www.cnic.org.cn/eng/).

L'OMS actualise tous les 2 semaines[5] les informations sur l'activité grippale dans le monde. D'autres informations relatives à la surveillance de la grippe peuvent être obtenues sur le Web du Programme mondial de lutte contre la grippe.[6] ■

[5] See http://www.who.int/influenza/surveillance_monitoring/updates/en/

[6] See http://www.who.int/influenza

[5] Voir http://www.who.int/influenza/surveillance_monitoring/updates/en/.

[6] Voir http://www.who.int/influenza.

How to obtain the WER through the Internet

(1) WHO WWW server: Use WWW navigation software to connect to the WER pages at the following address: **http://www.who.int/wer/**

(2) An e-mail subscription service exists, which provides by electronic mail the table of contents of the WER, together with other short epidemiological bulletins. To subscribe, send a message to **listserv@who.int**. The subject field should be left blank and the body of the message should contain only the line subscribe wer-reh. A request for confirmation will be sent in reply.

Comment accéder au REH sur Internet?

1) Par le serveur Web de l'OMS: A l'aide de votre logiciel de navigation WWW, connectez-vous à la page d'accueil du REH à l'adresse suivante: **http://www.who.int/wer/**

2) Il existe également un service d'abonnement permettant de recevoir chaque semaine par courrier électronique la table des matières du REH ainsi que d'autres bulletins épidémiologiques. Pour vous abonner, merci d'envoyer un message à **listserv@who.int** en laissant vide le champ du sujet. Le texte lui même ne devra contenir que la phrase suivante: subscribe wer-reh.

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