

**INFORMATION FOR THE VACCINE AND RELATED
BIOLOGICAL PRODUCTS ADVISORY COMMITTEE
CBER, FDA**

**Global Surveillance and Virus Characterization
March 1, 2018**

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Atlanta, GA 30333**



Global Influenza Surveillance and Response System (GISRS)

- All year around surveillance conducted by GISRS
 - WHOCCs, NICs, ERLs, H5 Reference Laboratories
- A WHO Consultation 19-22 Feb 2018: Review, analysis and conclusion
 - Cochaired by Drs. Kanta Subbarao, WHOCC Melbourne and John McCauley, WHOCC London
 - 9 Advisers: Directors of 6 WHOCCs and 3 ERLS
 - 30 observers from NICs, H5 Reference Laboratories, WHOCCs, WHO ERLs, NICs, academia, veterinary sector and national authorities



Global circulation of influenza viruses

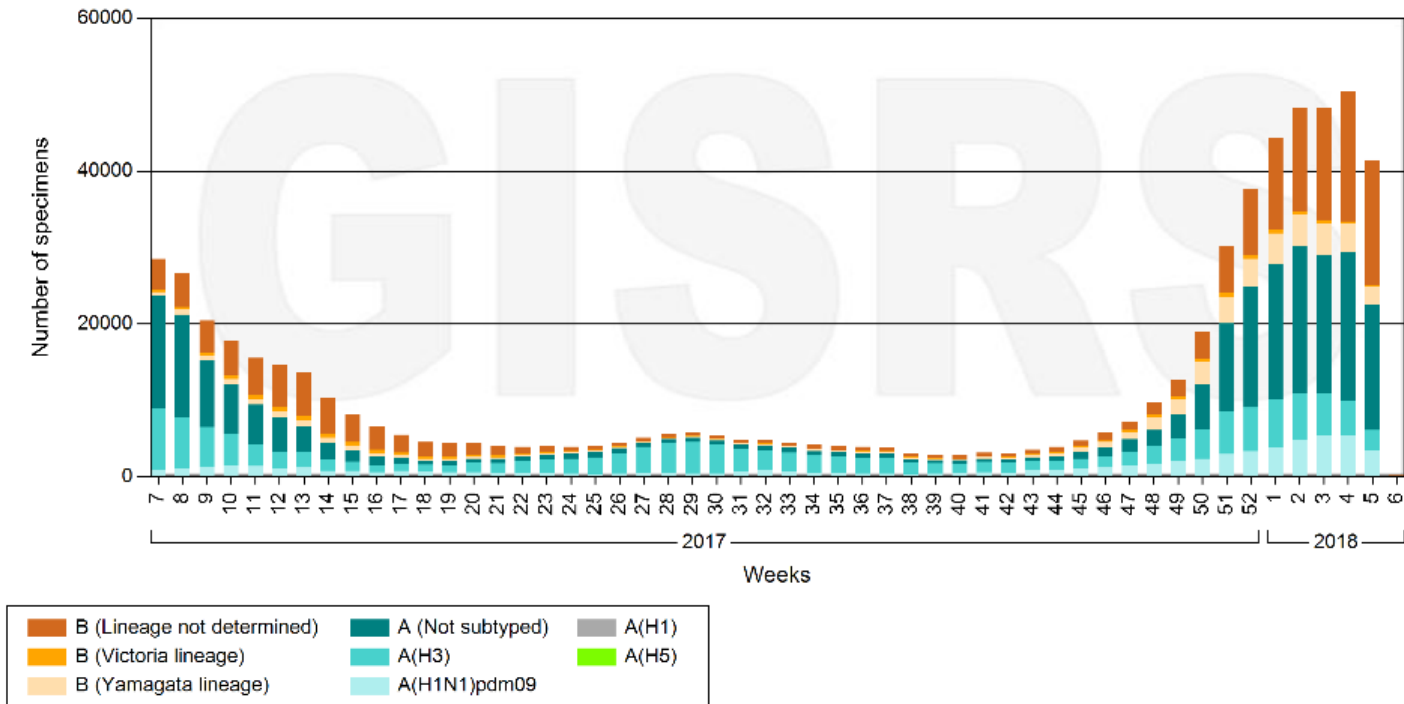


Influenza Laboratory Surveillance Information
by the Global Influenza Surveillance and Response System (GISRS)

generated on 13/02/2018 10:35:26 UTC

Global circulation of influenza viruses

Number of specimens positive for influenza by subtype

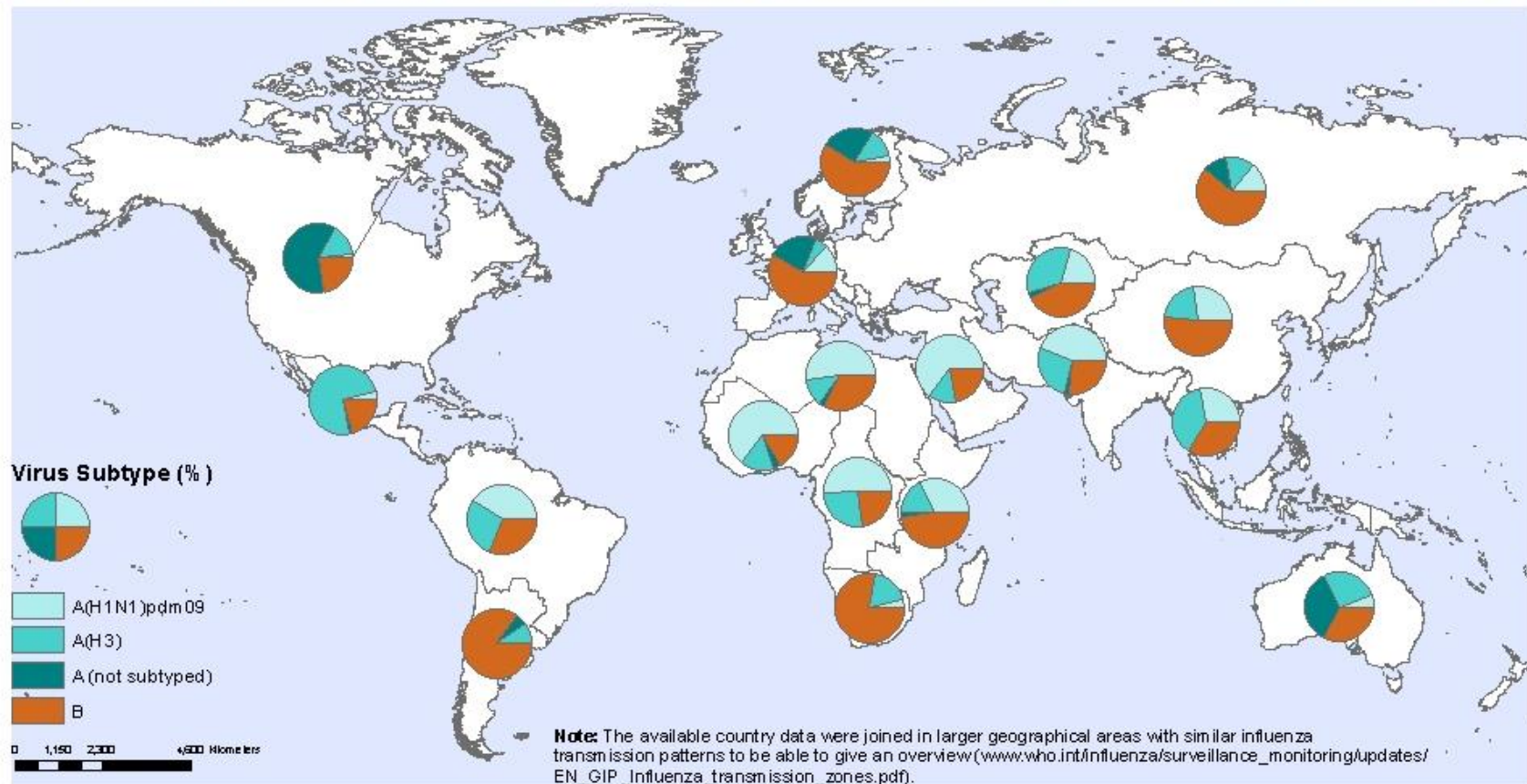


Data source: FluNet (www.who.int/flu-net), GISRS

© World Health Organization 2018

Influenza activity – Sep 2017 to Jan 2018

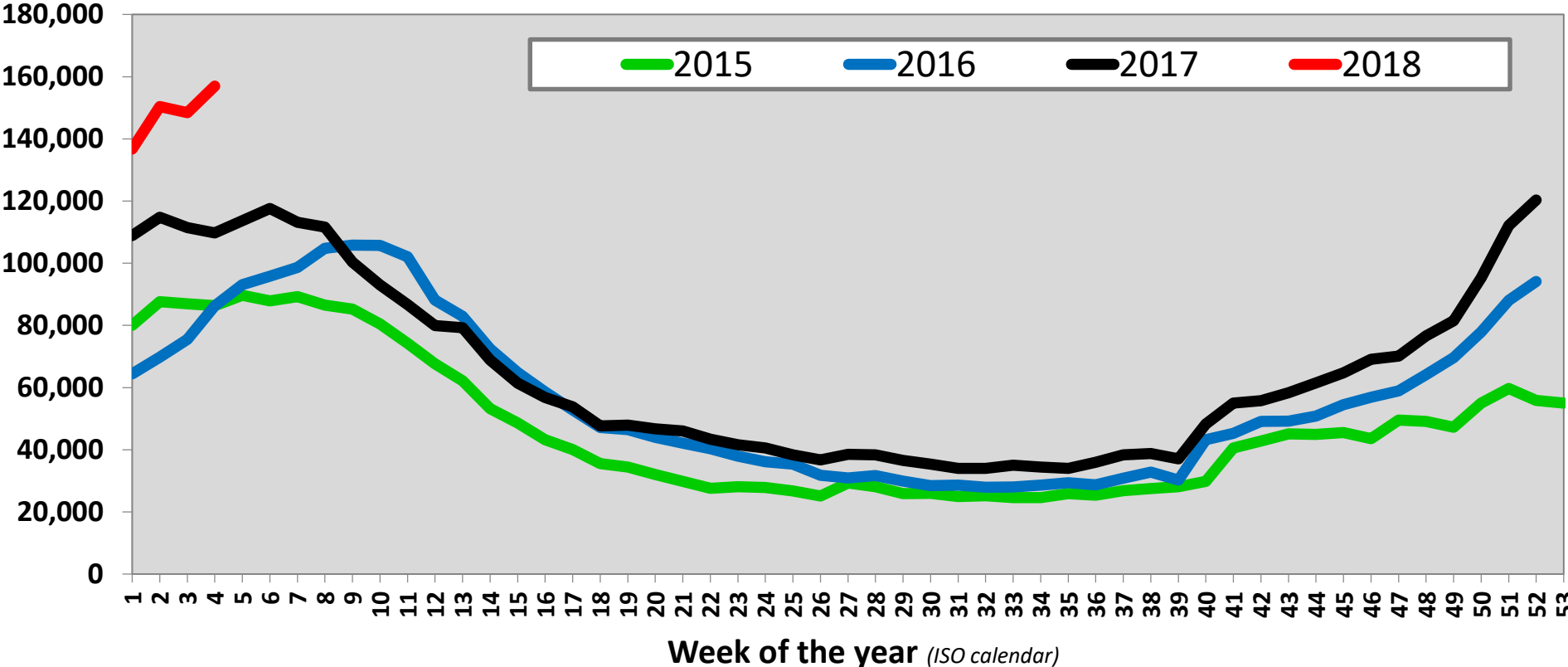
Distribution of influenza virus subtypes by influenza transmission zone, September 2017 to January 2018



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

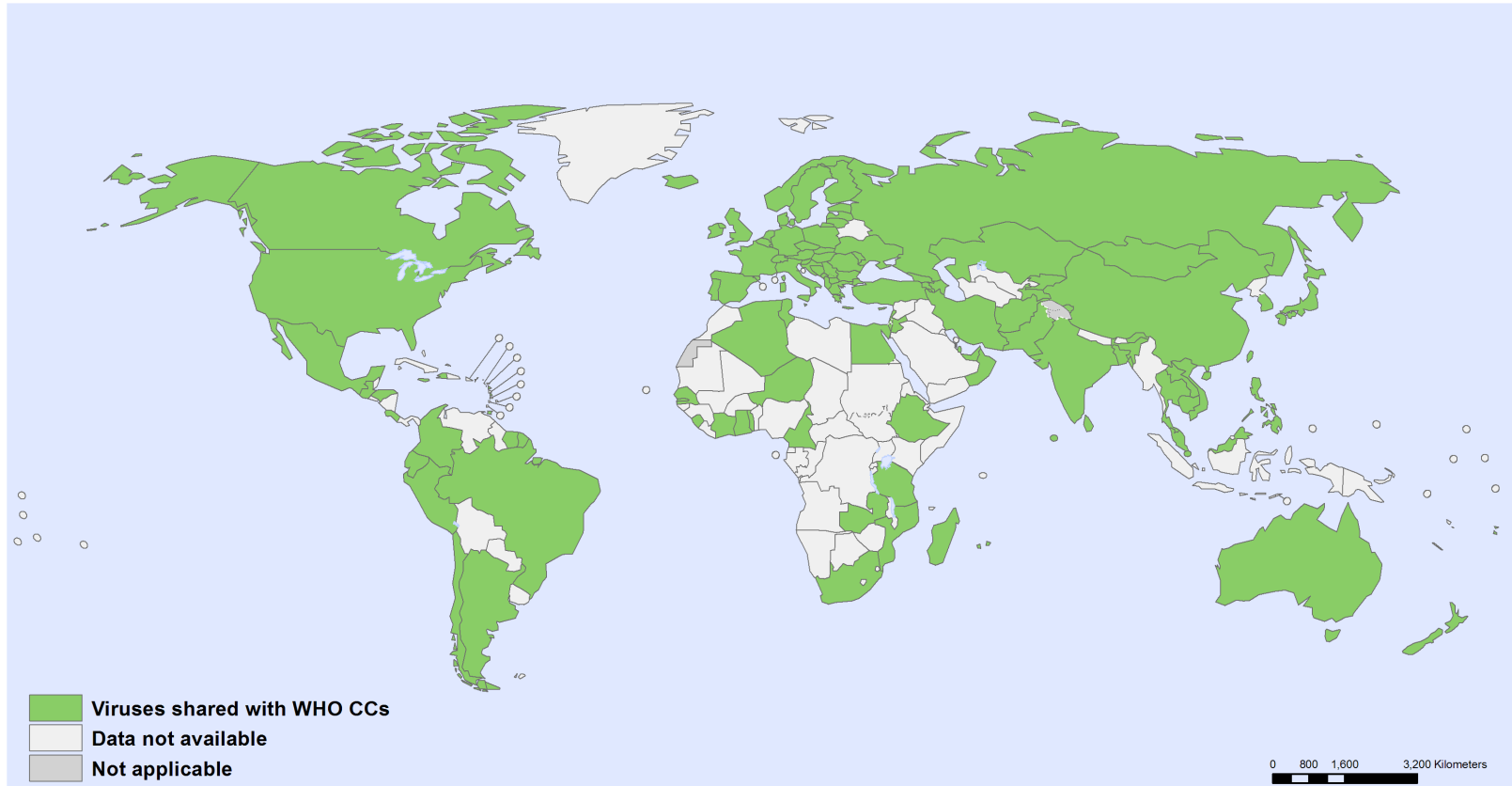
Data Source:
 WHO GIS, FluNet (www.who.int/flu-net)
 as of 16 February 2018, 08:00 UTC

Number of specimens processed by GISRS by week



Data source: FluNet, (www.who.int/flunet), Global Influenza Surveillance and Response System (5 February 2018)

Countries, areas and territories shared viruses with WHO CCs (Sep 2017 – Jan 2018)



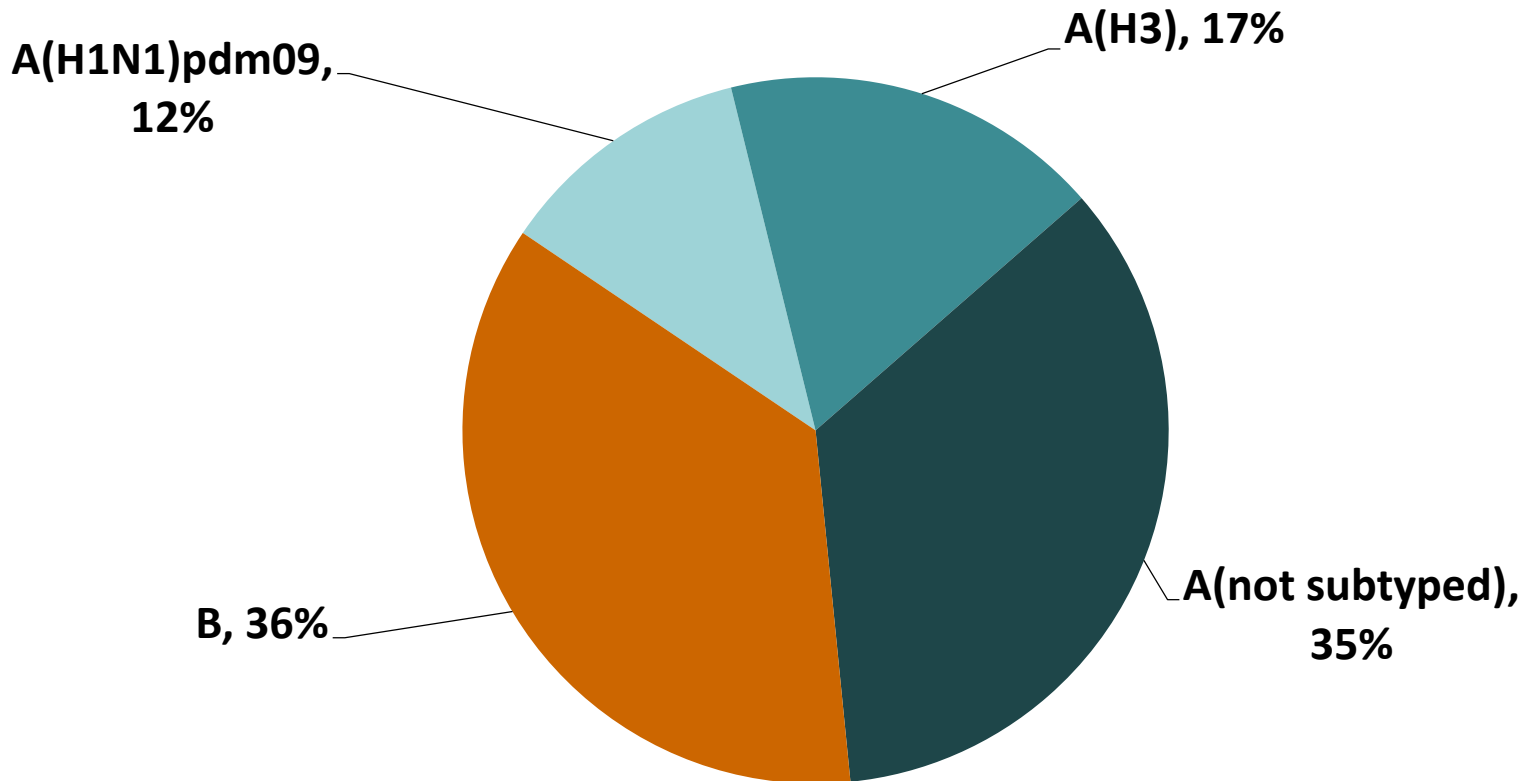
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: WHO CCs reports for the WHO influenza vaccine composition consultation in February 2018
Map Production: WHO GISRS Team
World Health Organization



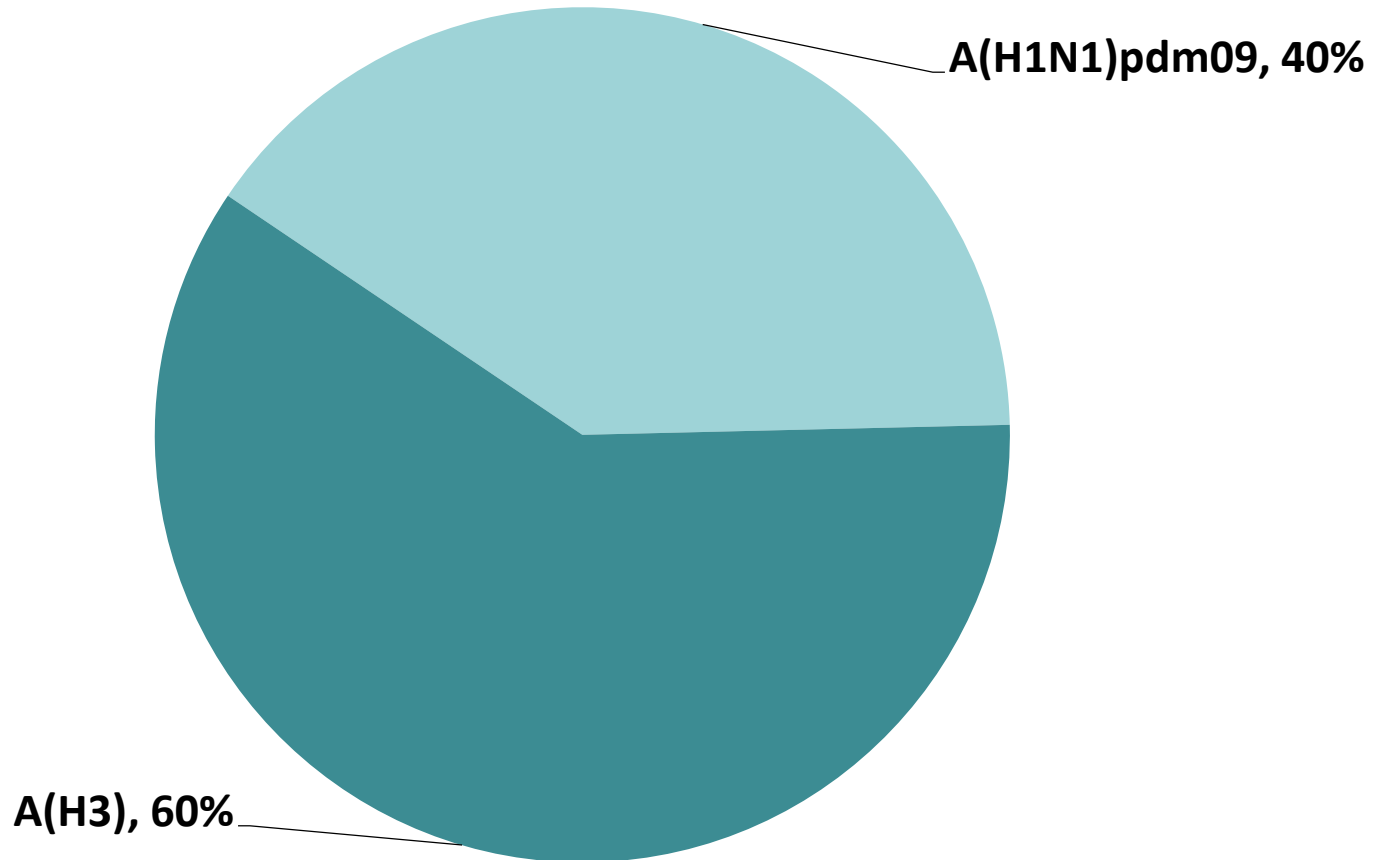
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Percentage of influenza viruses by subtypes (From 4 September 2017– 28 January 2018)

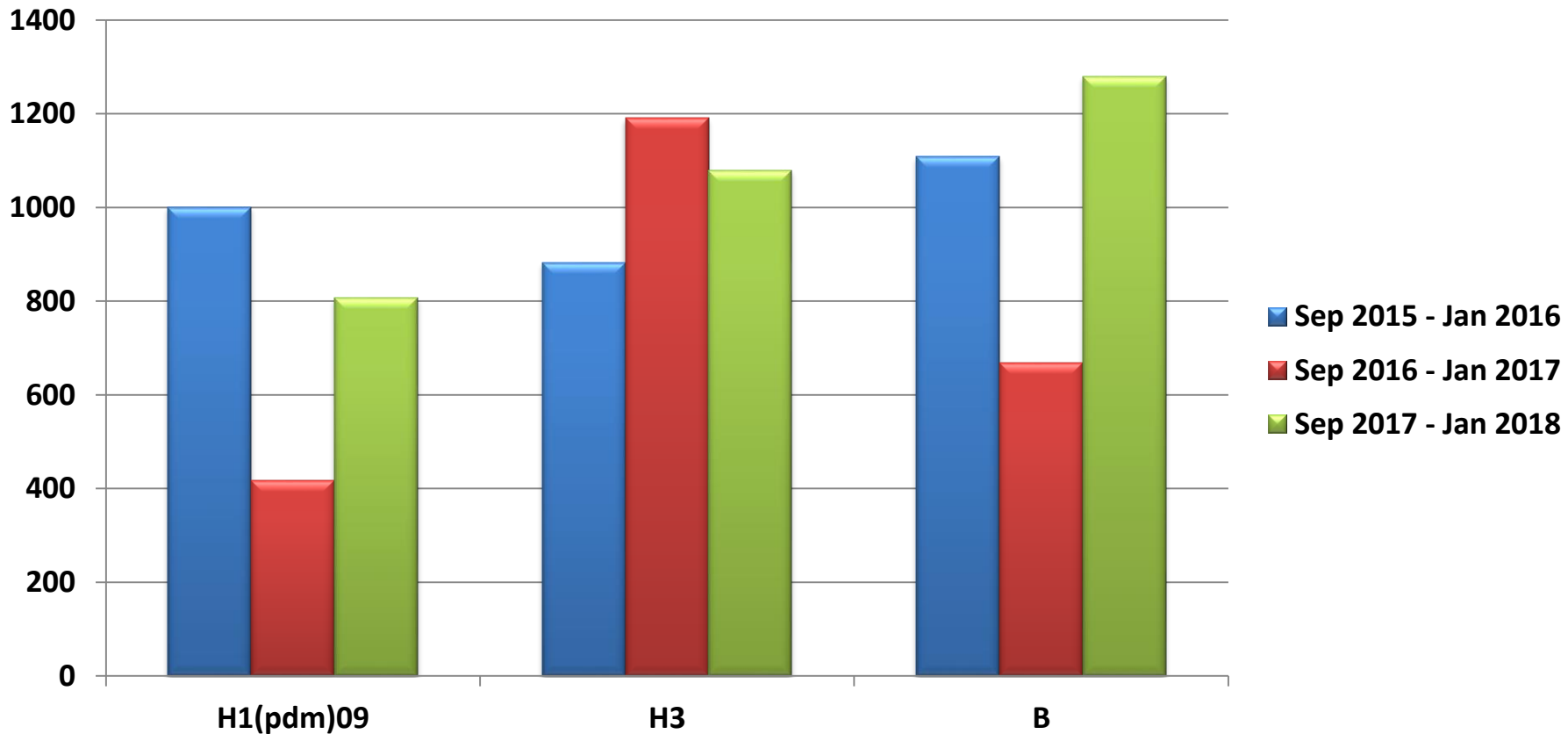


Data source: FluNet, (www.who.int/flunet), Global Influenza Surveillance and Response System (13 February 2018)

Percentage of influenza A viruses by subtypes (From 4 September 2017– 28 January 2018)



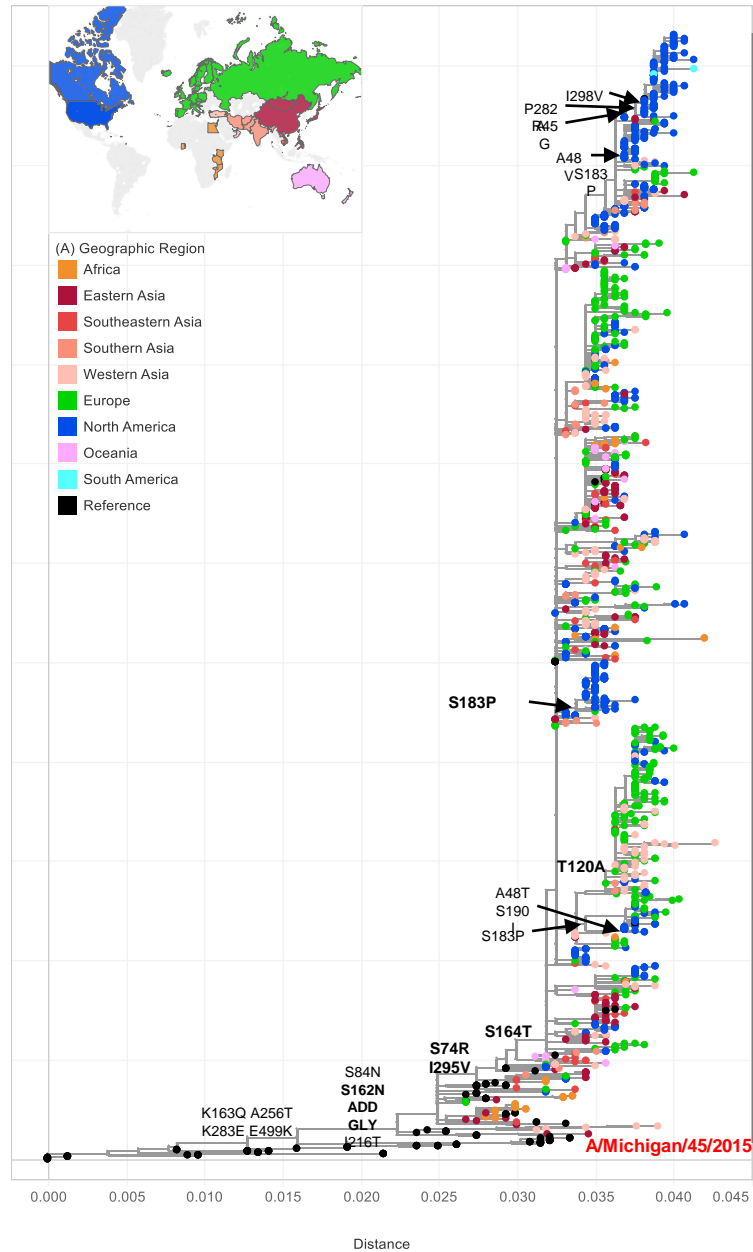
Total viruses characterized during the past 3 Northern Hemisphere reporting periods



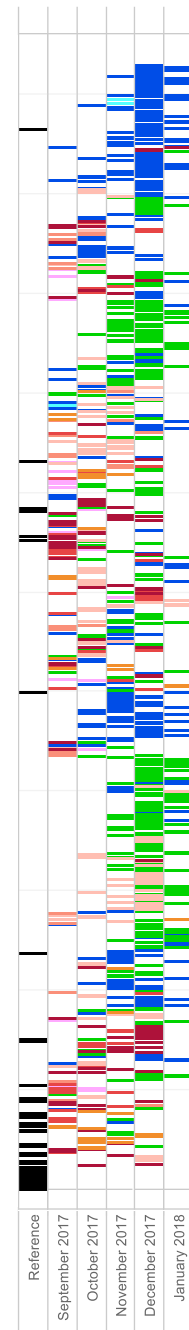
Influenza A(H1N1)pdm09 viruses September 2017 – February 2018

Phylogenetic Tree of A(H1N1)pdm09 HA, All Available Since September 1, 2017

Current Northern Hemisphere Vaccine
 \$ CDC Serology Antigens



(A)



Evolutionary Relationships Among Influenza A(H1N1)pdm09 NA Genes, 2017 (WHOCC Atlanta)

Current Northern Hemisphere Vaccine Strain

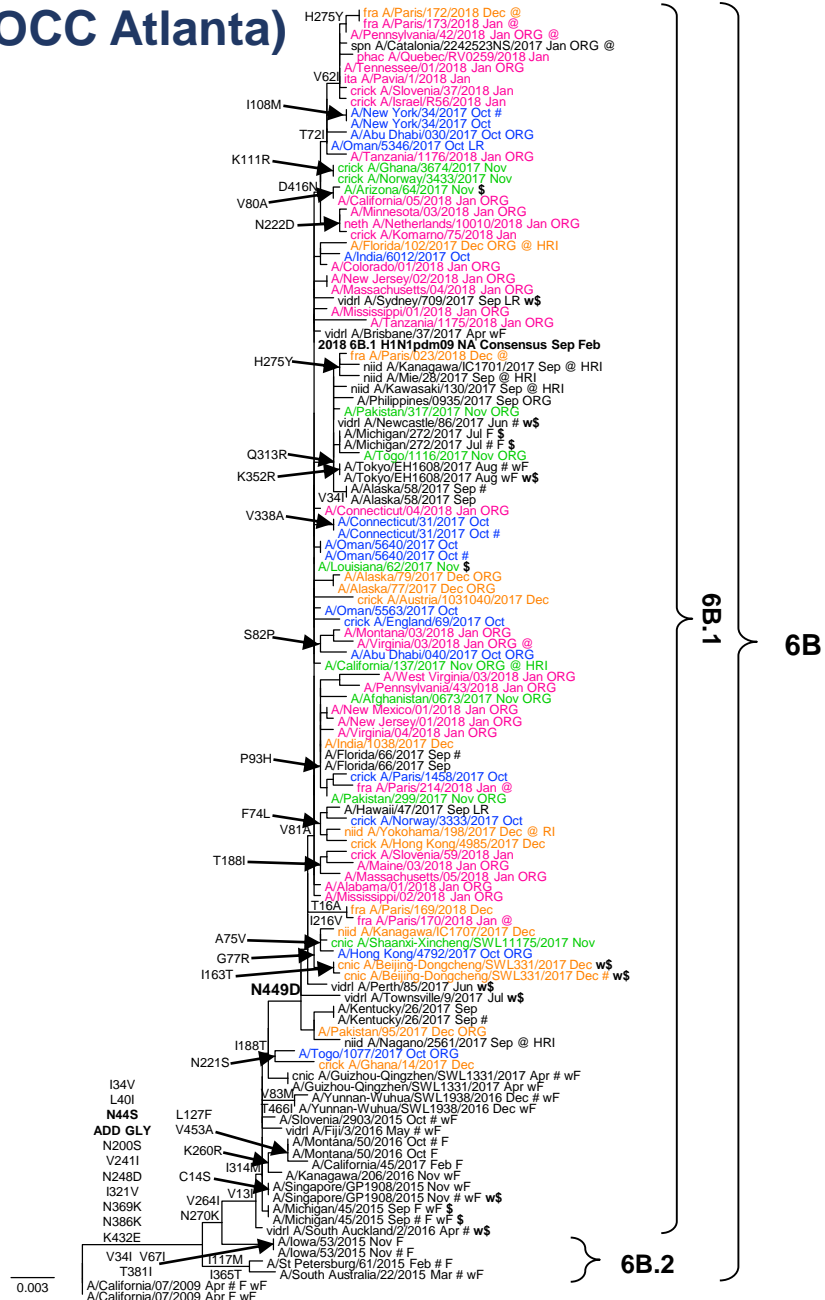
LR - Low Reactor to A/Michigan/45/2015 (≥ 8 fold)

F - CDC Reference Antigen
wF - WHOCC Reference Antigen
\$ - Serology Antigen
w\$ - WHOCC Serology Antigen

- Egg Isolate
ORG - Original Clinical Specimen
ITT - Insufficient Titer for Testing
VNR - Virus Not Recovered

RI - Reduced Inhibition
HRI - Highly Reduced Inhibition
@ - H275Y Oseltamivir Resistance Marker in NA

October 2017
November 2017
December 2017
January 2018

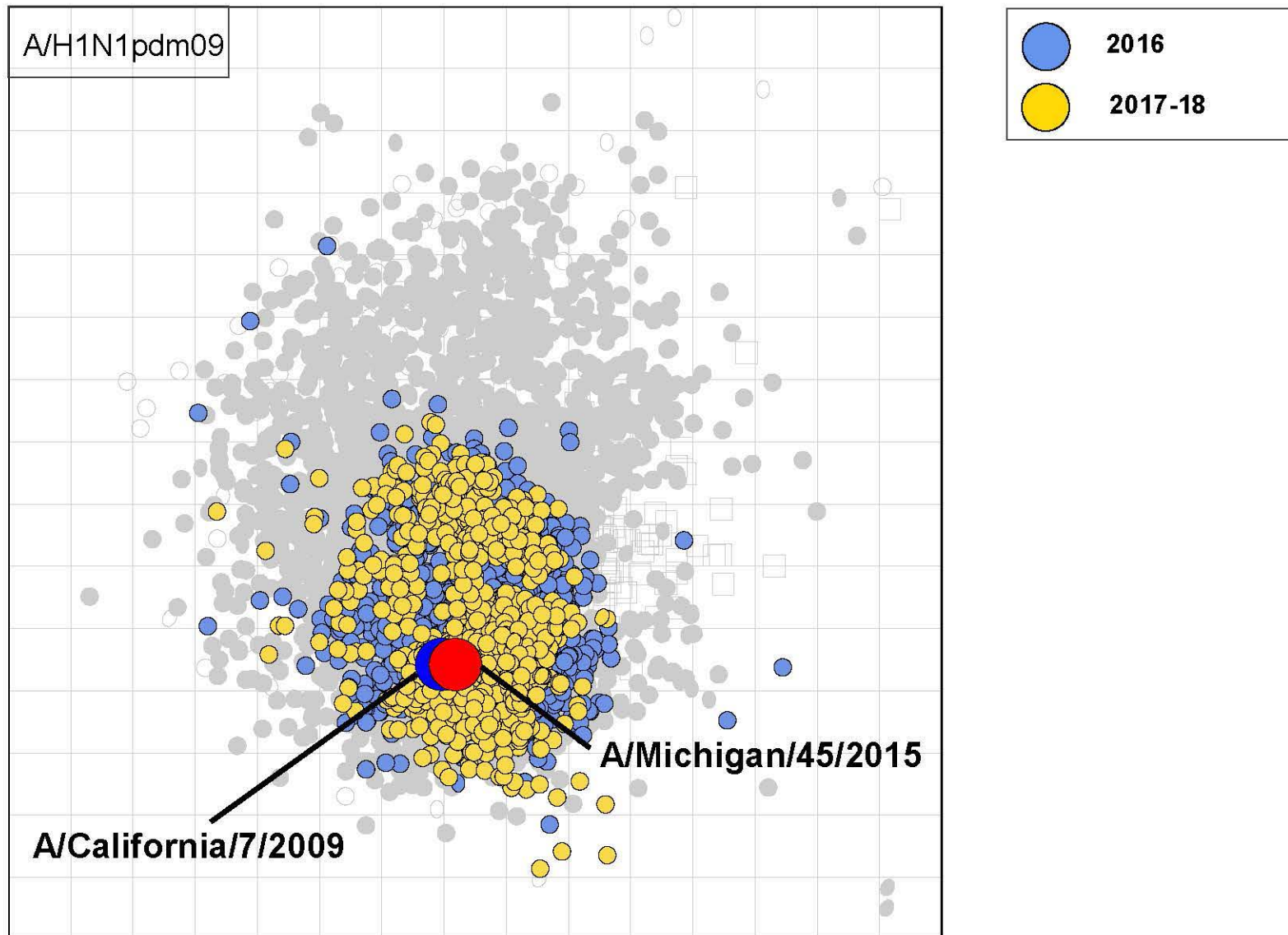


Antigenic Characterization of A(H1N1)pdm09 viruses by HI (WHOCC Atlanta)

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA A(H1N1)pdm09 VIRUSES

REFERENCE VIRUSES		REFERENCE FERRET ANTISERA							Post Vaccination Human Pool		HA GROUP	DATE COLLECTED	Passage	
		6B		6B.1			6B.2		USSR PRIMED	17/18				
		EGG CA/7	MDCK CA/7	EGG UR/61	EGG MI/45	MDCK MI/45	EGG MT/50	MDCK MT/50						MDCK IA/53
1	A/CALIFORNIA/7/2009	2560	2560	320	2560	5120	5120	2560	2560	640	640	6B	2009/04/09	E3
2	A/CALIFORNIA/7/2009	2560	2560	320	2560	2560	2560	2560	1280	640	320	6B	2009/04/09	C3
3	A/ST PETERSBURG/61/2015	320	320	640	640	640	640	320	320	<20	320	6B	2015/02/20	E2/E2
4	A/MICHIGAN/45/2015	2560	2560	320	2560	5120	2560	5120	5120	40	640	6B.1	2015/09/07	E3
5	A/MICHIGAN/45/2015	2560	2560	320	2560	2560	2560	2560	2560	40	640	6B.1	2015/09/07	M1/C3
6	A/MONTANA/50/2016	2560	2560	320	2560	5120	2560	2560	2560	<20	320	6B.1	2016/10/10	E4
7	A/MONTANA/50/2016	2560	2560	320	2560	5120	5120	2560	2560	20	640	6B.1	2016/10/10	C2
8	A/IOWA/53/2015	2560	2560	320	1280	2560	2560	2560	1280	40	320	6B.2	2015/11/04	C3
TEST VIRUSES														
9	A/ARKANSAS/32/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/11/06	C1
10	A/DELAWARE/36/2017	2560	2560	320	2560	5120	5120	5120	2560	40	640	6B.1	2017/10/25	C1
11	A/FLORIDA/83/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/10/31	C1
12	A/IOWA/34/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/10/26	C1
13	A/IOWA/35/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/10/28	C1
14	A/MARYLAND/85/2017	2560	2560	320	2560	5120	5120	2560	2560	160	320	6B.1	2017/10/20	C1
15	A/MARYLAND/88/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/11/02	C1
16	A/MISSISSIPPI/28/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/11/01	C1
17	A/MISSISSIPPI/29/2017	2560	2560	320	2560	5120	5120	5120	2560	40	320	6B.1	2017/11/02	C1
18	A/NORTH CAROLINA/38/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/10/14	C1
19	A/OKLAHOMA/27/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/10/19	C1
20	A/PENNSYLVANIA/266/2017	2560	2560	320	2560	5120	5120	5120	2560	40	320	6B.1	2017/11/03	C1
21	A/TEXAS/294/2017	2560	2560	320	2560	5120	2560	2560	2560	20	320	6B.1	2017/10/23	C1
22	A/TEXAS/295/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/10/06	C1
23	A/WASHINGTON/305/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/10/13	C1
24	A/MISSISSIPPI/26/2017	2560	2560	320	2560	2560	2560	2560	1280	40	320	6B.1	2017/10/20	C1
25	A/WYOMING/23/2017	2560	2560	320	1280	2560	2560	2560	1280	20	640	6B.1	2017/10/23	C1
26	A/TRINIDAD/2176/2017	1280	1280	160	1280	2560	2560	1280	640	20	320	6B.1	2017/09/01	C2
27	A/ONTARIO/RV2287/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/09/08	X2/C1
28	A/ONTARIO/RV2297/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/09/14	X2/C1
29	A/NEW ZEALAND/2264/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/09/25	SX/C1
30	A/NEW ZEALAND/2280/2017	2560	2560	320	2560	5120	2560	2560	1280	40	320	6B.1	2017/09/20	SX/C1
31	A/NEW ZEALAND/2309/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/09/29	SX/C1
32	A/NEW ZEALAND/963/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/09/08	SX/C1
33	A/NEW ZEALAND/2395/2017	1280	1280	160	1280	2560	2560	1280	1280	20	320	6B.1	2017/09/04	CX/C1
34	A/BANGLADESH/2004/2017	2560	2560	320	2560	5120	5120	5120	2560	40	320	6B.1	2017/06/06	C1
35	A/BANGLADESH/3005/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/06/03	C1
36	A/HONG KONG/4807/2017	2560	2560	320	2560	5120	5120	5120	2560	40	640	6B.1	2017/10/17	C1
37	A/HONG KONG/4821/2017	2560	2560	320	2560	5120	5120	5120	2560	40	640	6B.1	2017/10/22	C1
38	A/LAOS/2197/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/06/29	C1
39	A/BURKINA FASO/066/2017	2560	2560	320	2560	5120	5120	2560	2560	40	320	6B.1	2017/06/02	C2
40	A/MOZAMBIQUE/344/2017	2560	2560	320	2560	5120	5120	5120	2560	40	320	6B.1	2017/09/05	C1
41	A/MOZAMBIQUE/413/2017	2560	2560	320	2560	5120	5120	2560	2560	40	640	6B.1	2017/10/09	C1

Antigenic cartography of A(H1N1)pdm09 viruses (WHOCC Atlanta)



Antigenic Characterization of A(H1N1)pdm09 by HI Compared to MDCK-propagated Reference Viruses WHO CCs

WHO CC	A/Michigan/45-like - cell	Low (≥ 8 fold)
CDC	299 (99.3%)	2 (0.7%)
CNIC	102 (99%)	1 (1%)
NIID	76 (100%)	0 (0%)
VIDRL	131 (98.5%)	2 (1.5%)
TOTAL	608 (99.2%)	5 (0.8%)

Antigenic Characterization of A(H1N1)pdm09 by HI Compared to Egg-propagated Reference Viruses WHO CCs

WHO CC	A/Michigan/45-like - egg	Low (≥ 8 fold)
CDC	299 (99.7%)	1 (0.3%)
CNIC	99 (96.1%)	4 (3.9%)
Crick	157 (99.4%)	1 (0.6%)
NIID	76 (100%)	0 (0%)
VIDRL	127 (95.5%)	6 (4.5%)
TOTAL	758 (98.4%)	12 (1.6%)

2017-18 Northern Hemisphere Human Pre- and Post-Vaccination Serum Panels

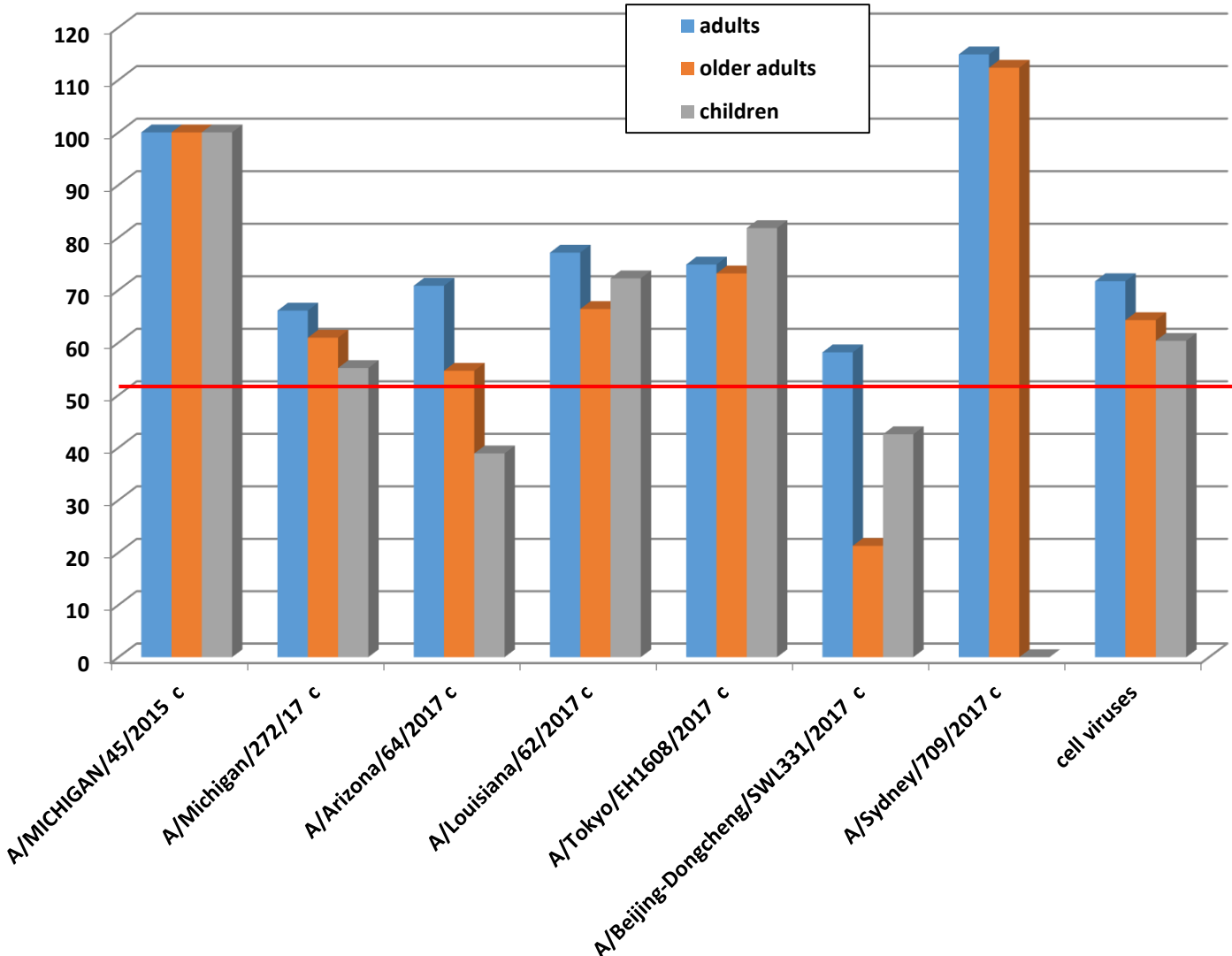
Population	Age Group	Age Range	Vaccine Component
UK	Adults	23-62y	A/Hong Kong/4801/2014 X-263B (H3N2) A/Michigan/45/2015 X-275 (H1N1)pdm09 B/Phuket/3073/2013 B/Brisbane/60/2008
Japan	Adults	23-55y	A/Hong Kong/4801/2014 X-263 (H3N2) A/Singapore/GP1908/2015 H1N1pdm09 IVR-180
	Old adults	66-100y	B/Phuket/3073/2013 B/Texas/02/2013
US ¹	Pediatric	7-32m	A/Hong Kong/4801/2014 X-263B (H3N2)
	Adults	18-49y	A/Michigan/45/2015 X-275 (H1N1)pdm09
	Older Adults	51-63y	B/Phuket/3073/2013
	Elderly	65-85y	B/Brisbane/60/2008
China	Pediatric	2-5y	A/Michigan/45/2015(H1N1)pdm-like strain(NYMC X-275)
	Adults	26-59y	A/Hong Kong/4801/2014(H3N2)-like strain(NYMC X-263B)
	Elderly	61-83y	B/Brisbane/60/2008-like strain(NYMC BX-35)
US ²	Pediatric	3-9y	A/Michigan/45/2015 X-275 (H1N1pdm) A/Hong Kong/4801/2014 NYMC X-263B (H3N2)
	Adults	18-62y	B/Brisbane/60/2008 (B Victoria lineage) B/Phuket/3073/2013 (B Yamagata lineage)
	Elderly	65-86y	A/Michigan/45/2015 X-275* (H1N1) A/Hong Kong/4801/2014 NYMC X-263B* (H3N2) B/Brisbane/60/2008* (B Victoria lineage)

* High dose

1. Provided by CDC

2. Provided by CBER

HI Antibody Responses to the A(H1N1)pdm09 Component among Persons Vaccinated with 2017-2018 N. Hemisphere TIV/QIV: Compared to cell-propagated A/Michigan/45/2015



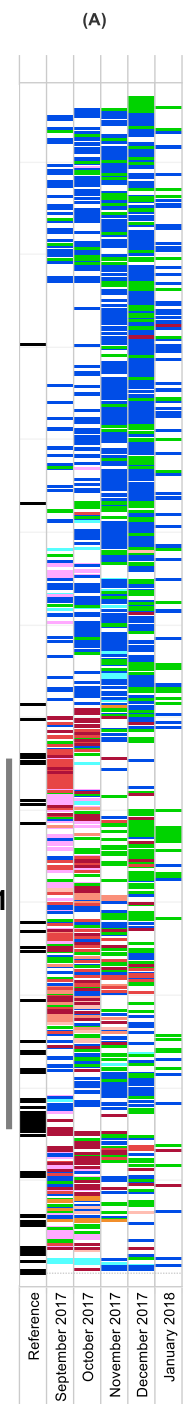
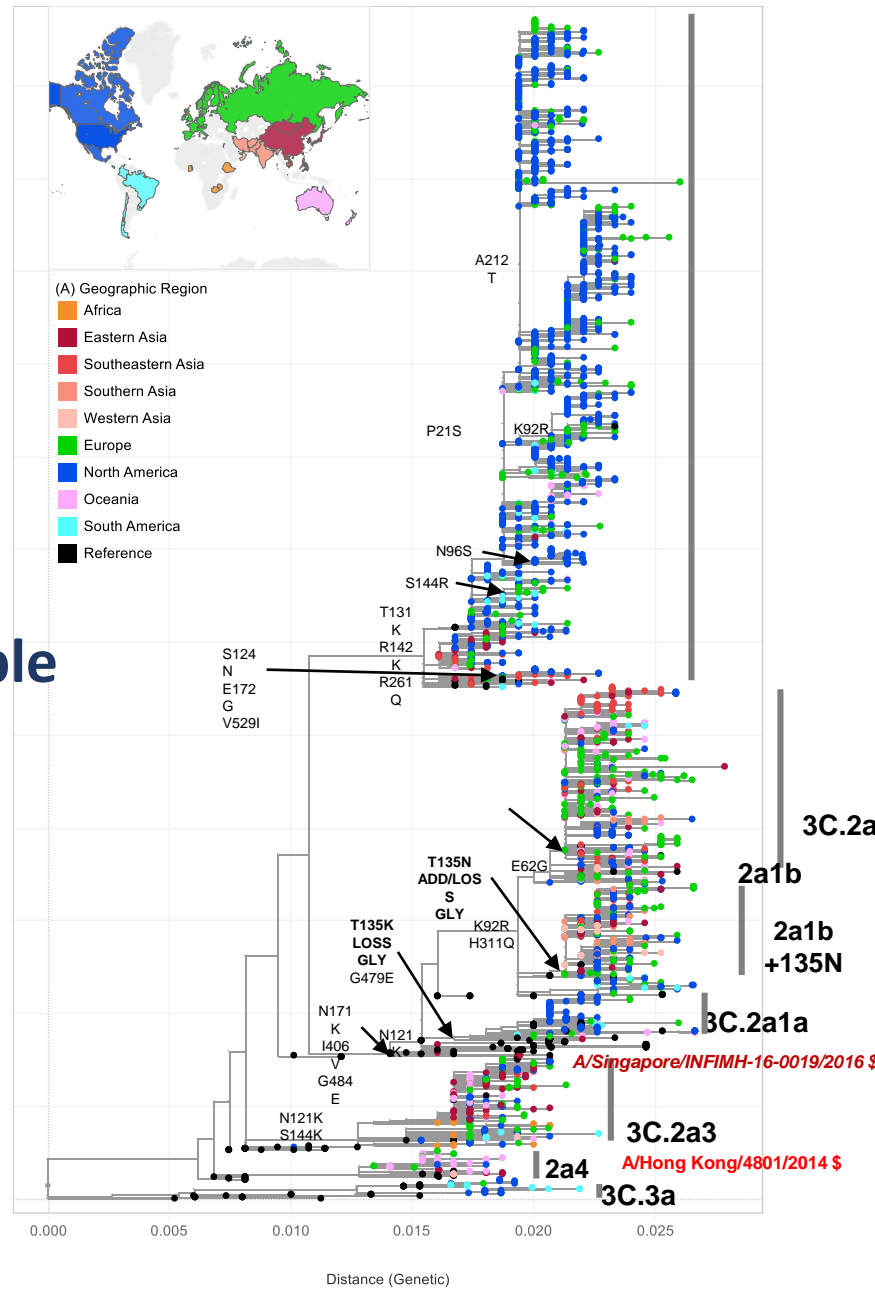
A(H1N1)pdm09 Summary

- **A(H1N1)pdm09 virus activity higher than 2016-17 season**
 - **Outbreaks reported from Africa, Asia, Middle East and parts of Europe**
- **The vast majority of HA gene sequences belonged to phylogenetic subclade 6B.1**
 - **With additional amino acid substitutions in the HA of S74R, S164T and I295V**
- **Almost all recent A(H1N1)pdm09 viruses were antigenically similar to the reference vaccine viruses, egg-or cell-propagated A/Michigan/45/2015**
- **Post-vaccination geometric mean HI titers of human serum panels against most recent circulating viruses tested were not significantly reduced compared with HI titers to reference cell-propagated A/Michigan/45/2015 vaccine viruses**

A(H3N2) viruses

September 2017 – February 2018

Phylogenetic Tree of A(H3N2) HA, All Available Sequence Since September 1, 2017



A(H3N2) HA

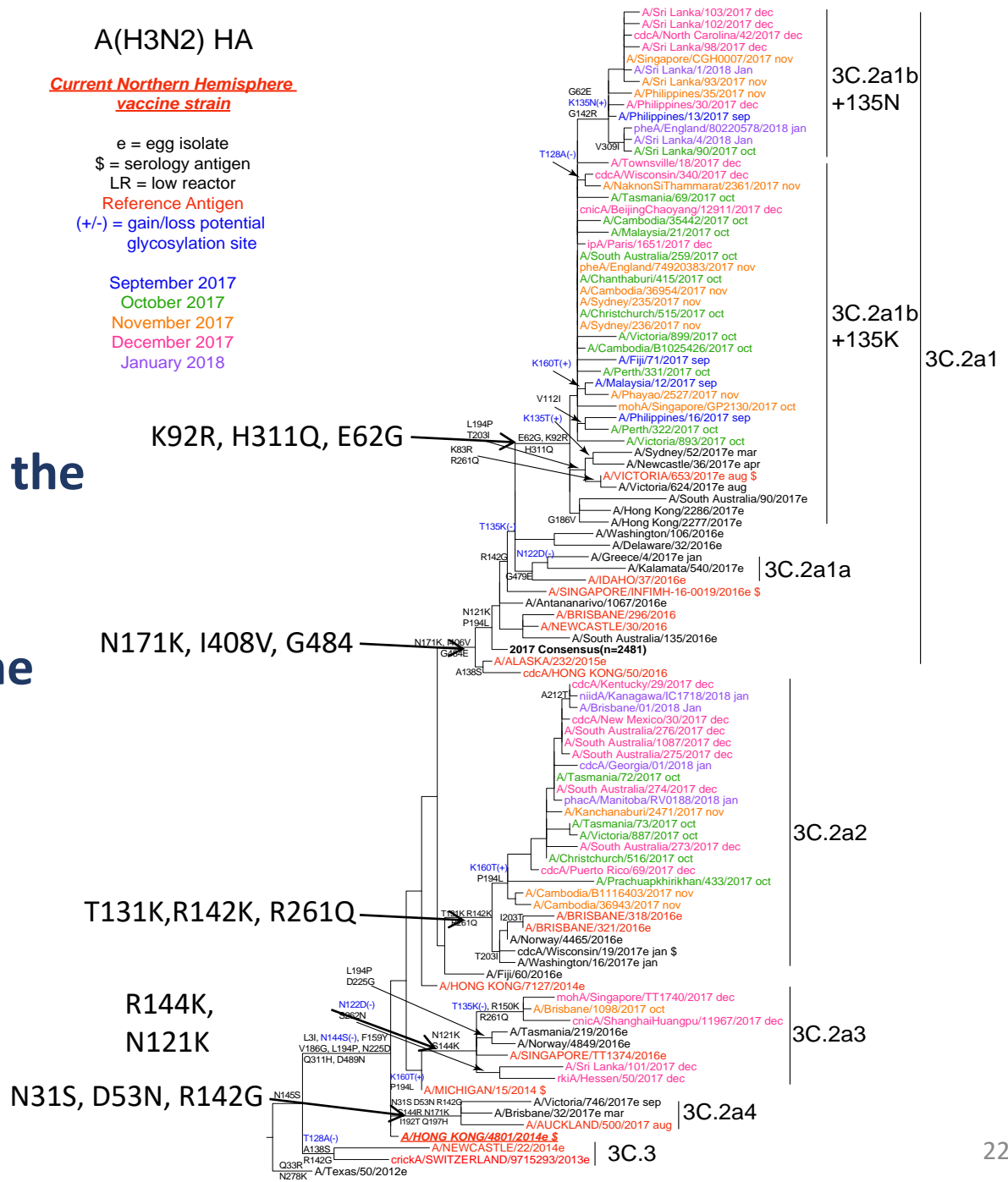
Current Northern Hemisphere vaccine strain

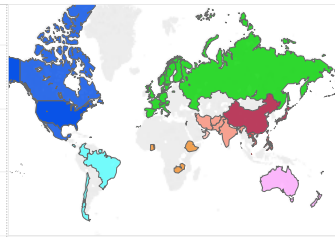
e = egg isolate
\$ = serology antigen
LR = low reactor
Reference Antigen
(+/-) = gain/loss potential glycosylation site

September 2017
October 2017
November 2017
December 2017
January 2018

Phylogenetic Tree of the A(H3N2) HA

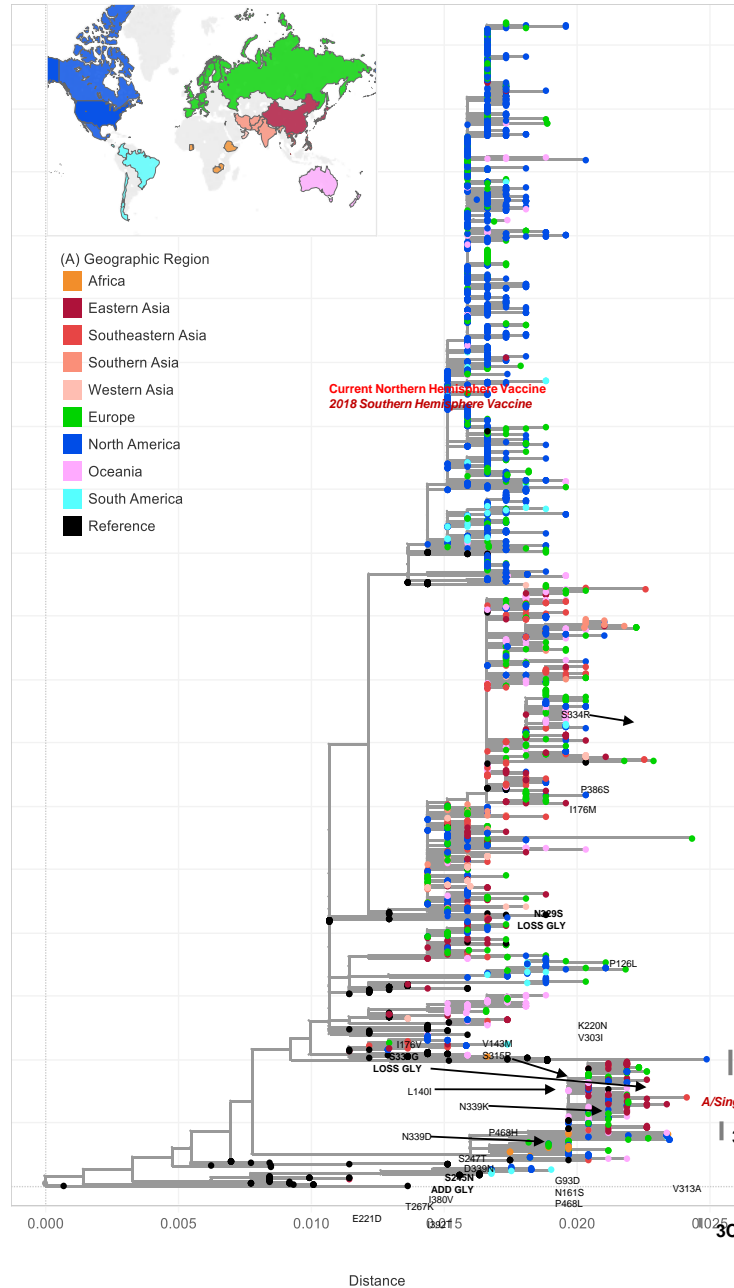
WHOCC Melbourne





- (A) Geographic Region
- Africa
 - Eastern Asia
 - Southeastern Asia
 - Southern Asia
 - Western Asia
 - Europe
 - North America
 - Oceania
 - South America
 - Reference

Current Northern Hemisphere Vaccine
2018 Southern Hemisphere Vaccine



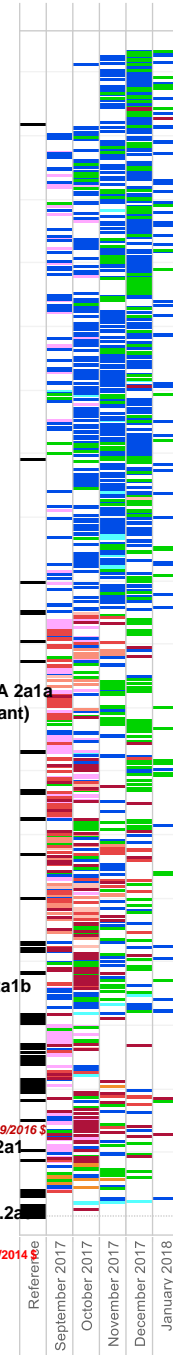
HA 3C.2a2/NA 2a1a
(Reassortant)

2a1a

2a1b

3C.2a2
3C.3a
3C.3a
3C.2a4
3C.2a1
3C.2a2
3C.2a

3C.3a Hong Kong/4801/2014

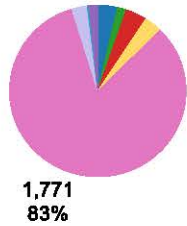


Reference
September 2017
October 2017
November 2017
December 2017
January 2018

Phylogenetic Tree of A(H3N2) NA, All Available Sequence Since September 1, 2017

H3N2 Predominant Clades from N. America Differ from Other Regions

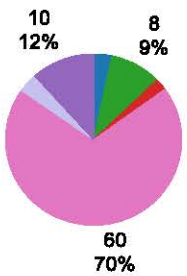
North America



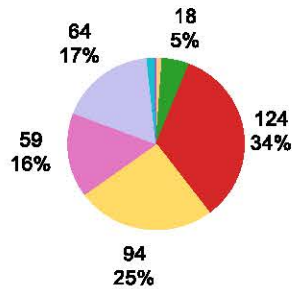
Africa



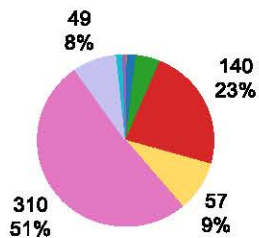
Central and South America



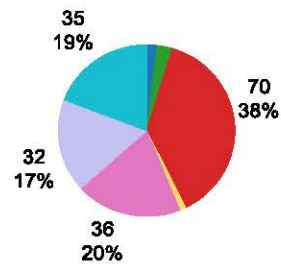
Asia



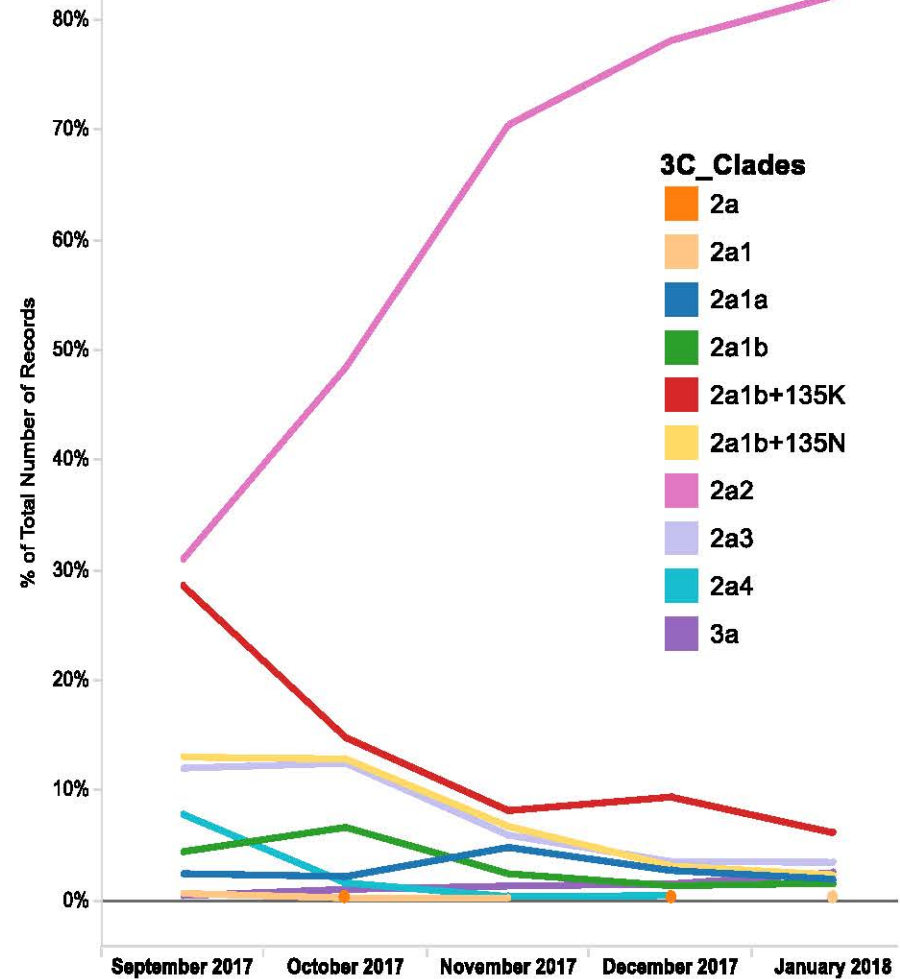
Europe



Oceania



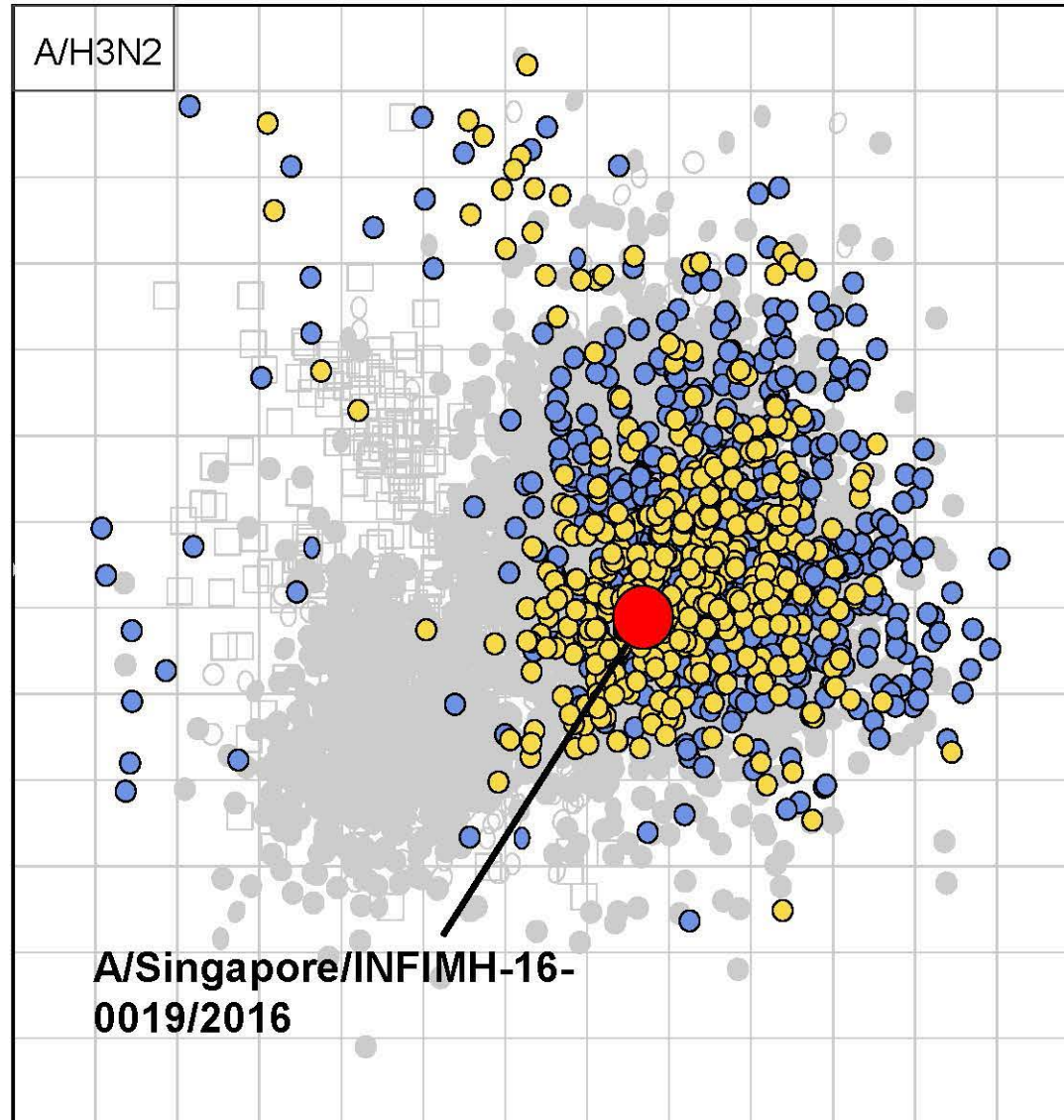
Proportion of 3C Clades



Antigenic Characterization of A(H3N2) viruses by HI (WHOCC Melbourne)

		Reference Antisera														
Sequenced		A	B	C	D	E	F	G	H	I	J	K	L			
February 2, 2018 - Part B		F3814	F3419	F4295	F4376	F4377	F4293	F4297	F4339	F4296	F4379	F4378	F4381	Passage	Sample	
		M1,S1,S3	E6	E6	SIAT4	E8	M1,S1	E6	M1,S3	E5	E8	E5	SIAT1	Details	Date	
		Mich/15	HK/4801	Bris/321	Bris/318	Bris/318	TT1374	TT1374	16-0019	16-0019	Ida/37	Vic/653	Vic/653			
Reference Antigens		3c.2a			3c.2a1											
Clade 3C																
A	A/MICHIGAN/15/2014	2a	160	160	40	80	80	40	160	80	160	40	<40	160	M1,S1,S3	
B	A/Hong Kong/4801/2014	2a	320	640	320	320	320	320	320	160	1280	160	1280	640	E7	
C	A/Brisbane/321/2016	2a2	320	640	2560	2560	>5120	320	320	160	1280	320	640	640	E6	
D	A/Brisbane/318/2016	2a2	160	160	320	1280	640	160	320	320	320	160	40	320	SIAT5	
E	A/Brisbane/318/2016	2a2	640	160	640	2560	2560	320	640	1280	640	640	80	>5120	E8	
F	A/Singapore/TT1374/16	2a3	40	40	<40	80	40	80	320	160	160	40	<40	160	M1,S4	
G	A/Singapore/TT1374/16	2a3	320	320	160	320	320	640	1280	320	640	80	640	1280	E6	
H	A/Sing/INFIMH-16-0019/16	2a1	40	80	<40	80	40	80	160	160	160	80	<40	160	M1,S3	
I	A/Sing/INFIMH-16-0019/16	2a1	160	320	160	160	160	320	320	160	640	160	640	320	E5	
J	A/Idaho/37/2016	2a1	160	160	80	40	160	160	40	160	80	>5120	320	2560	E8	
K	A/Victoria/653/2017	2a1b	160	160	160	80	160	320	320	160	320	320	1280	2560	E5	
L	A/Victoria/653/2017	2a1b	80	40	<40	160	160	160	320	320	160	160	1280	SIAT2		
Test Antigens																
1	A/Brisbane/195/2017		160	160	320	640	320	160	320	320	80	40	320	M2,S1	1/11/2017	
2	A/Cambodia/B1108407/17		160	160	160	640	320	160	160	320	160	80	<40	320	SIAT2	30/10/2017
3	A/Sri Lanka/93/2017	2a1b	80	80	40	160	160	160	320	160	320	160	40	320	SIAT2	15/11/2017
4	A/Sri Lanka/94/2017		80	80	40	160	80	160	320	160	320	160	40	320	SIAT2	30/11/2017
5	A/Sri Lanka/95/2017		160	80	40	160	80	80	320	160	160	160	<40	160	SIAT2	4/12/2017
6	A/Sri Lanka/1/2018	2a1b	80	40	40	160	80	80	320	160	320	160	<40	160	SIAT2	8/01/2018
7	A/Sri Lanka/4/2018	2a1b	80	80	<40	80	80	80	160	160	160	80	<40	160	SIAT2	9/01/2018
8	A/Brisbane/203/2017		80	80	40	80	80	160	320	160	160	80	<40	160	M1,S1	30/11/2017
9	A/Townsville/16/2017		80	80	40	160	160	80	160	160	80	80	<40	160	M1,S1	29/11/2017
10	A/Brisbane/204/2017		80	40	<40	80	40	80	160	160	160	160	640	SIAT2	7/12/2017	
11	A/Townsville/18/2017	2a1b	80	40	<40	80	80	40	80	160	160	80	80	640	M1,S1	29/12/2017
12	A/Brisbane/211/2017	2a2	160	80	160	640	320	160	320	160	160	160	<40	320	M3,S1	17/12/2017
13	A/Brisbane/01/2018	2a2	160	80	160	640	320	160	320	160	160	80	<40	320	M1,S1	2/01/2018
14	A/Cambodia/B1120469/17	2a2	160	160	160	320	320	160	320	160	320	80	40	320	SIAT2	30/10/2017
15	A/Cambodia/C0112404/17	2a3	80	80	40	80	160	80	320	160	160	160	40	640	SIAT2	13/11/2017
16	A/Cambodia/B1025417/17	2a1b	40	40	<40	80	80	80	160	160	160	160	640	SIAT2	16/10/2017	
17	A/Cambodia/35442/17	2a1b	<40	<40	<40	80	40	40	160	160	80	80	320	SIAT1	11/10/2017	
18	A/Singapore/KK1381/17		40	40	<40	80	40	80	160	80	80	160	640	M1,S1	18/12/2017	
19	A/Sri Lanka/85/2017		80	80	40	160	160	80	160	80	160	160	40	160	SIAT2	30/09/2017
20	A/Sri Lanka/97/2017		80	40	<40	40	80	80	80	80	160	80	<40	160	X,S2	12/12/2017
21	A/Sri Lanka/98/2017	2a1b	80	40	<40	80	80	80	160	80	160	80	<40	160	X,S2	17/12/2017
22	A/Brisbane/197/2017		80	40	40	80	80	80	80	80	80	80	640	M1,S1	17/11/2017	
23	A/Brisbane/201/2017		160	80	<40	<40	40	80	80	80	160	80	640	M1,S1	26/11/2017	
24	A/Brisbane/207/2017		80	80	<40	80	80	80	80	160	80	160	640	M2,S1	17/12/2017	
25	A/Cambodia/B1116403/17		40	40	80	160	80	40	160	80	80	40	<40	80	SIAT1	15/11/2017
26	A/Cambodia/36508/2017		40	<40	<40	40	40	40	160	80	80	40	80	320	SIAT1	12/10/2017
27	A/Sri Lanka/101/2017	2a3	40	40	<40	80	40	80	160	40	<40	<40	80	X,S2	19/12/2017	
28	A/Sri Lanka/102/2017	2a1b	40	40	<40	40	80	40	160	40	40	<40	160	X,S2	25/12/2017	
29	A/Cambodia/B1025426/17	2a1b	<40	<40	<40	<40	<40	<40	80	40	<40	<40	80	SIAT1	24/10/2017	
30	A/Cambodia/B0926502/2017		40	40	40	160	40	40	<40	<40	<40	160	80	SIAT1	24/09/2017	

Antigenic cartography of A(H3N2) Haemagglutination Inhibition (WHO CC Atlanta) Assay



Antigenic
cartography from
Univ. Cambridge

Antigenic Characterization of A(H3N2) viruses by VN (WHOCC Atlanta)

H3 FOCUS REDUCTION ASSAY (WHOCC Atlanta)

REFERENCE VIRUSES		REFERENCE FERRET ANTISERA							HA Group	HA subgroup	Date	
		3C.2a			3C.2a1						Collected	Passage
		EGG HK/4801	SIAT MI/15	SIAT WI/19	SIAT WA/106	EGG SN/E	SIAT SN/S	SIAT MP/1067				
1	A/HONG KONG/4801/2014	<u>3200</u>	1280	1280	1280	5120	1280	640	3C.2a	3C.2a Consensus	2014/02/26	E5/E2
2	A/MICHIGAN/15/2014	800	<u>640</u>	640	640	320	640	320	3C.2a	3C.2a Consensus	2014/09/24	M1/S2
3	A/WISCONSIN/19/2017	800	640	<u>>5120</u>	640	320	1280	1280	3C.2a	T131K.R142K.R261Q	2017/01/23	S2
4	A/WASHINGTON/106/2016	<200	80	320	<u>320</u>	80	320	320	3C.2a1	N121K.T135K.R142G	2016/12/18	S3
5	A/SINGAPORE/INFIMH-16-0019	1600	640	640	640	<u>640</u>	640	320	3C.2a1	N121K.R142G	2016/06/14	E5/E2
6	A/SINGAPORE/INFIMH-16-0019	200	40	80	40	20	<u>640</u>	1280	3C.2a1	N121K.R142G	2016/06/14	C1S3/S2
7	A/ANTANANARIVO/1067/2016	200	320	320	320	40	320	<u>640</u>	3C.2a1	N121K	2016/04/05	S3
TEST VIRUSES												
8	A/NORTH DAKOTA/26/2017	400	640	640	640	320	2560	640	3C.2a	N121K.T135K.S144K.R150K.R261Q	2017/11/21	S1
9	A/DELAWARE/39/2017	400	640	>5120	640	320	640	640	3C.2a	T131K.R142K.R261Q	2017/11/13	S1
10	A/IOWA/39/2017	200	640	>2560	640	640	2560	2560	3C.2a	T131K.R142K.R261Q	2017/11/14	S1
11	A/SOUTH DAKOTA/35/2017	400	1280	>5120	1280	640	2560	1280	3C.2a	T131K.R142K.R261Q	2017/11/21	S1
12	A/SOUTH DAKOTA/33/2017	400	640	>5120	640	320	1280	640	3C.2a	T131K.R142K.R261Q	2017/11/17	S1
13	A/NORTH DAKOTA/27/2017	800	640	5120	640	320	640	640	3C.2a	T131K.R142K.R261Q	2017/11/22	S1
14	A/NORTH DAKOTA/29/2017	400	640	>5120	640	320	1280	1280	3C.2a	T131K.R142K.R261Q	2017/11/26	S1
15	A/MASSACHUSETTS/19/2017	400	640	>5120	640	320	1280	1280	3C.2a	T131K.R142K.R261Q	2017/11/15	S1
16	A/NEW YORK/42/2017	400	1280	>5120	640	640	1280	2560	3C.2a	T131K.R142K.R261Q	2017/11/25	S1
17	A/ARKANSAS/38/2017	400	640	>5120	640	640	1280	1280	3C.2a	T131K.R142K.R261Q	2017/11/15	S1
18	A/OREGON/23/2017	800	640	1280	2560	320	1280	640	3C.2a1	E62G.K92R.N121K.T135K.R142G.H311Q	2017/11/12	S1
19	A/HAWAII/53/2017	400	640	640	1280	160	1280	640	3C.2a1	N121K.N122D.T135K.G479E	2017/10/19	S1
20	A/MISSOURI/37/2017	400	1280	1280	640	320	1280	640	3C.2a1	K92R.N121K.T135N.H311Q	2017/11/08	S1
21	A/ARKANSAS/37/2017	400	640	1280	640	320	2560	1280	3C.2a1	K92R.N121K.T135N.H311Q	2017/11/13	S1
22	A/OKLAHOMA/33/2017	400	640	1280	1280	320	1280	640	3C.2a1	K92R.N121K.T135N.H311Q	2017/11/20	S1
23	A/NEW MEXICO/27/2017	<200	80	<20	80	<20	160	<20	3C.3a	L31.S91N.N144K.F193S.D489N	2017/11/13	S1

Test Date: 01/24/2018

Summary of Antigenic Characterisation for A(H3N2) Viruses Compared with Cell Culture-propagated Reference Virus

	HI		VN	
	A/Hong Kong/4801-like - Cell	Low (≥ 8 fold)	A/Hong Kong/4801-like - Cell	Low (≥ 8 fold)
CDC	228 (99%)	2 (1%)	129 (96%)	6 (4%)
CNIC	245 (88%)	35 (13%)	60 (100%)	0 (0%)
NIID	ND	ND	18 (50%)	18 (50%)
CRICK	30 (100%)	0 (0%)	88 (88%)	12 (12%)
VIDRL	174 (85%)	30 (15%)	74 (80%)	18 (20%)
	677 (91%)	67 (9%)	369 (87%)	54 (13%)

Summary of Antigenic Characterisation by HI for A(H3N2) Viruses Compared to Egg-propagated Reference Viruses

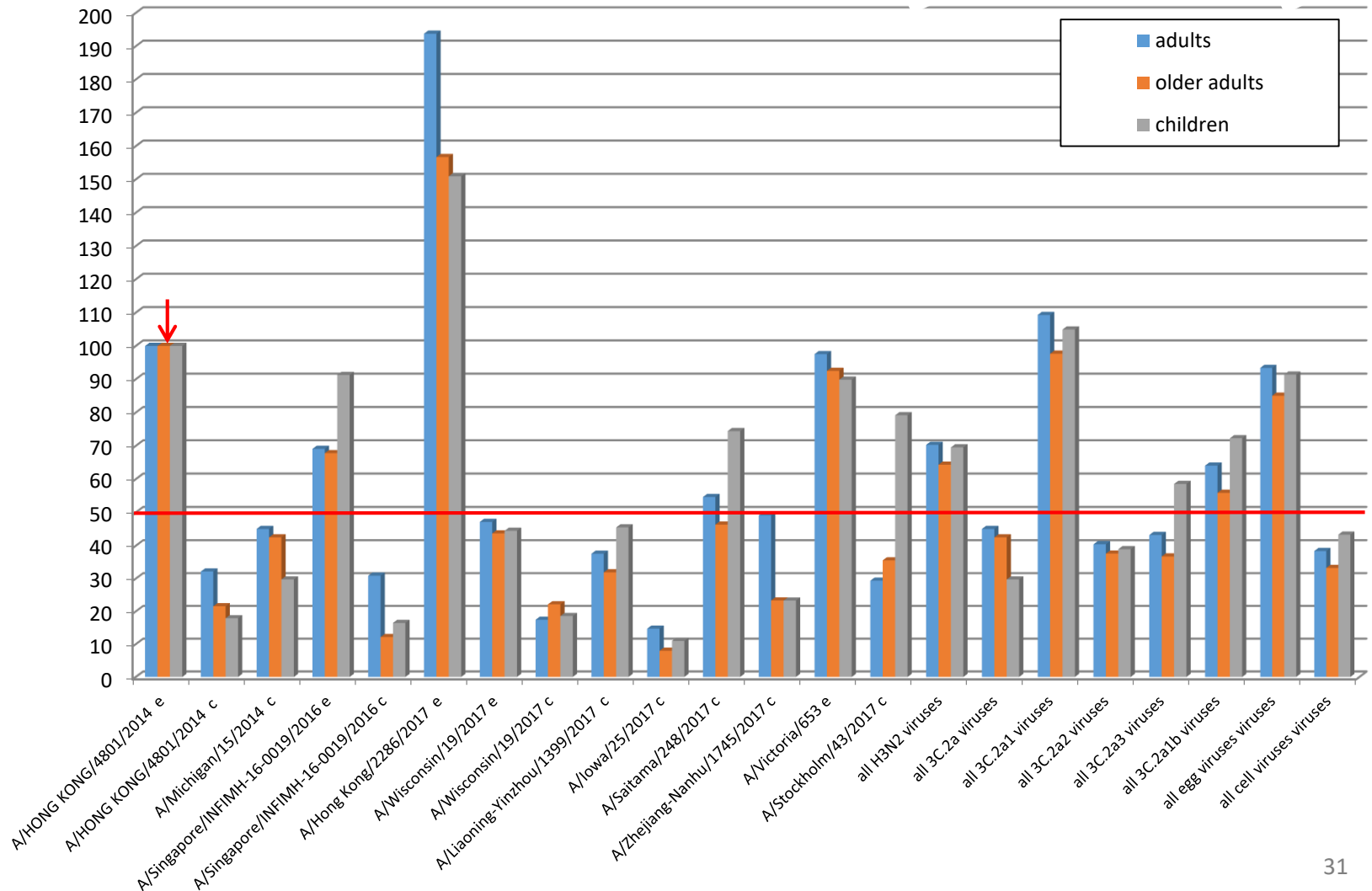
WHO CC	A/Hong Kong/4801-like - Low (≥ 8 fold) Egg	A/Singapore/INF1 MH-16-0019/2016-egg	Low (≥ 8 fold)	
CDC	176 (77%)	54 (23%)	186 (89%)	24 (11%)
CNIC	64 (23%)	216 (77%)	82 (92%)	7 (8%)
CRICK	0 (0%)	30 (100%)	19 (63%)	11 (37%)
VIDRL	89 (44%)	115 (56%)	133 (65%)	71 (35%)
Total	329 (44%)	415 (56%)	420 (79%)	113 (21%)

Summary of Antigenic Characterization by VN for A(H3N2) Viruses Compared to Egg-propagated Reference Viruses

WHO CC	A/Hong Kong/4801-like - Egg	Low (≥ 8 fold)	A/Singapore/INF IMH-16-0019/2016-egg	Low (≥ 8 fold)
CDC	16 (15%)	88 (85%)	87 (91%)	9 (9%)
CNIC	1 (2%)	59 (98%)	0 (0%)	60 (100%)
NIID	0 (0%)	52 (100%)	34 (68%)	16 (32%)
CRICK	40 (40%)	60 (60%)	17 (17%)	83 (83%)
VIDRL	65 (71%)	27 (29%)	81 (88%)	11 (12%)
Total	122 (30%)	286 (70%)	219 (55%)	179 (45%)

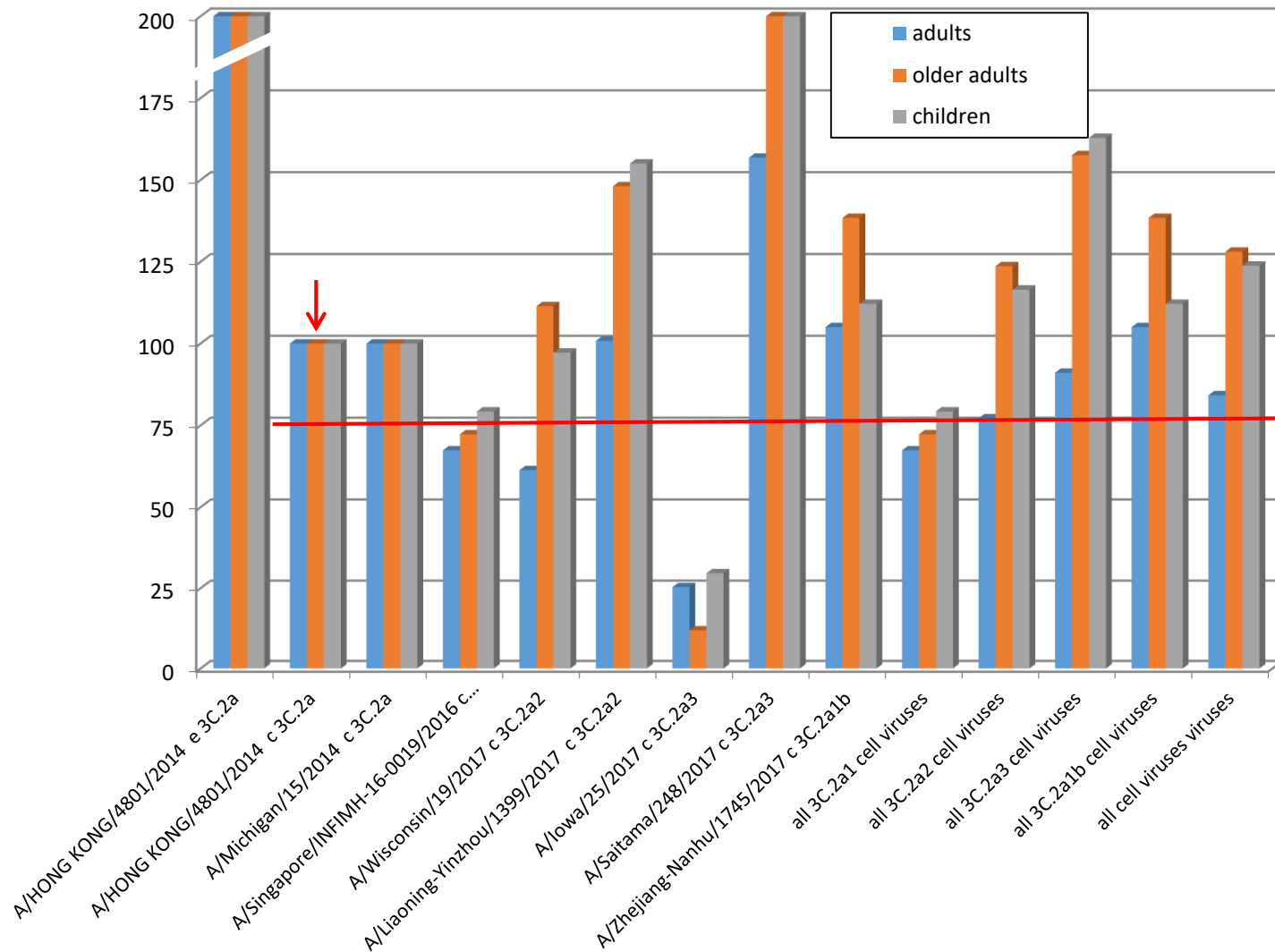
HI Antibody Responses to the A(H3N2) Component among Persons Vaccinated with 2017-2018 N. Hemisphere TIV/QIV:

Compared with Egg-propagated A/Hong Kong/4801/2014 reference virus



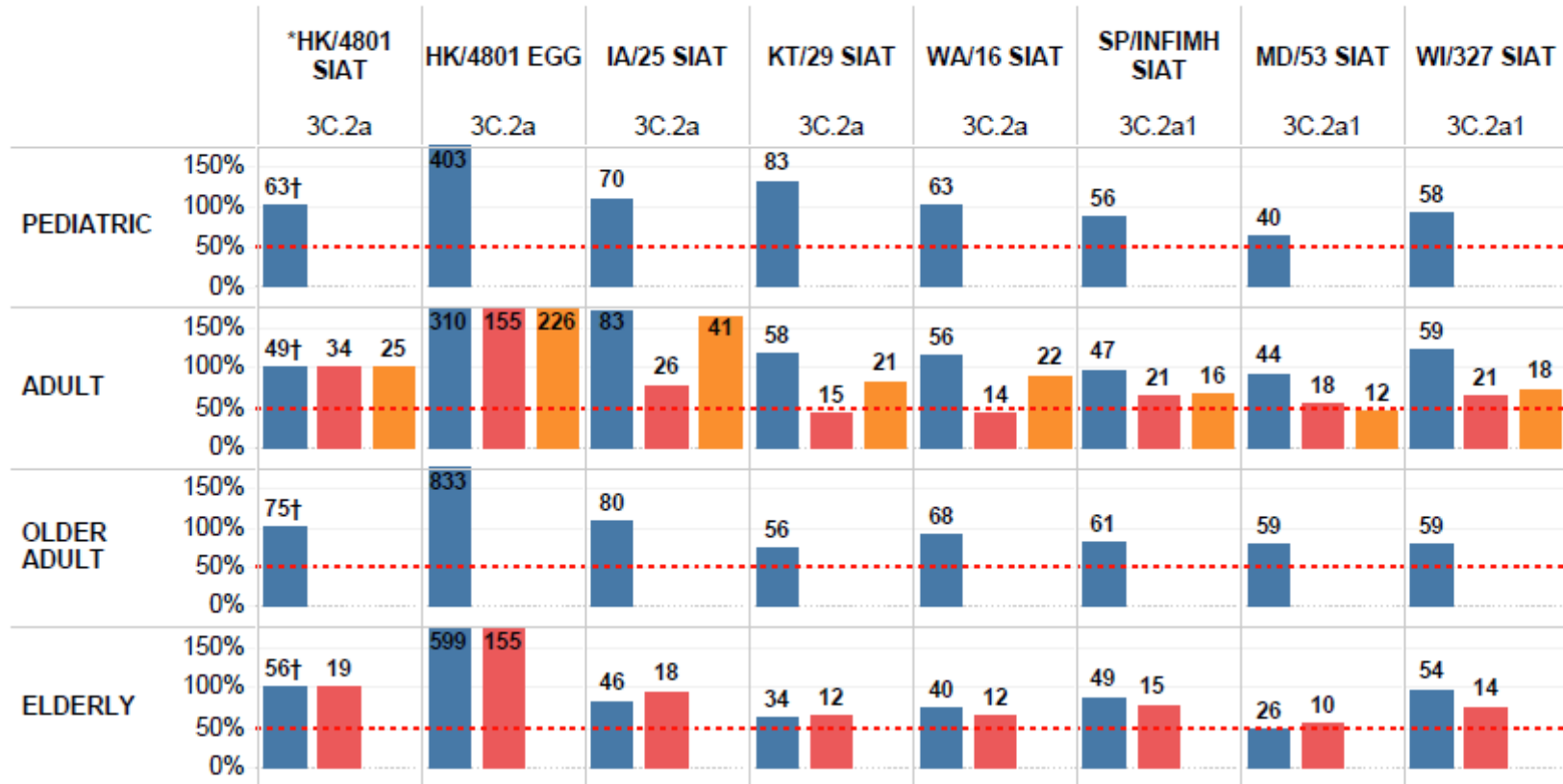
HI Antibody Responses to the A(H3N2) Component among Persons Vaccinated with 2017-2018 N. Hemisphere TIV/QIV:

Compared with Cell-propagated A/Hong Kong/4801/2014-like reference viruses



VN Antibody Responses to the A(H3N2) Component among Persons Vaccinated with 2017-2018 N. Hemisphere QIV: (WHOCC Atlanta)

REFERENCE: A/HONG KONG/4801/2014 SIAT



† Post-vaccination GMT

Dashed-line (red; 50% GMT), post-vaccination % GMT titers above this line are statistically non-inferior to the applied reference antigen; y-axis restricted to highlight region below this line

Included A(H3N2) strains: A/Hong Kong/4801/2014 (HK/4801); A/Iowa/25/2017 (IA/25); A/Kentucky/29/2017 (KT/29); A/Maryland/53/2017 (MD/53); A/Singapore/INFIMH-16-0019/2016 (SP/INFIMH); A/Washington/16/2017 (WA/16); A/Wisconsin/327/2017 (WI/327)

■ USA ■ Japan ■ UK

A(H3N2) Summary - I

- **Influenza A(H3N2) predominated in several countries**
 - **Some countries in North America had severe epidemics due to H3N2**
- **The majority of influenza A(H3N2) viruses collected from September, 2017 to January, 2018 fell into the phylogenetic HA clade 3C.2a; only few 3C.3a viruses were detected**
 - **Multiple subclades circulated; revised nomenclature was developed to describe major subclades: 2a2, 2a3, 2a4, 2a1, 2a1a and 2a1b (+135K or 135N)**
 - **2a2 viruses predominated in the Americas and are increasing elsewhere**
- **Ferret antisera raised against reference cell-propagated A/Hong Kong/4801/2014-like (3C.2a) and A/Singapore/INFIMH-16-0019 (2a1) viruses inhibited the majority of viruses tested in HI and Virus Neutralisation (VN) assays**
- **Egg propagation is known to introduce additional changes that affect antigenicity**
 - **This is particularly problematic for recent A(H3N2) viruses**

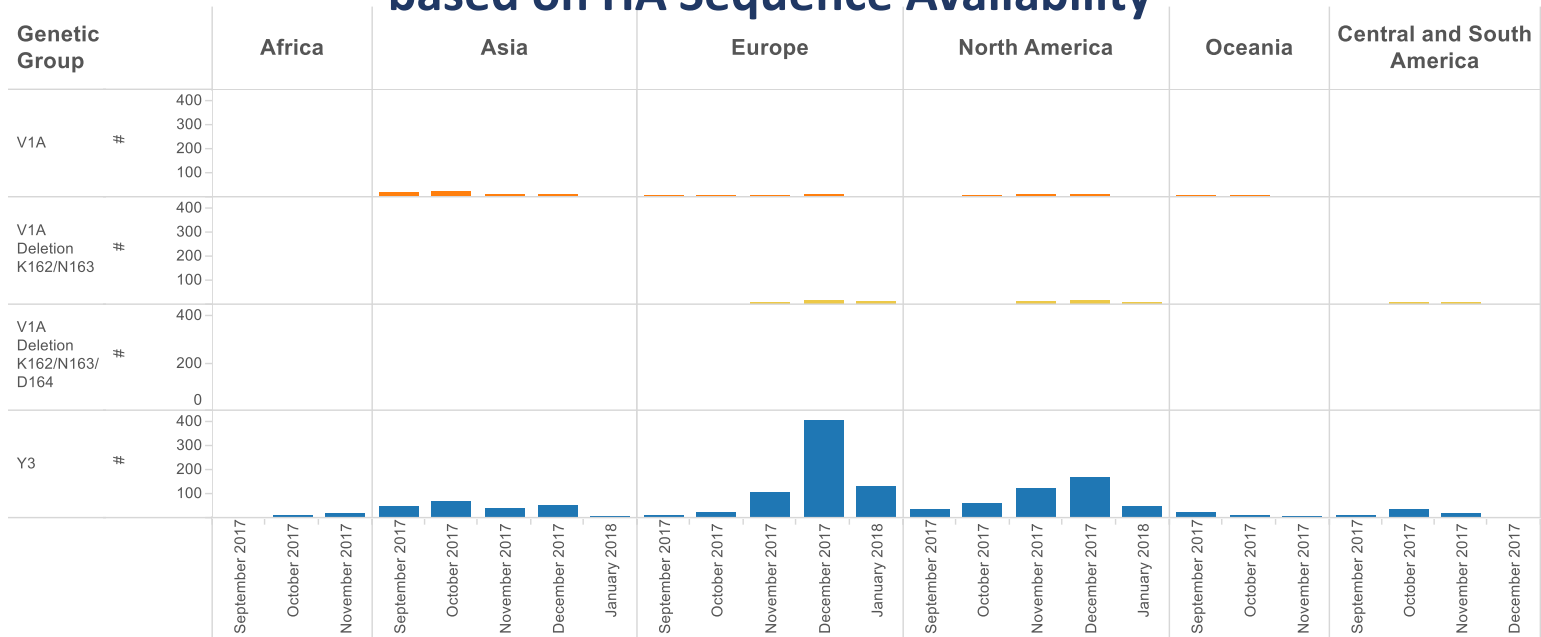
A(H3N2) Summary - II

- **Ferret antisera raised against reference egg-propagated A/Hong Kong/4801/2014 virus poorly inhibited many viruses tested in HI (56%) and VN (73%) assays**
 - **Ferret antisera produced against several egg-propagated viruses belonging to clades 2a2, 2a1 and 2a1b poorly inhibited recently circulating H3N2 viruses**
- **Ferret antisera raised against reference egg-propagated A/Singapore/INFIMH-16-0019/2016 virus well inhibited a majority of viruses tested**
- **In human serology studies, post-vaccination geometric mean titers against representative cell culture-propagated viruses were not significantly reduced when compared with cell culture-propagated A/Hong Kong/4801/2014-like viruses**

Influenza B viruses

September 2017 – February 2018

Global Influenza B HA Genetic Groups Since February 1, 2017 based on HA Sequence Availability

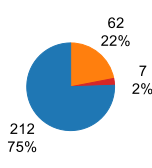


Genetic Group
■ V1A
■ V1A Deletion K162/N163
■ V1A Deletion K162/N163/D164
■ Y3

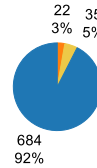
Africa



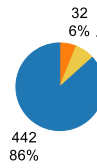
Asia



Europe



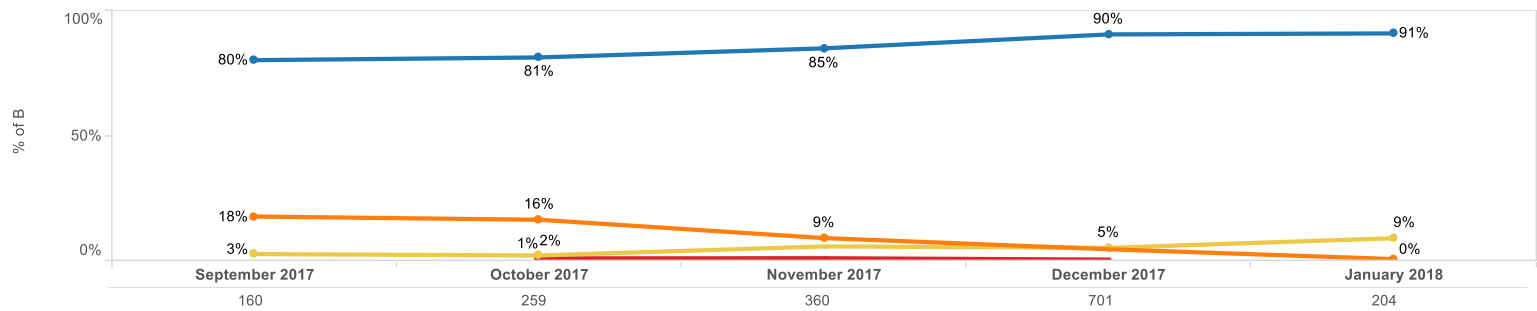
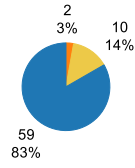
North America



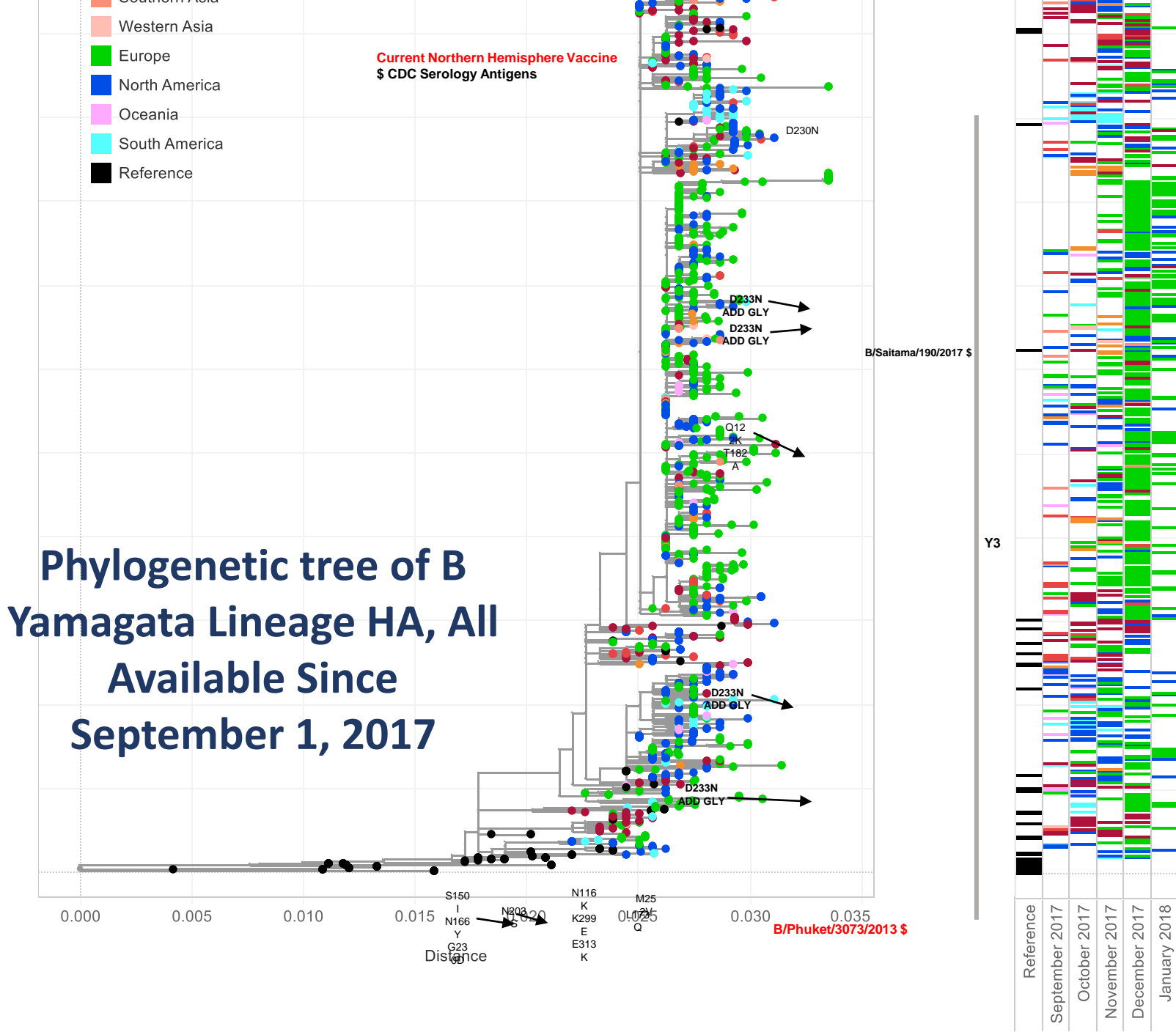
Oceania



Central and South America



B/Yamagata-lineage viruses



Evolutionary Relationships Among Influenza B Yamagata NA Genes, 2017-18 (WHOCC Atlanta)

Current Northern Hemisphere Quadrivalent Vaccine Strain

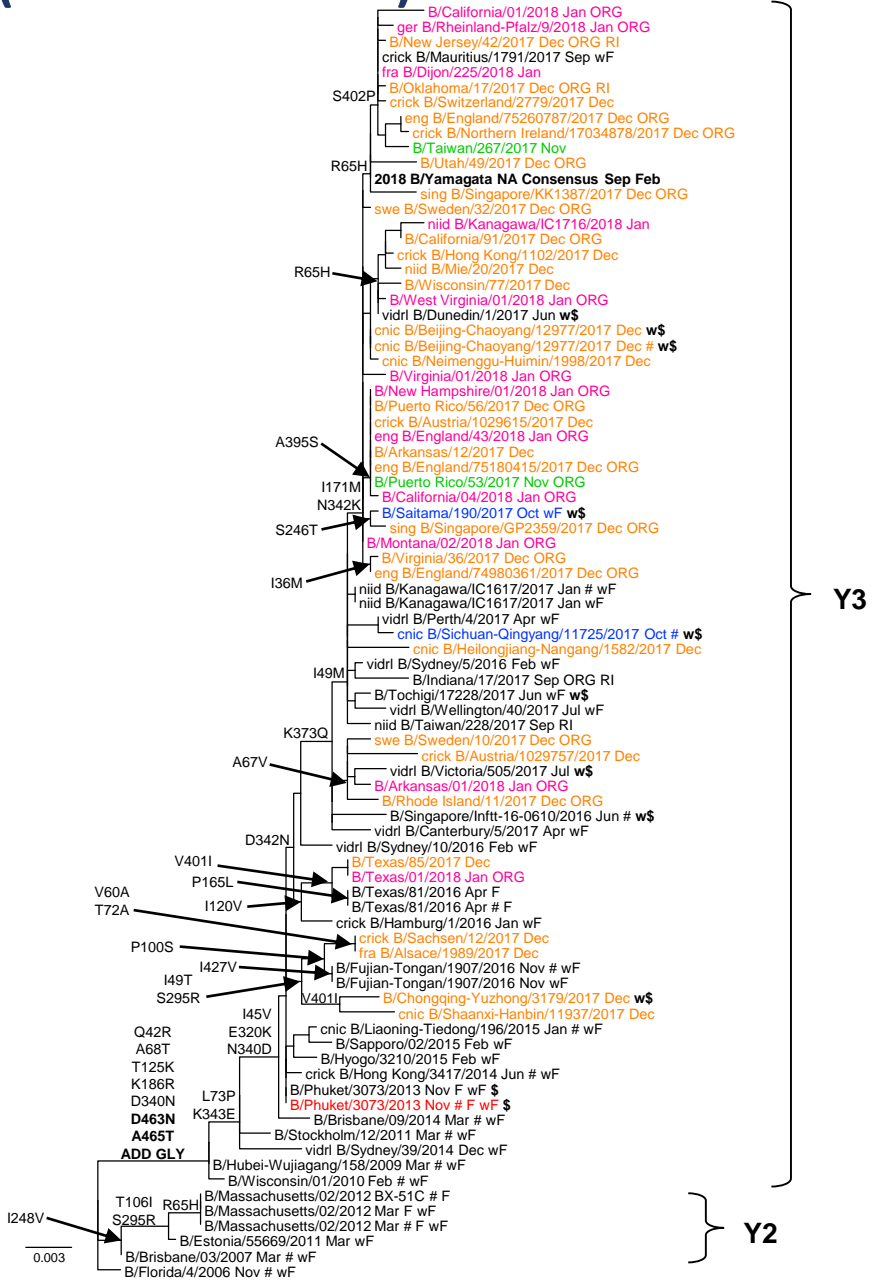
LR - Low Reactor to B/Phuket/3073/2013 (≥ 8 fold)

F - CDC Reference Antigen
wF - WHOCC Reference Antigen
\$ - Serology Antigen
w\$ - WHOCC Serology Antigen

- Egg Isolate
ORG - Original Clinical Specimen
ITT - Insufficient Titer for Testing
VNR - Virus Not Recovered

RI - Reduced Inhibition
HRI - Highly Reduced Inhibition

October 2017
November 2017
December 2017
January 2018

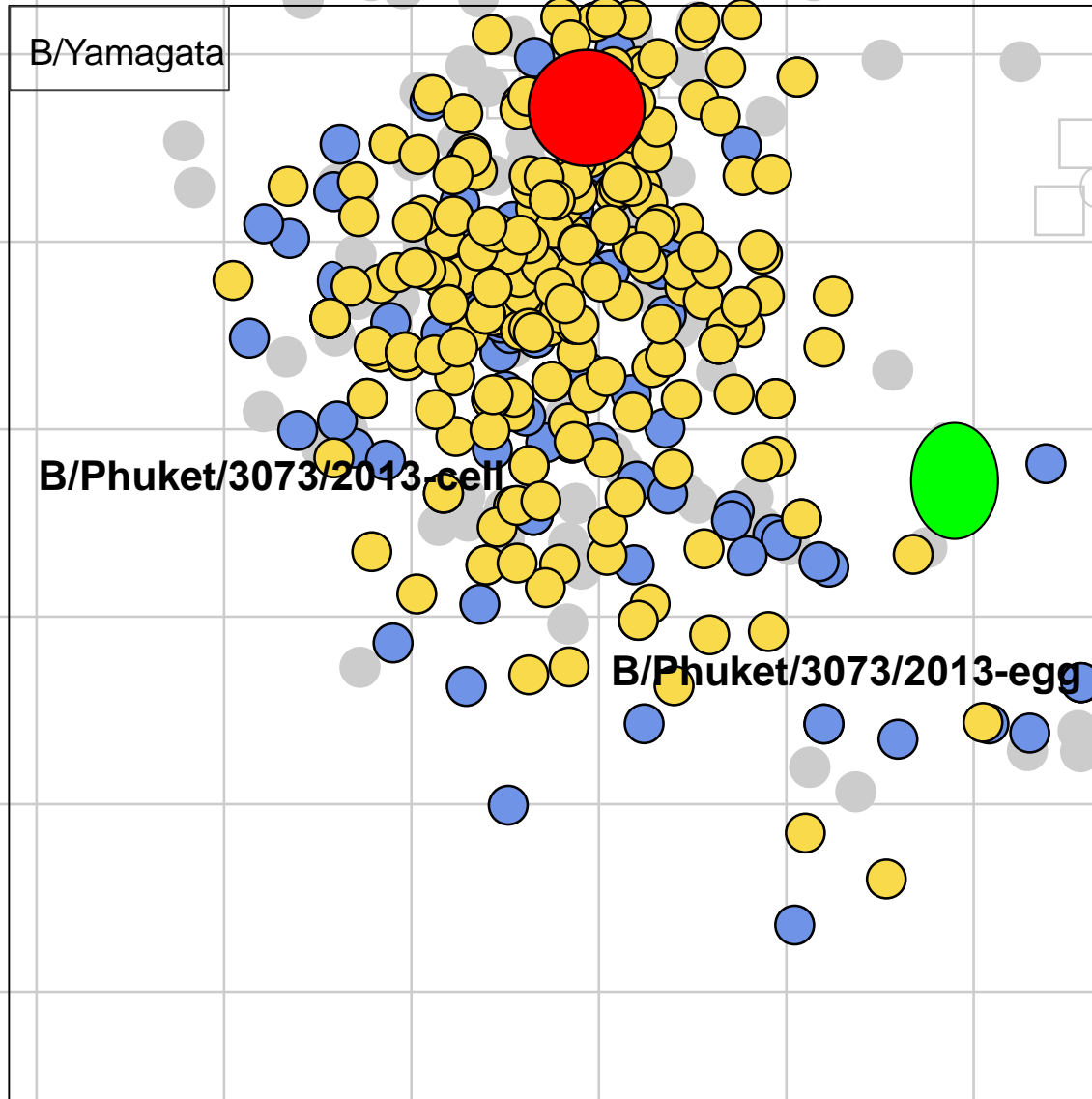


Antigenic Characterization of B/Yamagata viruses (WHOCC Atlanta)

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA TYPE B YAMAGATA LINEAGE VIRUSES

REFERENCE VIRUSES		REFERENCE FERRET ANTISERA					HA Group	Date Collected	Passage
		Y3				Y3V1A			
		EGG PHU/3073	MDCK PHU/3073	EGG TX/81	MDCK TX/81	MDCK NH/01			
1	B/PHUKET/3073/2013	<u>320</u>	320	1280	320	160	Y3	2013/11/21	E4/E2
2	B/PHUKET/3073/2013	160	<u>640</u>	320	640	320	Y3	2013/11/21	C2/C2
3	B/TEXAS/81/2016	320	320	<u>1280</u>	320	160	Y3	2016/04/19	E3
4	B/TEXAS/81/2016	160	640	320	<u>320</u>	160	Y3	2016/04/19	C2
5	B/NEW HAMPSHIRE/01/2016	160	640	640	320	<u>320</u>	Y3V1A	2016/01/07	C2
TEST VIRUSES									
6	B/TEXAS/86/2017	80	640	320	320	320	Y3	2017/12/18	C1
7	B/ALASKA/23/2017	80	640	320	320	320	Y3	2017/12/12	C1
8	B/CALIFORNIA/73/2017	160	640	320	640	320	Y3	2017/11/21	C1
9	B/FLORIDA/108/2017	160	640	320	640	320	Y3	2017/12/05	C1
10	B/MISSISSIPPI/20/2017	80	640	320	640	640	Y3	2017/12/12	C1
11	B/MONTANA/25/2017	160	640	640	640	640	Y3	2017/11/20	C1
12	B/NEW HAMPSHIRE/15/2017	80	640	320	320	320	Y3	2017/12/18	C1
13	B/NORTH DAKOTA/14/2017	80	640	320	640	640	Y3	2017/12/15	C1
14	B/OREGON/14/2017	160	640	320	640	640	Y3	2017/11/21	C1
15	B/OREGON/15/2017	160	640	640	640	640	Y3	2017/11/30	C1
16	B/UTAH/49/2017	160	640	320	640	640	Y3	2017/12/12	C1
17	B/WEST VIRGINIA/20/2017	160	640	320	320	320	Y3	2017/12/12	C1
18	B/WISCONSIN/80/2017	160	640	320	320	320	Y3	2017/12/20	C1
19	B/MISSOURI/14/2017	80	320	160	320	320	Y3	2017/12/13	C1
20	B/MISSOURI/15/2017	80	320	160	320	320	Y3	2017/12/19	C1
21	B/ARKANSAS/12/2017	80	320	160	320	640	Y3	2017/12/11	C1
22	B/KANSAS/04/2017	80	320	160	320	320	Y3	2017/12/12	C1
23	B/MISSISSIPPI/21/2017	80	320	320	320	320	Y3	2017/12/19	C1
24	B/NEW YORK/36/2017	80	320	160	320	320	Y3	2017/12/12	C1
25	B/PUERTO RICO/53/2017	80	320	160	320	320	Y3	2017/11/29	C1
26	B/SOUTH DAKOTA/37/2017	80	320	320	320	320	Y3	2017/12/14	C1
27	B/CONCEPCION/85156/2017	160	640	320	320	320	Y3	2017/10/25	C1
28	B/COYHAIQUE/80788/2017	80	640	160	320	320	Y3	2017/10/23	C1
29	B/CURICO/79752/2017	160	640	320	320	320	Y3	2017/10/16	C1
30	B/MEXICO/2650/2017	160	640	320	320	320	Y3	2017/09/06	C1/C1
31	B/PUNTA ARENAS/84895/2017	160	640	320	320	320	Y3	2017/11/07	C1
32	B/RIO GRANDE DO SUL/950/2017	160	640	320	320	320	Y3	2017/09/24	C1
33	B/LA SERENA/80547/2017	80	320	320	320	320	Y3	2017/10/23	C1
34	B/PUERTO MONTT/81437/2017	80	320	320	320	320	Y3	2017/10/19	C2
35	B/SANTIAGO/80166/2017	80	320	160	320	320	Y3	2017/10/20	C1
36	B/SANTIAGO/81374/2017	80	320	160	320	320	Y3	2017/10/25	C1
37	B/SAITAMA/190/2017	320	1280	640	640	320	Y3	2017/10/16	C1C2/C1
38	B/PHILIPPINES/1027/2017	160	640	320	320	320	Y3	2017/09/22	C1

Antigenic cartography of B/Yamagata viruses



Antigenic
cartography from
Univ. Cambridge

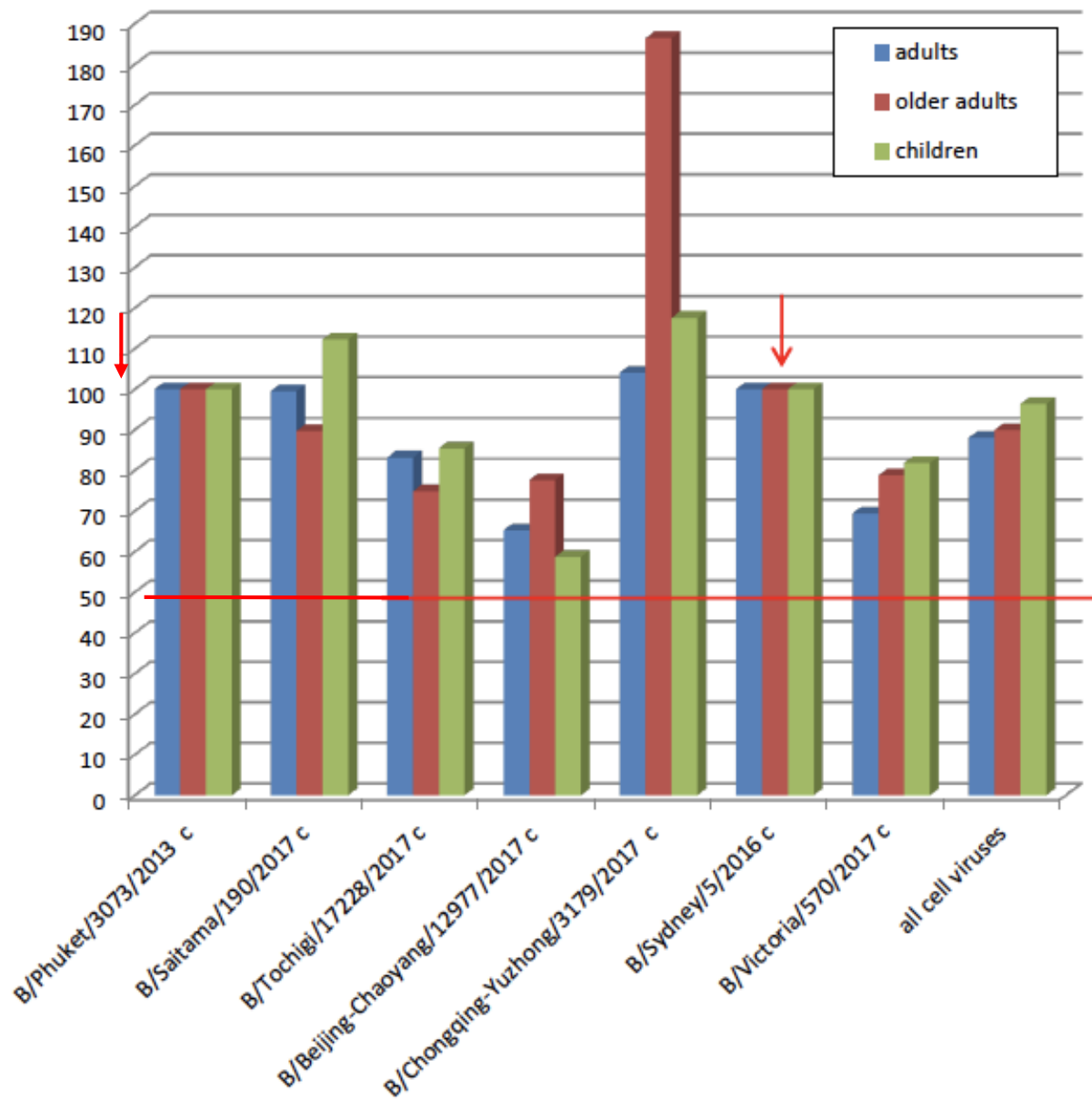
Summary of Antigenic Characterisation for B/Yamagata Lineage Viruses by HI Compared with Cell-propagated Reference Virus

WHO CC	B/Phuket/3073/2013-like - Cell	Low (≥ 8 fold)
CDC	296 (100%)	
CNIC	296 (98%)	6 (2%)
Crick	115 (86%)	19 (14%)
NIID	94 (98%)	2 (2%)
VIDRL	313 (>99%)	1 (<1%)
TOTAL	1114 (97%)	28 (3%)

Summary of Antigenic Characterisation for B/Yamagata lineage Viruses by HI Compared with Egg-propagated Reference Virus

WHO CC	B/Phuket/3073/2013-like - egg	Low (≥ 8 fold)
CDC	289 (98%)	7 (2%)
CNIC	301 (100%)	1 (0%)
Crick	114 (86%)	19 (14%)
NIID	95 (99%)	1 (1%)
VIDRL	300 (96%)	14 (4%)
TOTAL	1099 (96%)	42 (4%)

HI Antibody Responses to the B/Yamagata/16/88 Lineage Component among Persons Vaccinated with 2017-2018 N. Hemisphere TIV and QIV: Compare with MDCK cell-propagated B/Phuket/3073/2013



B/Victoria-Lineage Viruses

Detection and Geographic Distribution of B/Victoria Deletion Variants

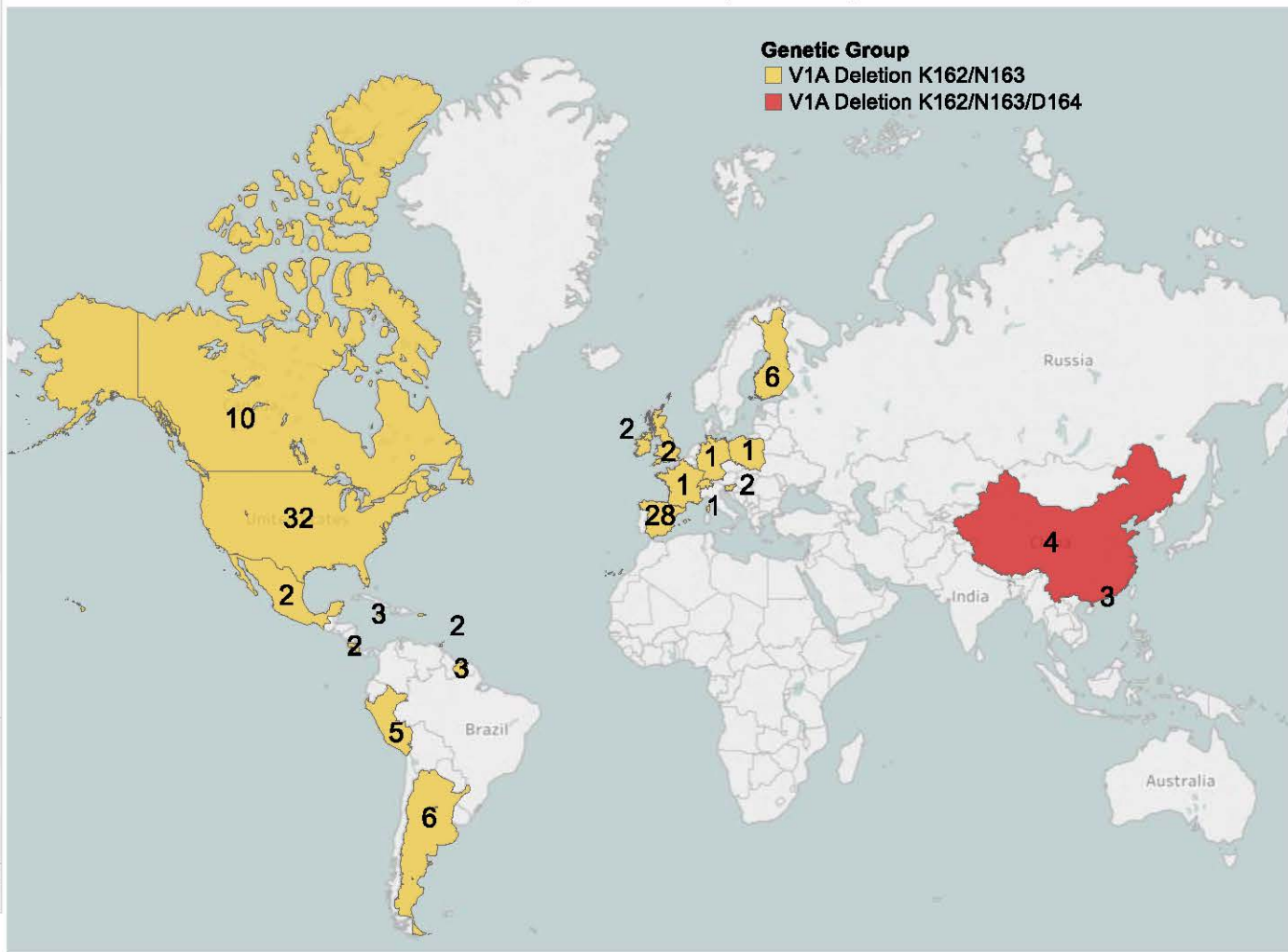
V1A-2 DEL

Geo region	Country	
Central and South America	Argentina	6
	Costa Rica	2
	Jamaica	3
	Peru	5
	Suriname	3
	Trinidad and Tobago	2
Europe	Finland	6
	France	1
	Germany	1
	Ireland	2
	Poland	1
	Slovenia	2
	Spain	28
	Switzerland	1
	United Kingdom	2
	North America	Canada
Mexico		2
United States		32
Grand Total		109

V1A-3 DEL

Geo region	Country	
Asia	China	4
	Hong Kong	3
Grand Total		7

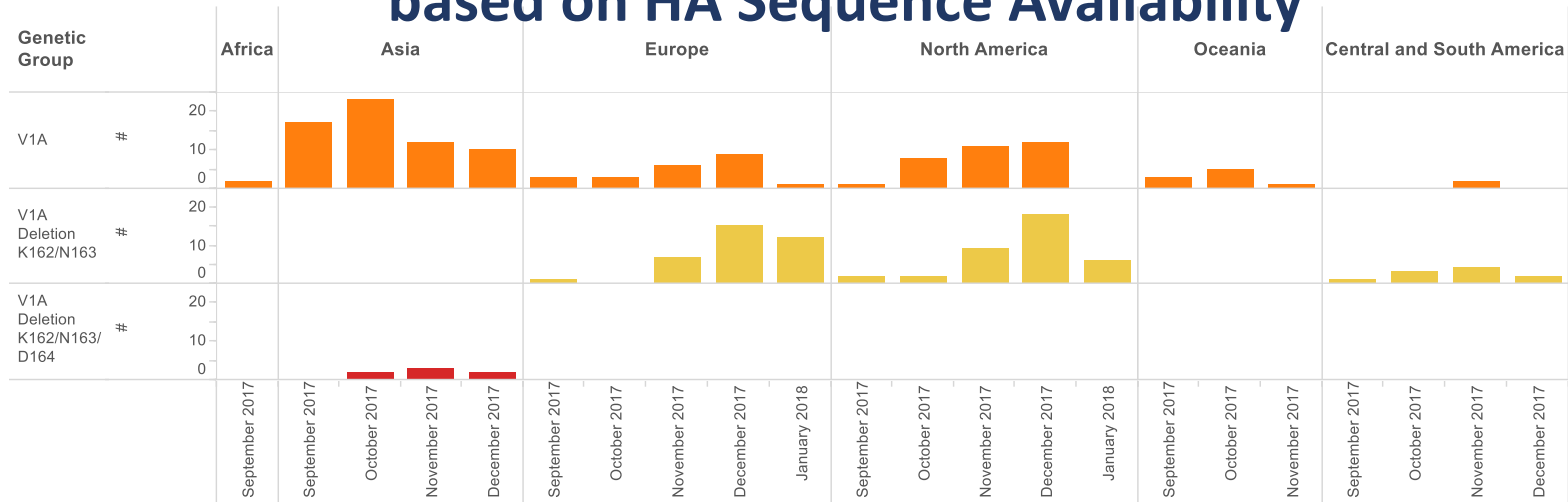
Based on HA Sequence Availability Since September 1, 2017



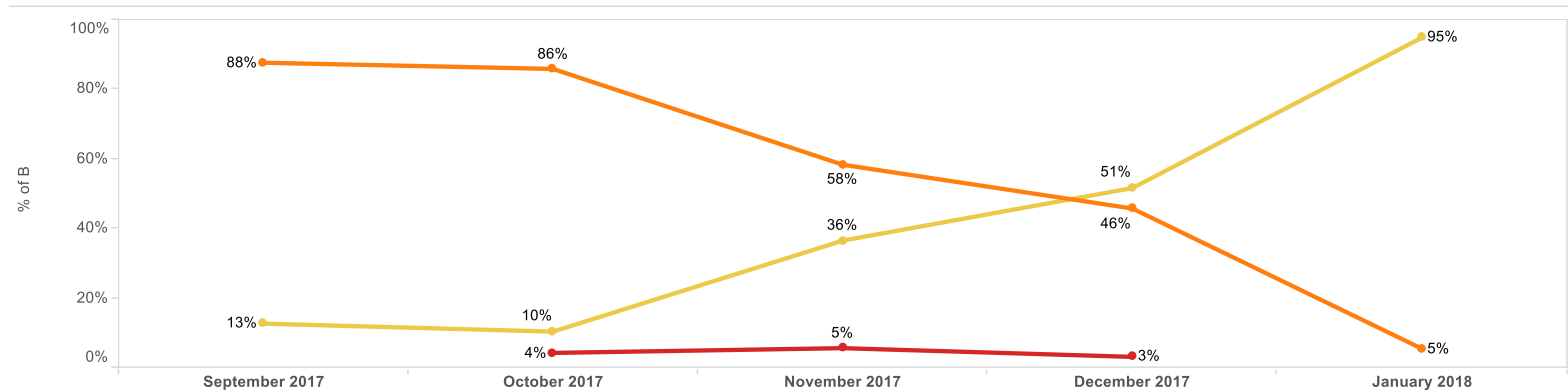
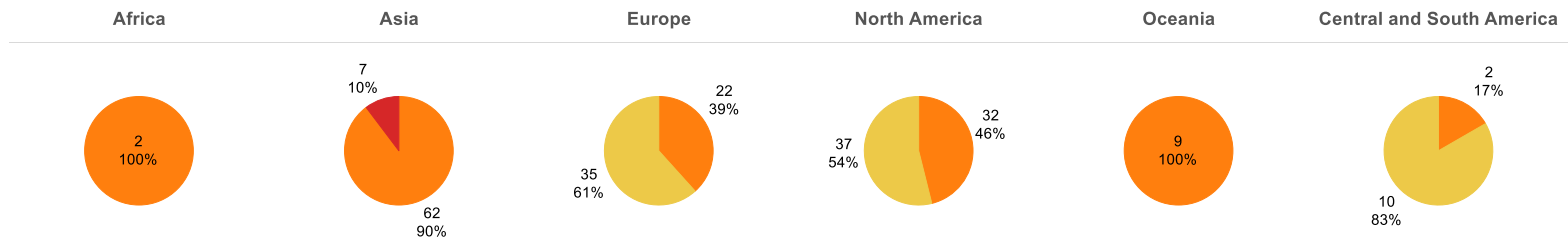
V1A-2 DEL = 109 viruses in 18 Countries

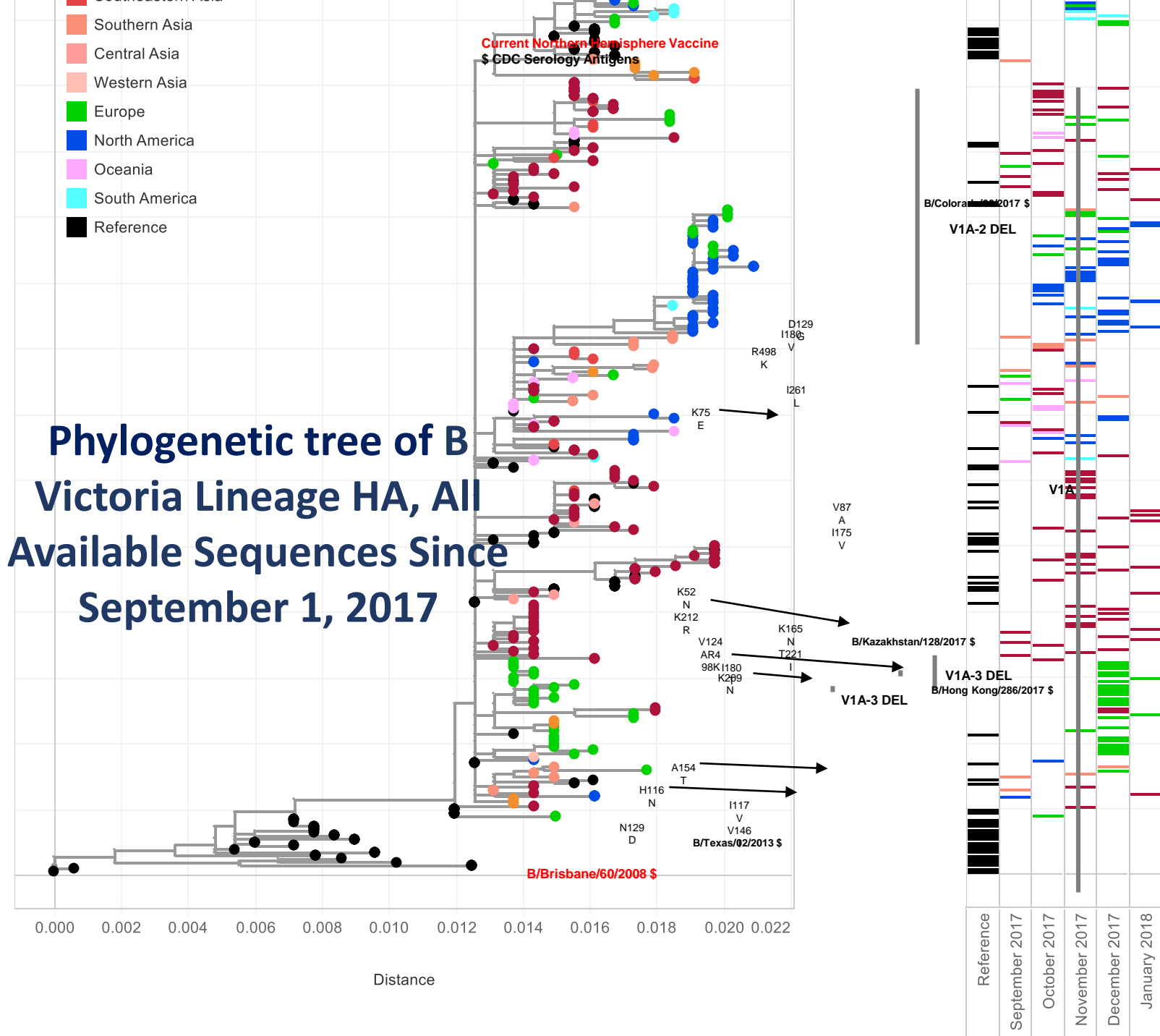
V1A-3 DEL = 7 viruses from China & Hong Kong SAR

Global Influenza B Victoria HA Genetic Groups Since Sept. 1, 2017 based on HA Sequence Availability



Genetic Group
■ V1A
■ V1A Deletion K162/N163
■ V1A Deletion K162/N163/D164





Evolutionary Relationships Among Influenza B Victoria NA Genes, 2017-18

(WHOC Atlanta)

Current Northern Hemisphere Vaccine Strain

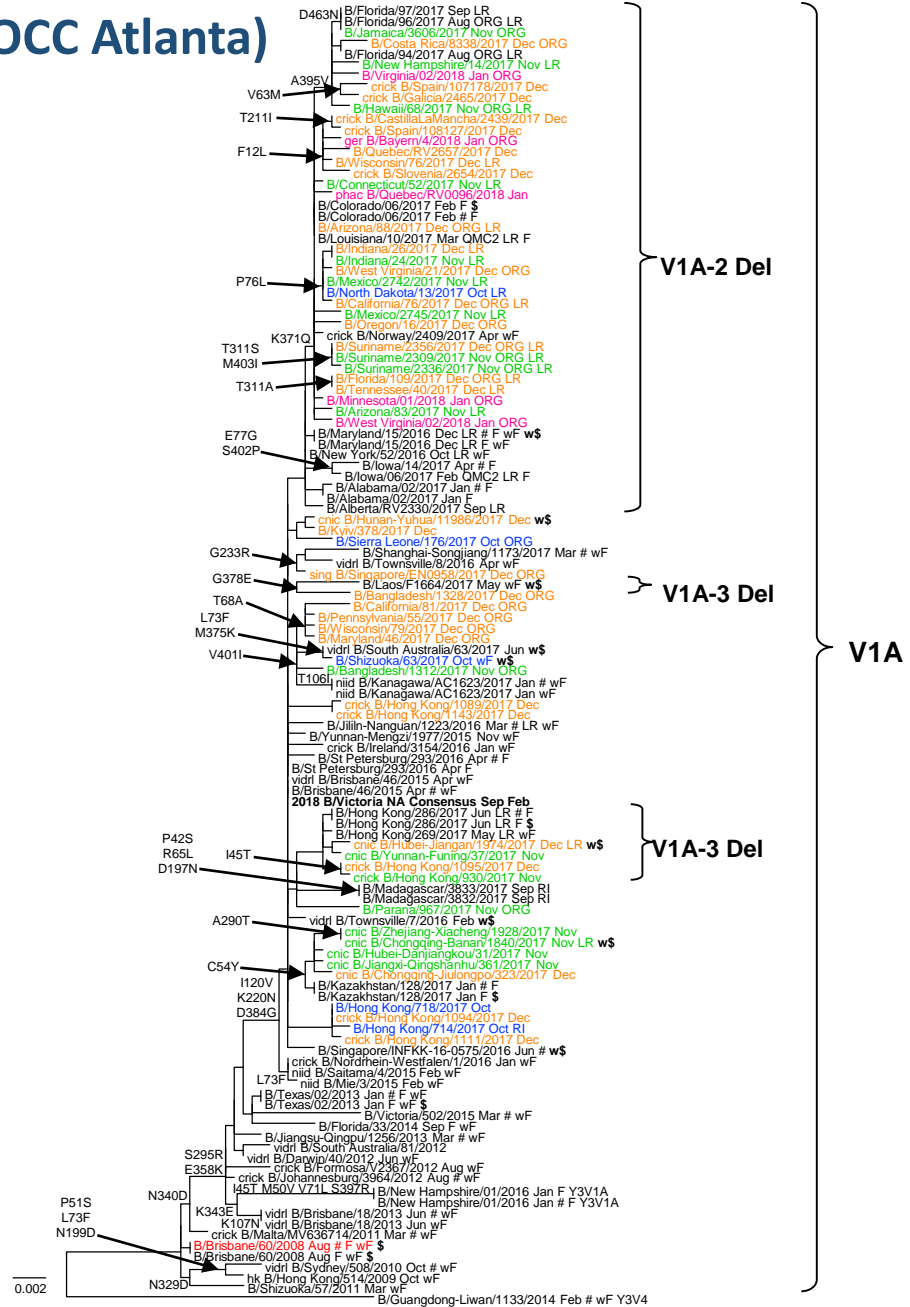
LR - Low Reactor to B/Brisbane/60/2008 (≥ 8 fold)

F - CDC Reference Antigen
wF - WHOc Reference Antigen
\$ - Serology Antigen
w\$ - WHOc Serology Antigen

- Egg Isolate
ORG - Original Clinical Specimen
ITT - Insufficient Titer for Testing
VNR - Virus Not Recovered

RI - Reduced Inhibition
HRI - Highly Reduced Inhibition

October 2017
November 2017
December 2017
January 2018

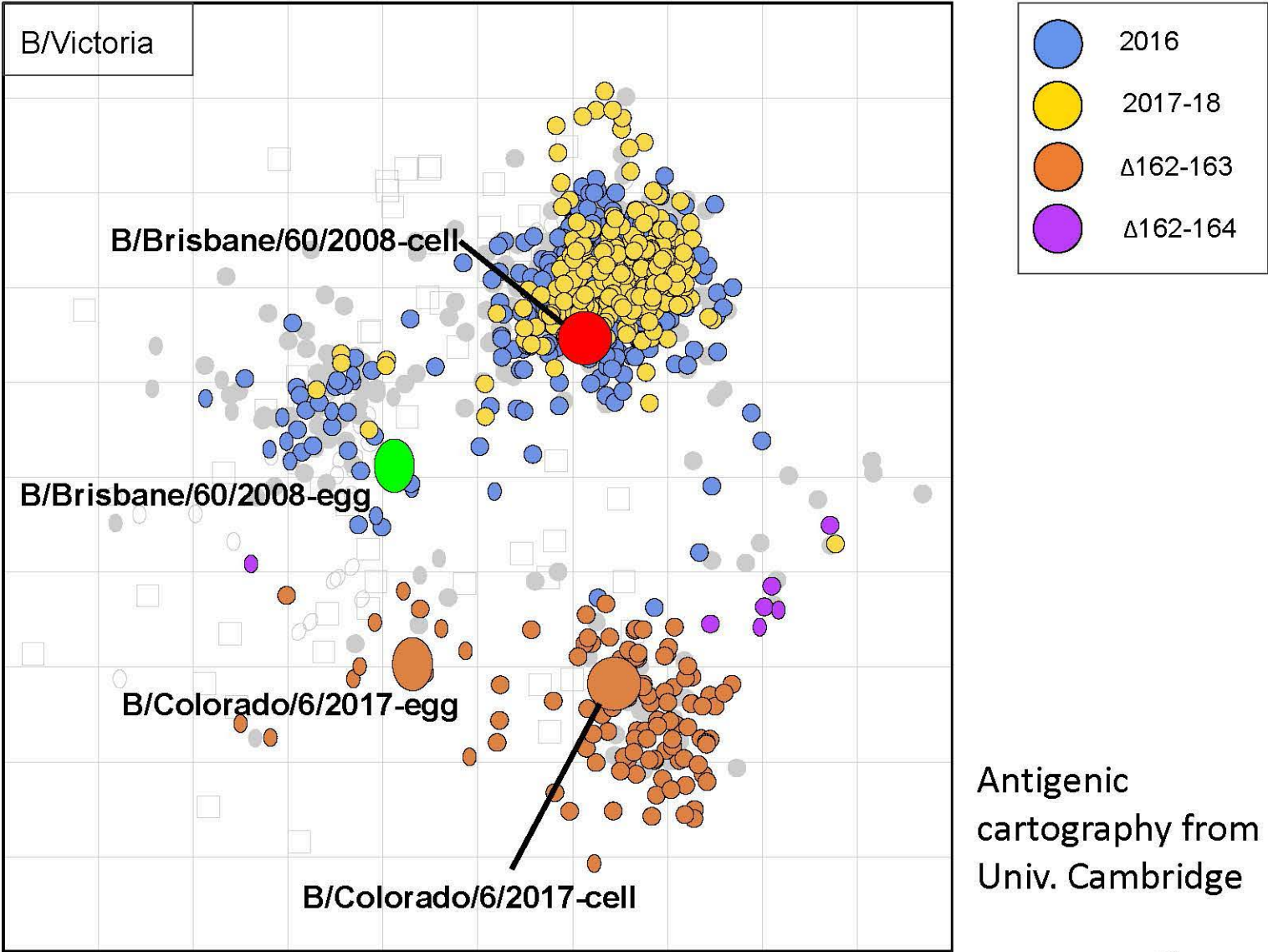


Antigenic Characterization of B/Victoria Lineage Viruses by HI (WHOCC Atlanta)

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA TYPE B VICTORIA LINEAGE VIRUSES

REFERENCE VIRUSES		REFERENCE FERRET ANTISERA														HA Group	Date Collected	Passage
		V1A						V1A-2 DEL					V1A-3 DEL					
		N129D,I117V, V146I		K165N				D129G										
		Unboosted						Unboosted										
EGG	MDCK	MDCK	MDCK	EGG	MDCK	EGG	MDCK	EGG	MDCK	EGG	MDCK	MDCK	EGG	MDCK				
BRI/60	BRI/60	TX/02	ST.P/293	KA/128	KA/128	MD/15	MD/15	CO/06	CO/06	LA/10	HK/286	HK/286						
1	B/BRISBANE/60/2008	1280	1280	640	640	640	1280	640	20	640	80	<10	80	80	V1A	2008/08/04	E4/E4	
2	B/BRISBANE/60/2008	1280	1280	640	1280	640	2560	640	40	640	160	10	160	160	V1A	2008/04/08	CX,C4/C2	
3	B/TEXAS/02/2013	320	640	320	640	40	320	160	10	160	80	10	80	40	V1A	2013/01/09	M1/C2	
4	B/ST. PETERSBURG/293/2016	320	640	160	320	20	160	80	40	40	10	40	80	80	V1A	2016/04/20	C1/C2	
5	B/KAZAKHSTAN/128/2017	160	80	80	40	320	1280	320	<10	320	40	<10	40	40	V1A	2017/01/12	E2	
6	B/KAZAKHSTAN/128/2017	320	80	40	40	320	1280	320	<10	320	40	<10	80	40	V1A	2017/01/12	C2	
7	B/MARYLAND/15/2016	320	160	80	80	320	1280	640	320	640	160	320	80	80	V1A-2 DEL	2016/12/27	E4	
8	B/MARYLAND/15/2016	160	80	40	10	10	80	160	320	160	160	320	80	80	V1A-2 DEL	2016/12/27	C3	
9	B/COLORADO/06/2017	160	40	40	20	160	640	320	160	320	80	160	40	40	V1A-2 DEL	2017/02/25	E5	
10	B/COLORADO/06/2017	160	80	40	20	40	80	320	160	320	160	320	80	80	V1A-2 DEL	2017/02/25	C2	
11	B/LOUISIANA/10/2017	80	80	20	10	10	40	160	320	80	160	160	40	80	V1A-2 DEL	2017/03/06	QMC2	
12	B/HONG KONG/286/2017	320	80	80	40	320	1280	640	40	320	80	<10	320	320	V1A-3 DEL	2017/06/06	E3	
13	B/HONG KONG/286/2017	320	160	80	80	320	640	640	80	320	160	10	640	640	V1A-3 DEL	2017/06/06	C2	
TEST VIRUSES																		
14	B/CALIFORNIA/79/2017	160	640	320	640	10	80	40	20	10	20	<10	20	40	V1A	2017/12/11	C1	
15	B/CALIFORNIA/83/2017	320	640	320	640	10	80	80	20	20	40	<10	20	80	V1A	2017/12/12	C1	
16	B/CALIFORNIA/87/2017	160	640	160	320	10	80	40	40	10	20	<10	40	40	V1A	2017/12/22	C1	
17	B/MARYLAND/46/2017	160	640	160	320	10	80	40	40	20	20	10	40	80	V1A	2017/12/21	C1	
18	B/PENNSYLVANIA/55/2017	160	640	320	640	10	80	40	40	20	40	10	QNS	QNS	V1A	2017/12/18	C1	
19	B/CALIFORNIA/80/2017	160	320	160	320	10	80	40	20	10	20	<10	20	40	V1A	2017/12/11	C1	
20	B/CALIFORNIA/81/2017	160	320	160	320	10	80	40	20	10	20	<10	10	40	V1A	2017/12/12	C1	
21	B/CALIFORNIA/82/2017	160	320	160	320	10	80	40	20	10	20	<10	20	80	V1A	2017/12/12	C1	
22	B/CALIFORNIA/88/2017	160	320	160	320	10	80	40	20	10	20	10	20	40	V1A	2017/12/24	C1	
23	B/CALIFORNIA/90/2017	160	320	160	320	10	80	40	20	10	20	10	QNS	QNS	V1A	2017/12/28	C1	
24	B/IDAHO/31/2017	160	320	160	320	10	80	80	20	20	40	10	40	80	V1A	2017/12/11	C1	
25	B/NEW JERSEY/45/2017	80	80	20	10	10	80	160	320	160	320	320	80	80	V1A-2 DEL	2017/12/25	C1	
26	B/ARIZONA/90/2017	80	40	20	10	10	40	160	320	80	160	320	40	80	V1A-2 DEL	2017/12/12	C1	
27	B/CALIFORNIA/84/2017	80	40	20	10	10	40	160	320	160	160	160	40	40	V1A-2 DEL	2017/12/12	C1	
28	B/DELAWARE/46/2017	80	40	20	10	10	40	160	320	160	160	320	80	80	V1A-2 DEL	2017/12/31	C1	
29	B/MINNESOTA/01/2018	80	40	20	10	10	40	160	320	80	160	160	QNS	QNS	V1A-2 DEL	2018/01/01	C1	
30	B/NEW JERSEY/44/2017	80	40	20	10	10	40	160	320	160	160	320	40	40	V1A-2 DEL	2017/12/25	C1	
31	B/NORTH CAROLINA/30/2017	80	40	20	10	10	40	160	320	160	160	320	40	80	V1A-2 DEL	2017/12/27	C1	
32	B/OREGON/16/2017	160	40	20	20	10	40	160	320	160	160	320	QNS	QNS	V1A-2 DEL	2017/12/16	C1	
33	B/UTAH/52/2017	80	40	20	10	10	40	160	160	160	160	160	40	40	V1A-2 DEL	2017/12/27	C1	
34	B/WEST VIRGINIA/21/2017	160	40	20	10	10	80	160	320	160	320	320	160	160	V1A-2 DEL	2017/12/28	C1	
35	B/MICHIGAN/91/2017	40	20	10	10	10	40	160	160	80	160	160	40	40	V1A-2 DEL	2017/12/06	C1	
36	B/ALBERTA/RV2559/2017	160	80	40	20	20	160	320	320	320	160	320	80	80	V1A-2 DEL	2017/11/06	X2/C1	
37	B/SASKATCHEWAN/RV2588/2017	320	80	40	40	160	640	320	160	320	160	320	80	40	V1A-2 DEL	2017/11/03	X2/C1	
38	B/QUEBEC/RV2657/2017	80	40	20	10	10	40	160	320	160	160	160	40	40	V1A-2 DEL	2017/12/05	X2/C1	
39	B/JAMAICA/3606/2017	80	40	20	10	10	40	160	320	160	160	320	40	40	V1A-2 DEL	2017/11/20	C1	
40	B/BANGLADESH/1312/2017	320	640	320	640	20	160	80	40	20	40	10	40	80	V1A	2017/11/26	C1	
41	B/PHILIPPINES/0838/2017	320	640	320	640	20	160	80	40	20	40	<10	40	80	V1A	2017/09/24	C2	
42	B/PHILIPPINES/0875/2017	320	640	320	320	20	160	80	40	40	40	10	40	80	V1A	2017/08/29	C2/C1	
43	B/LAOS/1592/2017	80	40	20	10	10	40	80	40	40	20	<10	320	320	V1A-3 DEL	2017/05/13	C1/C1	

Antigenic cartography of B/Victoria viruses (WHOCC Atlanta)



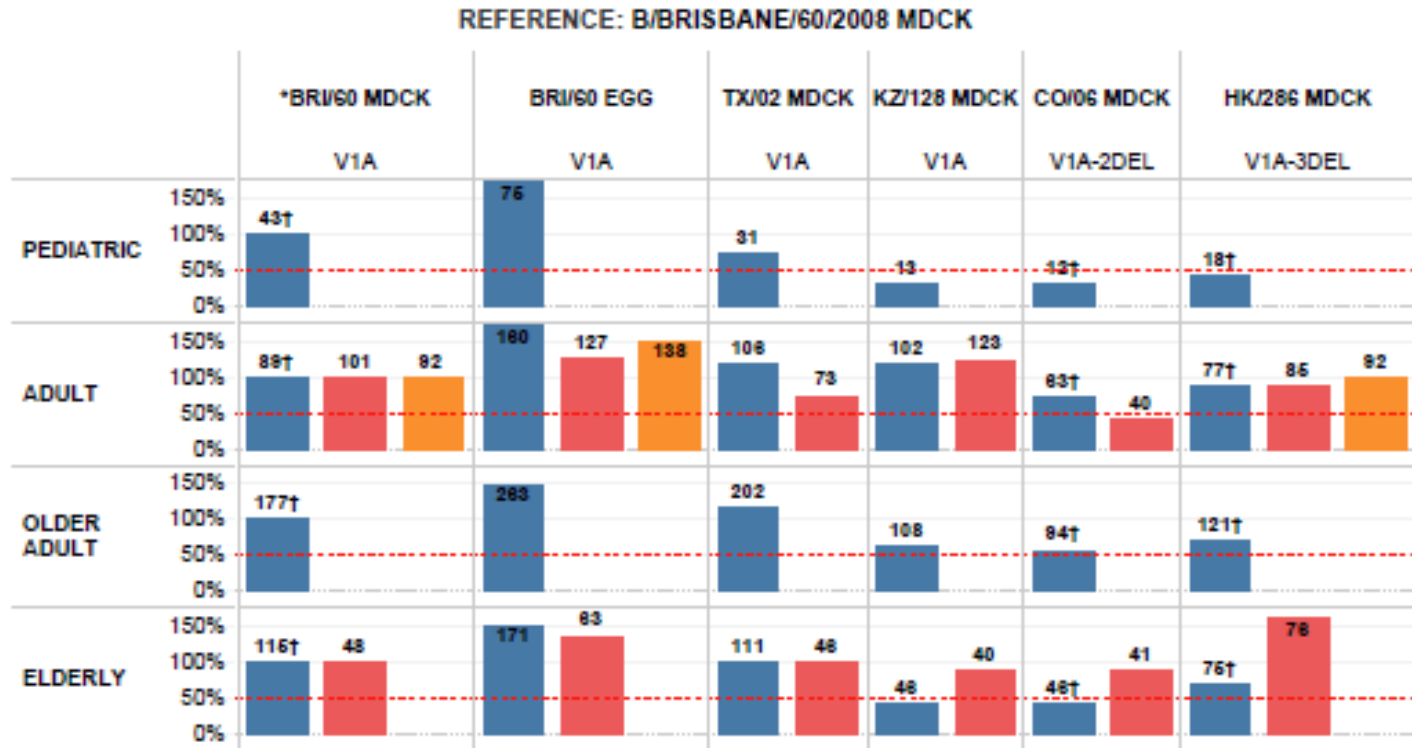
Summary of Antigenic Characterisation for B/Victoria lineage Viruses by HI Compared with Cell-propagated Reference Virus

WHO CC	B/Brisbane/60/2008-like - Cell	Low (≥ 8 fold)
CDC	49 (59%)	34 (41%)
CNIC	112 (87%)	17 (13%)
Crick	29 (50%)	28 (50%)
NIID	3 (100%)	
VIDRL	30 (86%)	5 (14%)
TOTAL	223 (72%)	84 (27%)

Summary of Antigenic Characterisation for B/Victoria lineage Viruses by HI Compared with Egg-propagated Reference Virus

WHO CC	B/Brisbane/60/2008-like - egg	Low (≥ 8 fold)
CDC	49 (59%)	34 (41%)
CNIC	70 (54%)	59 (46%)
Crick	29 (51%)	28 (49%)
NIID	2 (67%)	1 (33%)
VIDRL	2 (6%)	31 (94%)
TOTAL	152 (50%)	153 (50%)

HI Antibody Responses to the B/Victoria Lineage Component among Persons Vaccinated with 2017-2018 N. Hemisphere QIV (WHOCC Atlanta): Compared with Cell-propagated B/Brisbane/60/2008



† Post-vaccination GMT

Dashed-line (red; 50% GMT), post-vaccination % GMT titers above this line are statistically non-inferior to the applied reference antigen; y-axis restricted to highlight region below this line

Included B/Victoria strains: B/Brisbane/60/2008 (BRI/60); B/Colorado/06/2017 (CO/06); B/Hong Kong/286/2017 (HK/286); B/Kazakhstan/128/2017 (KZ/128); B/Texas/02/2013 (TX/02)

■ USA ■ Japan ■ UK

Influenza B Summary - I

- **B/Victoria and B/Yamagata lineage viruses co-circulated**
 - **B/Yamagata lineage viruses predominated**
- **B/Yamagata lineage viruses**
 - **All of HA genes belonged to genetic clade 3**
 - **Recently circulating viruses were well inhibited by ferret antisera raised against cell- and egg- propagated B/Phuket/3073/2013 viruses**
 - **Post-vaccination geometric mean HI titers against most representative recent B/Yamagata lineage viruses tested were similar to HI titres to the cell-propagated B/Phuket/3073/2013 virus**

B Virus Summary - II

- **B/Victoria lineage viruses**
 - **All HA genes belonged to genetic clade 1A**
 - **Double deletion (1A.1) variant viruses have increased in number and geographic spread**
 - **Many recently circulating viruses were well inhibited by ferret antisera raised against cell-propagated B/Brisbane/60/2008 or B/Texas/2/2013 viruses**
 - **An increasing proportion of viruses were poorly inhibited by ferret antisera raised against cell-propagated B/Brisbane/60/2008**
 - **Most of the low reactors had deletions of 2 (2DEL) or 3 (3DEL) amino acids in the HA**
 - **Ferret antiserum raised against a representative of 2DEL virus, B/Colorado/06/2017, well inhibited viruses within the 1A.1 subclade**
 - **Post-vaccination geometric mean HI titers of pediatric sera were reduced against most viruses with HA deletions compared to HI titres to cell-propagated reference vaccine virus B/Brisbane/60/2008**

Recommendation

- It is recommended that the following viruses be used vaccines in the 2018-2019 northern hemisphere influenza season:

Quadrivalent influenza:

- an A/Michigan/45/2015 (H1N1)pdm09-like virus;
- an A/Singapore/INFIMH-16-0019/2016 (H3N2)-like virus;
- a B/Colorado/06/2017-like virus (B/Victoria/2/87 lineage); and
- a B/Phuket/3073/2013-like virus (B/Yamagata/16/88 lineage).

Trivalent vaccines:

- an A/Michigan/45/2015 (H1N1)pdm09-like virus;
- an A/Singapore/INFIMH-16-0019/2016 (H3N2)-like virus; and
- a B/Colorado/06/2017-like virus (B/Victoria/2/87 lineage)

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- **Essential Regulatory Laboratories**
- **US partners:**
 - **Association of Public Health Laboratories**
 - **United States Air Force School of Aerospace Medicine (USAFSAM)**
 - **Naval Health Research Center (NHRC)**
- **Fitness forecasting partners in Europe and US**
- **CDC Influenza Division staff**