Recommended composition of influenza virus vaccines for use in the 2010 southern hemisphere influenza season

September 2009

The World Health Organization (WHO) convenes technical meetings[1] in February and September each year to recommend the composition of influenza vaccines[2] for the northern and southern hemispheres, respectively. This recommendation relates to the composition of vaccines for the forthcoming influenza season in the southern hemisphere (May to October 2010). A recommendation will be made in February 2010 relating to vaccines that will be used for the influenza season in the northern hemisphere (November 2010 to April 2011). For countries in equatorial regions epidemiological considerations will influence which recommendation (February or September) individual National Authorities consider more appropriate.

Influenza activity, February – September 2009

Between February and September 2009, influenza activity was reported in Africa, the Americas, Asia, Europe and Oceania (see Appendix). Activity was higher compared with the same period the previous year[3] and was due to both seasonal influenza and pandemic influenza A(H1N1) 2009 viruses. Following its emergence in March, the pandemic A(H1N1) virus spread rapidly throughout the world, leading to the declaration of an influenza pandemic by WHO on 11 June 2009[4].

Seasonal influenza

In the northern hemisphere, influenza activity was widespread in many countries in February and declined during March and April in some countries. The predominant viruses in Europe and many other countries were A(H3N2) while in Japan and North America higher proportions of A(H1N1) and B viruses were reported. Influenza A(H1N1), A(H3N2) and B viruses co-circulated in varying proportions in many northern hemisphere and tropical countries of Africa and Asia. From June to August, increased activity was reported in some countries in Asia with regional outbreaks of influenza A(H3N2) in China.

In the southern hemisphere, influenza activity began to increase in April and widespread outbreaks of influenza A(H3N2) were reported in South Africa in June. Influenza A(H3N2) and, to a lesser extent A(H1N1), circulated in Argentina, Australia and Chile, while New Zealand reported predominantly A(H1N1) activity. Local outbreaks of influenza B occurred in Madagascar and Réunion (France) and B viruses were detected at low levels in many other countries.

Pandemic A(H1N1) influenza

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

---

[1] http://www.who.int/csr/disease/influenza/vaccinerecommendations/en/index.html
[2] Description of the process of influenza vaccine virus selection and development available at: http://www.who.int/gb/pip/pdf_files/Fluvaccvirusselection.pdf
[3] http://www.who.int/wer/2008/wer8341/en/index.html
[4] http://www.who.int/mediacentre/news/statements/2009/h1n1_pandemic_phase6_20090611/en/index.html

Outbreaks of pandemic A(H1N1) occurred in many countries in the northern hemisphere during May to August. Following a decline in activity in some countries during July or August, a resurgence was reported in September in some countries in Europe and the Americas. From August, rapid increases in activity were reported in African and Asian countries, for example Cambodia, China, Japan, Kenya, Lao People's Democratic Republic, United Republic of Tanzania and Viet Nam.

In the southern hemisphere, pandemic A(H1N1) activity increased rapidly in many countries. Activity peaked in July in some countries, falling to low levels by August or September in Argentina, Australia, Brazil, Chile and New Zealand. In some other countries in the southern hemisphere and in tropical regions of the Americas and Asia, pandemic A(H1N1) influenza virus continued to circulate in September.

The extent and type/subtype of reported influenza activity worldwide are summarized in the appendix.

Influenza A(H5N1)

From 1 February to 21 September 2009, 37 human cases of influenza A(H5N1), 5 of which were fatal, were confirmed and reported by China, Egypt and Viet Nam, where highly pathogenic avian influenza A(H5N1) is present in poultry. Since December 2003, a total of 440 human cases and 262 deaths have been confirmed in 15 countries[5]. So far, there has been no evidence of sustained human-to-human transmission.

Antigenic and genetic characteristics of recent isolates

A combination of antigenic and genetic analyses is used to identify emergent antigenic variants of potential future epidemic importance and for consideration of their inclusion in vaccines. Antigenic relationships among contemporary viruses and vaccine viruses are of prime importance in determining vaccine composition. These relationships are evaluated mainly in haemagglutination inhibition (HI) tests with postinfection ferret antisera against egg and cell grown reference and vaccine viruses, using red blood cells principally from turkeys and guinea pigs, but also from other species as appropriate. Virus neutralization tests provide complementary data. Antigenic cartography is used as an additional analytical tool to visualize and integrate antigenic data. Phylogenetic analyses of haemagglutinin (HA) and neuraminidase (NA) genes help to define the genetic relatedness of antigenic variants to their predecessors and to elucidate the molecular basis for antigenic drift. The spread of antigenic variants associated with influenza outbreaks in different countries is also an important criterion for selection of epidemiologically relevant vaccine candidates.

Influenza A(H1N1) viruses

The majority of A(H1N1) viruses detected worldwide during this period were pandemic A(H1N1); a decreasing proportion was seasonal A(H1N1). HI tests using postinfection ferret antisera indicated that pandemic A(H1N1) viruses were antigenically homogeneous and closely related to the vaccine virus A/California/7/2009 (Table 1). Sequence analysis of the pandemic A(H1N1) viruses indicated that they were genetically homogeneous. Seasonal A(H1N1) viruses are distinct from the pandemic A(H1N1) viruses; most were antigenically and genetically closely related to A/Brisbane/59/2007.

[5] http://www.who.int/csr/disease/avian_influenza/country/cases_table_2009_08_31/en/index.html

Table 1 Results of haemagglutination inhibition tests of pandemic A(H1N1) viruses with postinfection ferret antisera

	A/California/7/2009	A/Narita/1/2009	A/Brisbane/59/2007
Antigens			
A/California/7/2009	**2560**	2560	10
A/Narita/1/2009	2560	**5120**	40
A/Brisbane/59/2007*	5	5	**1280**
Recent isolates			
A/Argentina/08/2009	2560	2560	10
A/Chile/7109/2009	2560	2560	10
A/Denmark/528/2009#	1280	5120	10
A/England/195/2009	1280	2560	20
A/Florida/12/2009	5120	5120	20
A/Haiti/89/2009	2560	2560	20
A/Kenya/31/2009	1280	1280	10
A/Kobe/91992/2009	2560	5120	10
A/Laos/1294/2009	2560	5120	10
A/Mexico/4108/2009	2560	ND	40
A/Myanmar/60/2009	2560	5120	10
A/New Zealand/876/2009	2560	2560	20
A/Panama/4264/2009	2560	2560	10
A/Paraguay/912/2009	5120	5120	40
A/Sichuan/sw11/2009	2560	ND	10
A/Uruguay/706/2009	5120	2560	20

* Seasonal A(H1N1) vaccine virus
# Oseltamivir resistant

Influenza A(H3N2) viruses

In HI tests with postinfection ferret antisera many viruses were antigenically closely related to the current vaccine viruses A/Brisbane/10/2007 and A/Uruguay/716/2007. Since March increasing proportions of viruses were antigenically and genetically distinguishable from the vaccine viruses and were closely related to A/Perth/16/2009 and A/Hong Kong/1985/2009 reference viruses (Table 2).

Table 2 Results of haemagglutination inhibition tests of influenza A(H3N2) viruses with postinfection ferret antisera

	A/Brisbane/10/2007	A/HK/1985/2009	A/Perth/16/2009
Antigens			
A/Brisbane/10/2007	**1280**	<40	40
A/Uruguay/716/2007	2560	80	<40
A/Hong Kong/1985/2009	80	**2560**	1280
A/Perth/16/2009	<40	320	**1280**
Recent isolates			
A/Cameroon/350/2009	320	80	80
A/Ghana/FS1110/2009	320	80	40
A/Iceland/6043/2009	640	40	<40
A/Lithuania/142K/2009	1280	40	80
A/Victoria/212/2009	640	ND	<40
A/Columbia/227/2009	80	1280	640
A/Costa Rica/5179/2009	80	ND	640
A/Ghana/FS1267/2009	80	2560	2560
A/Iran/755/2009	80	2560	2560
A/Johannesburg/385/2009	160	2560	640
A/Luxembourg/791/2009	80	5120	2560
A/Myanmar/77/2009	160	1280	1280
A/Philippines/2725/2009	40	ND	640
A/Singapore/33/2009	<40	5120	640
A/Wisconsin/15/2009	<40	2560	1280

Influenza B viruses

Influenza B viruses of both the B/Victoria/2/87 and the B/Yamagata/16/88 lineages circulated and B/Victoria/2/87 lineage viruses continued to predominate.

In HI tests with postinfection ferret antisera the majority of the B/Victoria/2/87 lineage viruses were antigenically closely related to the vaccine virus B/Brisbane/60/2008. The majority of B/Yamagata/16/88 lineage viruses were closely related to the previous vaccine viruses B/Florida/4/2006 and B/Brisbane/3/2007.

Resistance to influenza antiviral drugs

Neuraminidase inhibitors

The majority of pandemic A(H1N1) viruses were sensitive to the neuraminidase inhibitors oseltamivir and zanamivir. The few cases of resistance to oseltamivir among pandemic A(H1N1) viruses were linked to use of this drug for prophylaxis or treatment and were due to the histidine to tyrosine amino acid substitution at residue 275 (H275Y) in the neuraminidase. There were no reports of oseltamivir resistant A(H3N2) or B viruses, but the majority of seasonal A(H1N1) viruses circulating were oseltamivir resistant[6]. No zanamivir resistant viruses were reported.

M2 inhibitors

All pandemic A(H1N1) viruses and most A(H3N2) viruses were resistant to the M2 inhibitors, amantadine and rimantadine, while the majority of seasonal A(H1N1) viruses were sensitive. Resistance to these antiviral drugs remained predominantly associated with a serine to asparagine substitution at residue 31 (S31N) of the M2 ion channel protein. A small number of seasonal A(H1N1) viruses were resistant to both oseltamivir and M2 inhibitors.

Studies with inactivated influenza virus vaccines

The presence of antibodies to the HA of recent virus isolates was determined by HI tests in eight panels of sera from younger adult and elderly subjects who had received seasonal trivalent inactivated vaccines. The trivalent vaccines contained the antigens of A/Brisbane/59/2007 (H1N1) and A/Uruguay/716/2007 (H3N2); for the B component, vaccines contained B/Brisbane/60/2008 or B/Florida/4/2006. Only panels from recipients who had received vaccine containing B/Brisbane/60/2008 were used for the analysis of recent influenza B virus isolates. For all panels of sera, the antibody responses to the seasonal A(H1N1) vaccine component were not considered due to the predominance of pandemic A(H1N1) viruses in the world. In addition, two panels of sera from subjects participating in clinical trials of pandemic A(H1N1) vaccines were analysed.

Vaccines containing influenza A/California/7/2009-like antigen stimulated anti-HA antibodies of similar geometric mean HI titres to the vaccine virus and recent pandemic A(H1N1) isolates. Geometric mean HI titres were lower to a recent seasonal A(H1N1) virus than to the vaccine virus (average reductions: 83 %).

Vaccines containing influenza A/Brisbane/10/2007 (H3N2)-like antigens stimulated anti-HA antibodies of geometric mean HI titres that were lower to recent isolates than to the vaccine virus (average reductions: younger adults 67 %; elderly 70 %). Similar results were obtained in microneutralization tests for a subset of sera (average reductions: younger adults 76%; elderly 76%).

Vaccines containing influenza B/Brisbane/60/2008-like antigen stimulated anti-HA antibodies of similar geometric mean HI titres to the vaccine virus and recent B/Victoria/2/87 lineage isolates. However, geometric mean HI titres were somewhat lower to recent B/Yamagata/16/88 lineage viruses than to the vaccine virus (average reductions: younger adults 52 %; elderly subjects 69 %).

[6] http://www.who.int/csr/disease/influenza/h1n1_table/en/index.html

Recommended composition of influenza virus vaccines for use in the 2010 influenza season

Pandemic influenza A(H1N1) viruses emerged in March and spread globally to become predominant, while seasonal influenza A(H1N1), A(H3N2) and B viruses co-circulated to a lesser extent in many countries during the period February to September 2009.

Pandemic A(H1N1) viruses were antigenically and genetically similar to A/California/7/2009-like viruses. Vaccines containing A/California/7/2009 antigens stimulated anti-HA antibodies of similar titres against the vaccine virus and recent pandemic A(H1N1) viruses.

Seasonal influenza A(H1N1) viruses were associated with very few outbreaks and the numbers of isolates diminished significantly by August. The majority of recent viruses were antigenically and genetically similar to the vaccine virus A/Brisbane/59/2007.

Influenza A(H3N2) viruses were associated with outbreaks in several countries. The majority of recent viruses were antigenically and genetically distinguishable from the vaccine viruses A/Brisbane/10/2007 and A/Uruguay/716/2007 and were closely related to A/Perth/16/2009-like reference viruses. Current vaccines containing A/Uruguay/716/2007 antigens stimulated anti-HA antibodies with titres that were consistently lower to recent influenza A(H3N2) viruses.

Influenza B outbreaks were reported in several countries. While viruses of both B/Victoria/2/87 and B/Yamagata/16/88 lineages co-circulated, B/Victoria/2/87 lineage viruses predominated. The majority of recent B/Victoria/2/87 lineage viruses were antigenically and genetically closely related to B/Brisbane/60/2008. Most recent B/Yamagata/16/88 lineage viruses were antigenically closely related to B/Florida/4/2006. Current vaccines containing B/Brisbane/60/2008 antigens stimulated anti-HA antibodies that had similar titres against the vaccine viruses and recent viruses of the B/Victoria/2/87 lineage; however, titres were consistently lower to recent viruses of the B/Yamagata/16/88 lineage.

It is recommended that vaccines for use in the 2010 influenza season (southern hemisphere winter) contain the following:

– an A/California/7/2009 (H1N1)-like virus;
– an A/Perth/16/2009 (H3N2)-like virus;
– a B/Brisbane/60/2008-like virus.

As in previous years, national control 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[7].

Vaccine viruses (including reassortants) and reagents for use in the laboratory standardization of inactivated vaccine may be obtained from: Immunobiology Section, Office of Laboratory and Scientific Services, Therapeutic Goods Administration, P.O. Box 100, Woden ACT, 2606 Australia (fax: +61 2 6232 8564, email: influenza.standards@tga.gov.au; web site: http://www.tga.gov.au); Division of Virology, National Institute for Biological Standards and Control, Health Protection Agency, Blanche Lane, South Mimms, Potters Bar, Hertfordshire, EN6 3QG UK (fax: +44 1707 641050, e-mail: enquiries@nibsc.hpa.org.uk, web site: http://www.nibsc.ac.uk/flu_site/index.html); or Division of Product Quality, Center for Biologics Evaluation and Research, Food and Drug Administration, 1401 Rockville Pike, Rockville, MD 20892, United States (fax: +1 301 480 9748).

Requests for reference viruses for antigenic analysis should be addressed to the WHO Collaborating Centre for Reference and Research on Influenza, VIDRL, 10 Wreckyn Street, North Melbourne, Victoria 3051, Australia (fax: +61 3 9342 3939, web site: http://www.influenzacentre.org); the 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, web site: http://www.nih.go.jp/niid/index.html); the WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza, Centers for Disease Control and Prevention, 1600 Clifton Road, Mail Stop G16, Atlanta, GA 30333, United States (fax: +1 404 639 0080, web site: http://www.cdc.gov/flu/); or the WHO Collaborating Centre for Reference and Research on Influenza, MRC National Institute for Medical Research, The Ridgeway, Mill Hill, London NW7 1AA, UK (fax: +44 208 906 4477, web site: http://www.nimr.mrc.ac.uk/wic/). Updated epidemiological information is available on the WHO web site at http://www.who.int/influenza .

[7] http://www.who.int/docstore/wer/pdf/2002/wer7728.pdf

Appendix Extent and type of influenza activity worldwide, February – August 2009

Country, area or territory	February	March	April	May	June	July	August
Africa							
Algeria					H1(pdm)	H1(pdm)	H1(pdm)
Angola							H1(pdm)
Botswana						H1(pdm)	H1(pdm)
Cameroon	*H1, *B		*H1		****H3	*H1, ****H3	**H3, H1(pdm)
Cape Verde						H1(pdm)	*H1, *H3
Côte d'Ivoire	*H1, *H3, *B	*H3, *B	*H1, *H3, *B, H1(pdm)	**H1, **H3, *B, H1(pdm)	*H3, *B, H1(pdm)	*H1, *H3, H1(pdm)	
Democratic Republic of the Congo							H1(pdm)
Djibouti						**H3, **B	H1(pdm)
Egypt	*B	*B	*H1, * B	*H1, *B	H1(pdm)	H1(pdm)	
Ethiopia					H1(pdm)		
France, Mayotte							*A, H1(pdm),
France, Réunion					*B	**B, H1(pdm), *H3	**B, H1(pdm), *A
Gabon						H1(pdm)	
Ghana	*B		*H3, *B	*H1	*H1, *H3, *B	*H3	H1(pdm)
Kenya	*H1,*H3, *B	*H1,*H3	*H1,*H3	*H1, H1(pdm)	*H3, H1(pdm)	**H1, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)
Libyan Arab Jamahiriya						H1(pdm)	
Madagascar	*H1, *H3	*H3	*H1, *H3	*H1, *H3, *B	*H1, *H3, **B	*H3, **B	**B
Mauritius					*H3, H1(pdm)	*H3, *B	
Morocco	*H1	*B	*B		*A, H1(pdm)	*H1, H1(pdm)	H1(pdm)
Mozambique							H1(pdm)
Namibia						H1(pdm)	H1(pdm)
Nigeria		*A	*H3	*H3	*H3	*A	
Senegal					**H3	*H3	
Seychelles						H1(pdm)	
Somalia							H1(pdm)
South Africa			**H3	*H1, ***H3, *B	****H3, *B, H1(pdm)	*H1, ***H3, *B, H1(pdm)	**H3, H1(pdm)
Sudan						H1(pdm)	H1(pdm)
Swaziland							H1(pdm)

Country, area or territory	February	March	April	May	June	July	August
Tunisia	*H1, ****H3, *B	*H1, ****H3, *B	* *H3, *B		*H1, *B, H1(pdm)	*H3	*B, H1(pdm)
Uganda				H1(pdm)	H1(pdm)		
United Republic of Tanzania				H1(pdm)	H1(pdm)		
Zambia						H1(pdm)	H1(pdm)
Zimbabwe						H1(pdm)	H1(pdm)
America							
Antigua and Barbuda						H1(pdm)	H1(pdm)
Argentina			H1(pdm)	**H3, **H1, H1(pdm)	**H3, H1(pdm)	H1(pdm)	H1(pdm)
Bahamas				H1(pdm)	H1(pdm)		
Barbados				*H3	H1(pdm)		H1(pdm)
Belize						H1(pdm)	
Bolivia (Plurinational State of)				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Brazil	*B,	*H1, *B	*H1, H1(pdm)	*H1, *H3, *B, H1(pdm)	***A, *H1, *H3, *B, H1(pdm)	***A, *H3, *B, H1(pdm)	H1(pdm)
Canada	**H1, *H3, ***B	**H1, *H3, ***B	**H1, *H3, **B, H1(pdm)	*H1,*H3,** B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)
Chile	*H1		*H1	*H1,*H3, H1(pdm)	*H3, H1(pdm)	***H3,*B, H1(pdm)	H1(pdm)
Columbia	*H3, *B	*H1	*H1, *H3, H1(pdm)	*H1, *H3, H1(pdm)	****H3, H1(pdm)	H1(pdm)	
Costa Rica			****B, H1(pdm)	****H1, *B, H1(pdm)	****H3, ****B, *H1, H1(pdm)	H1(pdm)	H1(pdm)
Cuba				H1(pdm)	H1(pdm)		
Dominica					H1(pdm)		
Dominican Republic				*H1, *B, H1(pdm)	*H3, H1(pdm)	H1(pdm)	H1(pdm)
Ecuador	*H1,*H3	*H3		*H1, *H3, *B, H1(pdm)	*H1, ***H3, *B, H1(pdm)	*H3, H1(pdm)	H1(pdm)
El Salvador			H1(pdm)	*H1, *B, H1(pdm)	**H1, *B, H1(pdm)	**H1	
France, French Guiana	*H3, *B	*H3	*H3, *B,	*H3, *B,	*H3	*H1, *H3, H1(pdm)	*H1, *H3, *B, H1(pdm)
France, Guadeloupe		*H3			*H3, H1(pdm)	H1(pdm)	H1(pdm), *H3
France, Martinique	*H3				H1(pdm)	*H1, H1(pdm)	*H1, H1(pdm)

Country, area or territory	February	March	April	May	June	July	August
France, Saint Barthélemy							H1(pdm)
France, Saint Martin						H1(pdm)	
Grenada							H1(pdm)
Guatemala		*B, *H1	*H1, H1(pdm)	**H1, *H3, H1(pdm)	*H3, ****B,	*H3, *B	
Guyana						H1(pdm)	H1(pdm)
Haiti					*B, H1(pdm)	*H3, *B, H1(pdm)	
Honduras			*H3	*H1, *H3, *B, H1(pdm)	***H3, ***B, H1(pdm)	**H3, H1(pdm)	
Jamaica		*H1, *B	*H1, *H3		*H3, H1(pdm)		
Mexico	*H1, *H3, *B, H1(pdm)	*H1, **H3, **B, H1(pdm)	***H1, ***H3, H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Nicaragua					****H1, H1(pdm)	H1(pdm)	H1(pdm)
Panama	*A, *B	*A, *B		*H1, H1(pdm)	H1(pdm)	H1(pdm)	
Paraguay			H1(pdm)	*H3, H1(pdm)	*H1, *H3, H1(pdm)	H1(pdm)	H1(pdm)
Peru	*A, *B	*A, *B	*A	**H1, H1(pdm)			
Puerto Rico				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Saint Kitts and Nevis						H1(pdm)	
Saint Lucia						H1(pdm)	
Saint Vincent and the Grenadines							H1(pdm)
Suriname					*H3, H1(pdm)	H1(pdm)	H1(pdm)
Trinidad and Tobago		*H3	H1(pdm)	H1(pdm)	H1(pdm)		
United Kingdom of Great Britain and Northern Ireland, Anguilla					*H3		H1(pdm)
United Kingdom of Great Britain and Northern Ireland, Bermuda				H1(pdm)	H1(pdm)		
United Kingdom of Great Britain and Northern Ireland, British Virgin Islands					H1(pdm)		
United Kingdom of Great Britain and Northern Ireland, Cayman Islands				*H1	*H1, *H3, H1(pdm)		
United States of America	****H1, **H3, ****B	***H1, **H3, ***B, H1(pdm)	*H1, *H3, **B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)

Country, area or territory	February	March	April	May	June	July	August
United States of America, United States Virgin Islands							H1(pdm)
Uruguay	*A	*A		*A H1(pdm)	*H1, *B, H1(pdm)	H1(pdm)	H1(pdm)
Venezuela (Bolivarian Republic of)					H1(pdm)		
Asia							
Afghanistan					H1(pdm)	H1(pdm)	
Azerbaijan				*B	*B		H1(pdm)
Bahrain					H1(pdm)	H1(pdm)	H1(pdm)
Bangladesh		*H3	*H3	*H3	*H3, *B, H1(pdm)	H1(pdm)	
Bhutan					H1(pdm)	H1(pdm)	H1(pdm)
Brunei Darussalam					H1(pdm)	H1(pdm)	H1(pdm)
Cambodia					H1(pdm)	H1(pdm)	**H3, H1(pdm)
China	*H1, *H3, *B	*H1, *H3, **B	*H1, *H3,**B	*H1, *H3, *B, H1(pdm)	**H1, **H3, *B	**H1, ***H3, *B, H1(pdm)	**H1, ***H3, *B
Taiwan, China	**H1, *H3	*H1, *H3	*B	*H3, H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
China, Hong Kong SAR	**H1, *H3, *B	*H1, *H3, *B	*H1, *H3, *B	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, **H3, *B, H1(pdm)	*H1, **H3, *B, H1 (pdm)
Democratic People's Republic of Korea				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Indonesia					H1(pdm)	H1(pdm)	H1(pdm)
India	*H1	*H1			H1(pdm)	H1(pdm)	H1(pdm)
Iran (Islamic Republic of)	*H3, *B	*H1		*B	*H3, H1(pdm)	*H1, *H3, *B, H1(pdm)	H1(pdm)
Iraq					H1(pdm)	H1(pdm)	
Israel	***H3,*B	***H1, *H3, *B	*H1, * H3, * B	*H1, *H3, *B	H1(pdm)	H1(pdm)	H1(pdm)
Japan	****H1, **H3, ****B	**H1, *H3, ****B	*H1, **H3, **B	*H1, ***H3, *B, H1(pdm)	*H1, **H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	*H1, *H3, H1(pdm)
Jordan					H1(pdm)	H1(pdm)	H1(pdm)
Kazakhstan	*A	*A,*B	*A, *B	*A, *B		H1(pdm)	H1(pdm)
Kuwait				H1(pdm)	H1(pdm)	H1(pdm)	
Kyrgyzstan	*H3	* H1, *H3				*H1	*H3, H1(pdm)
Lao People's Democratic Republic					H1(pdm)	H1(pdm)	H1(pdm)
Lebanon				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Malaysia	*H3	*B	*H3, *B	*H3, *B	H1(pdm)	H1(pdm)	H1(pdm)
Mongolia	***H1	*H1					
Nepal					H1(pdm)	H1(pdm)	H1(pdm)
Myanmar					H1(pdm)	H1(pdm)	H1(pdm)

Country, area or territory	February	March	April	May	June	July	August
Oman			*H3, *B	*H3, *B	H1(pdm)	H1(pdm)	H1(pdm)
Pakistan	*H3, *B				H1(pdm)	*A	*A
Philippines	*H1, *H3	*H1, *H3	*H1, *H3	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Qatar					H1(pdm)		
Republic of Korea			H1(pdm)	*H3, H1(pdm)	H1(pdm)	*H1, *H3, H1(pdm)	*H3, *B, H1(pdm)
Saudi Arabia					H1(pdm)	H1(pdm)	H1(pdm)
Singapore	*B	*H1	*H3, *B	*H1, *H3, H1(pdm)	*H3, *B, H1(pdm)	H1(pdm)	H1(pdm)
Sri Lanka			*H1	*H1	*H1, H1(pdm)	*H1, *B, H1(pdm)	*H3, *B, H1(pdm)
Syrian Arab Republic						H1(pdm)	H1(pdm)
Thailand				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
United Arab Emirates				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Uzbekistan						H1(pdm)	H1(pdm)
Viet Nam			*H3, *B	*H3	H1(pdm)	H1(pdm)	H1(pdm)
Yemen					H1(pdm)	H1(pdm)	H1(pdm)
Europe							
Albania	*H3			*B		H1(pdm)	H1(pdm)
Andorra						H1(pdm)	
Austria	****H3	*H3, *B	*B	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Belarus	****H3	***A, *B	*A, *B			*A	
Belgium	*H1, ****H3, *B	****H3, *B	*B	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Bosnia and Herzegovina	****H3					H1(pdm)	H1(pdm)
Bulgaria	**H3		*H3, *B		H1(pdm)	H1(pdm)	H1(pdm)
Croatia	****H3, *B	**H3, **** B	*H3, **B			*H1	
Cyprus					H1(pdm)	H1(pdm)	H1(pdm)
Czech Republic	*H1, ****H3, *B	**H3, **B	*A, *B	H1(pdm)	H1(pdm)		
Denmark	****H3	*H1, *H3, *B	*H1, *B	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B, H1(pdm)	H1(pdm)	H1(pdm)
Estonia	****H3, *B	****H3, **B	*H1, **H3, **B	*H3, *B	*A , *B, H1(pdm)	H1(pdm)	H1(pdm)
Finland	*H1, ****H3, *B	*H1, ****H3	*H1, **H3, *B	*B, H1(pdm)			
France	*H1, ****H3, *B	*H3, ** B	*H3,*B H1(pdm)	*H1, *H3, H1(pdm)	*H1, *H3, *B H1(pdm)	*H1, *H3, H1(pdm)	*H1, *H3, *B, H1(pdm)
Georgia	*H3,*B	*H1, *H3, *B	*B	*B		H1(pdm)	H1(pdm)
Germany	*H1, ****H3, *B	*H1, ***H3, **B	*B	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Greece	*H3	**H3, **B	*H3, *B	*H3, H1(pdm)	H1(pdm)	*H3, H1(pdm)	H1(pdm)

Country, area or territory	February	March	April	May	June	July	August
Hungary	****H3, *B	****H3, *B	*A, *B		H1(pdm)	H1(pdm)	H1(pdm)
Iceland					H1(pdm)		
Ireland				H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Italy	*H1, ***H3, *B	*H3, *B	*H3, *B	*H1	*H1, *H3, H1(pdm)	*H1, *H3, H1(pdm)	H1(pdm)
Latvia	*H1, ***H3, *B	***H3, *B	*H1, * H3, * B	*H1, * H3, * B		H1(pdm)	H1(pdm)
Liechtenstein							H1(pdm)
Lithuania	**H3, *B				H1(pdm)	H1(pdm)	H1(pdm)
Luxembourg	****H3	**H3	*B	*H3	H1(pdm)	H1(pdm)	H1(pdm)
Malta					H1(pdm)	H1(pdm)	H1(pdm)
Monaco					H1(pdm)		
Montenegro					H1(pdm)		H1(pdm)
Netherlands	*H1, ****H3, *B	****H3, *B	*A, *B, H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Norway	*H1, ****H3	****H3	*H1,*H3, *B	*H3, *B, H1(pdm)	*H3, *B, H1(pdm)	*H3, *B, H1(pdm)	*H3, *B, H1(pdm)
Poland	*H1, ***H3,*B	**H3, *B	*H3, *B	*H1, *H3, H1(pdm)	*H1, *H3, H1(pdm)	H1(pdm)	H1(pdm)
Portugal	**H3	*H3		*B, H1(pdm)	*H3,*B, H1(pdm)	H1(pdm)	H1(pdm)
Republic of Moldova		*H3,* B			H1(pdm)		
Romania	***H3	***H3	**H3	*A, *B, H1(pdm)	*H1, *B, H1(pdm)	*H3, H1(pdm)	H1(pdm)
Russian Federation	**H1, **H3, **B	*H1, **H3, **B	* H1, **H3, **B	*H1, *H3, *B, H1(pdm)	*H1, *H3, *B	*H1, *H3,* B, H1(pdm)	H1(pdm)
Serbia	*H3,**B	**H3, **B			H1(pdm)	H1(pdm)	H1(pdm)
Slovakia	***H3,*B	**H3, *B	*B	H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Slovenia	****H3	***H3	**H1, *H3, *B	*H3, *B	H1(pdm)	H1(pdm)	H1(pdm)
Spain	**H3,*B	*H3, **B	*B, H1(pdm)	*B, H1(pdm)	H1(pdm)	H1(pdm)	H1(pdm)
Sweden	*H1, ****H3	**H3, *B	*H3, *B	*A, *B, H1(pdm)	*A, *B, H1(pdm)	H1(pdm)	H1(pdm)
Switzerland	****H3, **B	****H3, *B	*B	*B, H1(pdm)		H1(pdm)	H1(pdm)
The former Yugoslav Republic of Macedonia					H1(pdm)	H1(pdm)	H1(pdm)
Turkey		*H3, **B	*B	*B, H1(pdm)			H1(pdm)
Ukraine	**H3, *B	****H3, *B	**H3, *B	*B, H1(pdm)	*B		
United Kingdom of Great Britain and Northern Ireland	**H1, **H3, **B	*H1,*H3, *B	**H3, **B, H1(pdm)	*H1,*H3, *B, H1(pdm)	H1(pdm)	*H3, H1(pdm)	H1(pdm)
Oceania							
Australia	*H1	*H1,*H3, *B	*H1,*H3, *B	*H1,*H3, H1(pdm)	*H1,**H3, H1(pdm)	*H1,**H3, H1(pdm)	*H1,*H3, H1(pdm)
Fiji			*H1	*H1	H1(pdm)	H1(pdm)	

Country, area or territory	February	March	April	May	June	July	August
France, New Caledonia				*H1, *H3	**H1, *H3, H1(pdm)	*H1,**H3, H1(pdm)	***H3, H1(pdm)
France, Tahiti			*H1,	*H1, H1(pdm)	H1(pdm),	*A, H1(pdm)	*A, H1(pdm)
France, Wallis and Futuna							H1(pdm)
Kiribati					H1(pdm)	**H3, H1(pdm)	
Maldives						H1(pdm)	H1(pdm)
Marshall Islands							H1(pdm)
Micronesia (Federated States of), Chuuk					**H3, H1(pdm)	**H3, H1(pdm)	
Micronesia (Federated States of), Pohnpei					**H3, H1(pdm)	**H3, H1(pdm)	H1(pdm)
Micronesia (Federated States of), Yap					*H3	***H3, H1(pdm)	H1(pdm)
Nauru					H1(pdm)	H1(pdm)	
New Zealand		*H1, *H3	*H1, *H3, *B, H1(pdm)	***H1, **H3, *B	***H1, *H3, *B, H1(pdm)	*H1, *H3, H1(pdm)	*H1, *H3, H1(pdm)
Palau				*H3, *H1, H1(pdm)	*H3, H1(pdm)	H1(pdm)	*H3, H1(pdm)
Papua New Guinea				*H3	**H3, H1(pdm)	*H3, H1(pdm)	*H3
Timor-Leste							H1(pdm)
Tonga						H1(pdm)	H1(pdm)
United States of America, American Samoa					*H1	H1(pdm)	
United States of America, Guam				*H3	H1(pdm)	H1(pdm)	H1(pdm)
Vanuatu					*H1, **H3, H1(pdm)	*H1, **H3	

Data in Appendix were provided by the Global Influenza Surveillance Network

* = Sporadic activity ** = Local activity *** = Regional outbreaks ****= Widespread outbreaks	A = Influenza A (not subtyped) B = Influenza B H1 = Influenza A(H1N1) H3 = Influenza A(H3N2) H1(pdm) = Pandemic A (H1N1) 2009