OFFLU Swine Influenza Virus technical meeting
27 – 28 February 2019
OIE Headquarters, Paris, France

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Updated surveillance data and research activities since April 2018

- Human cases of H1 and H3 variant influenza A viruses in the USA
- Human cases internationally
- Emerging swine influenza virus lineages
- Population immunity

Updated surveillance data and research activities since April 2018

Strains of concern:

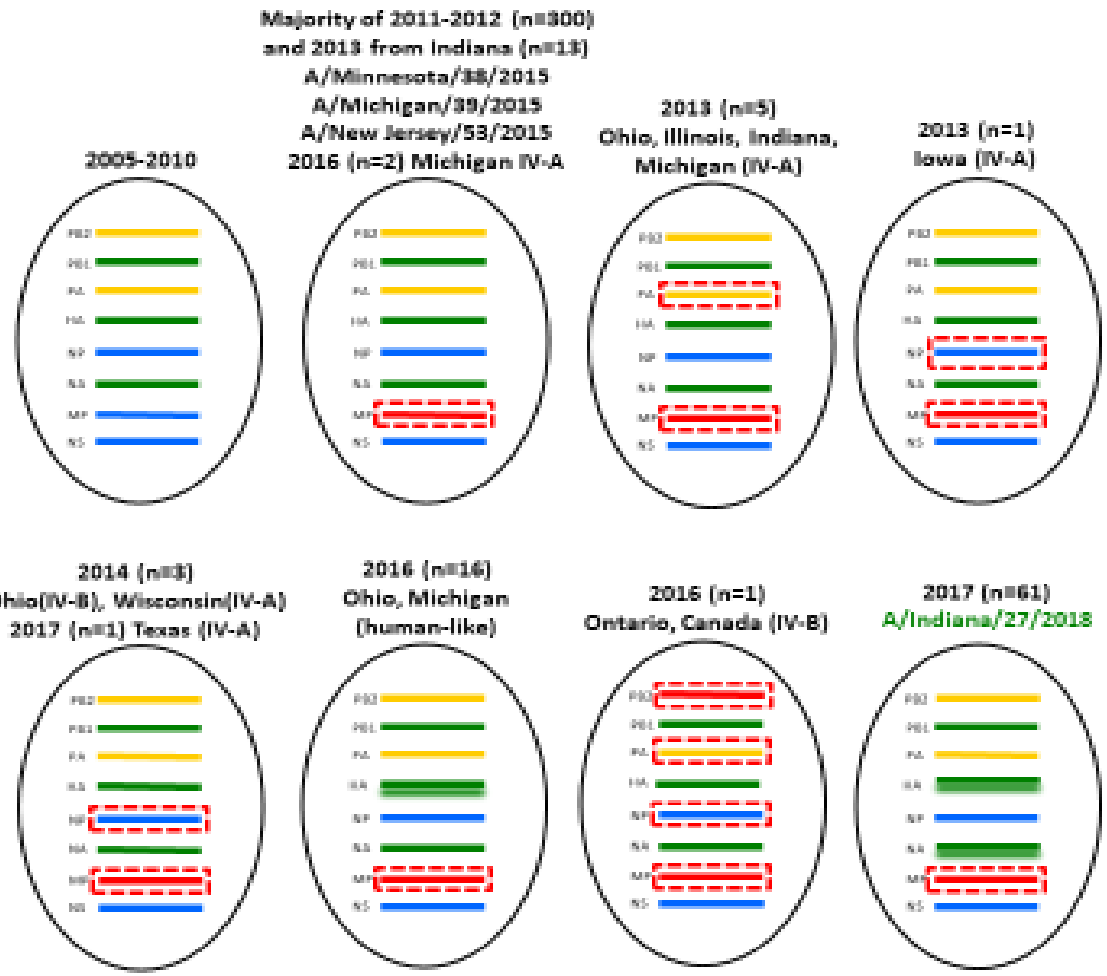
- H3N2v

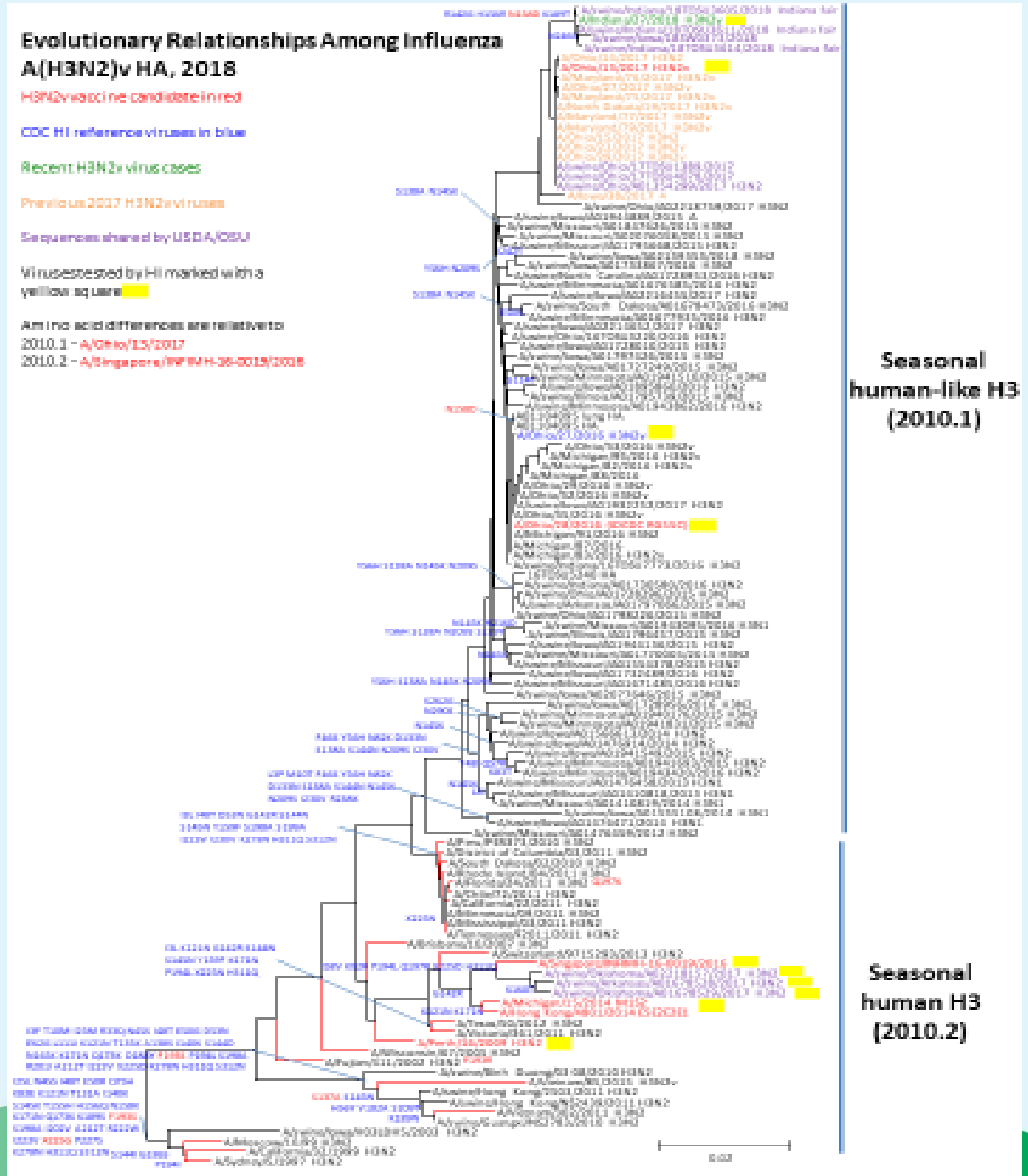
H3N2v

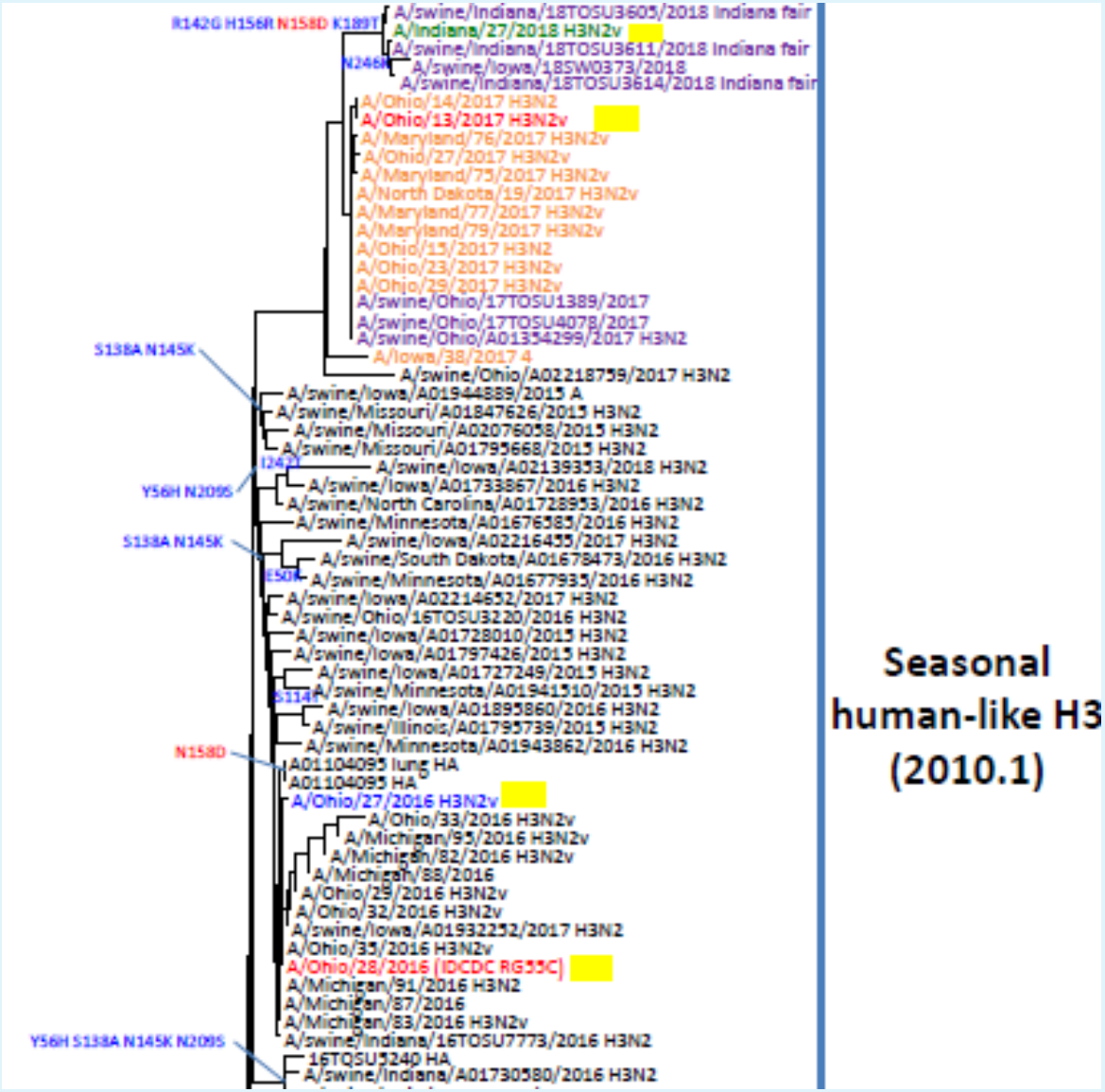
Summary of human infections with influenza A(H3N2)v

Country	Subtype	State	Age (yrs)	Sex	Onset date	Outcome	Exposure	Confirmed/ Reported	Isolate available	HI test date	Strain name
USA	H3N2v (human-like)	IN	9y	F	6/19/2018	Recovered	Exposure to swine	CDC, USA	yes	07/12/2018	A/Indiana/27/2018

Genome Comparisons of H3N2v 2005-2018

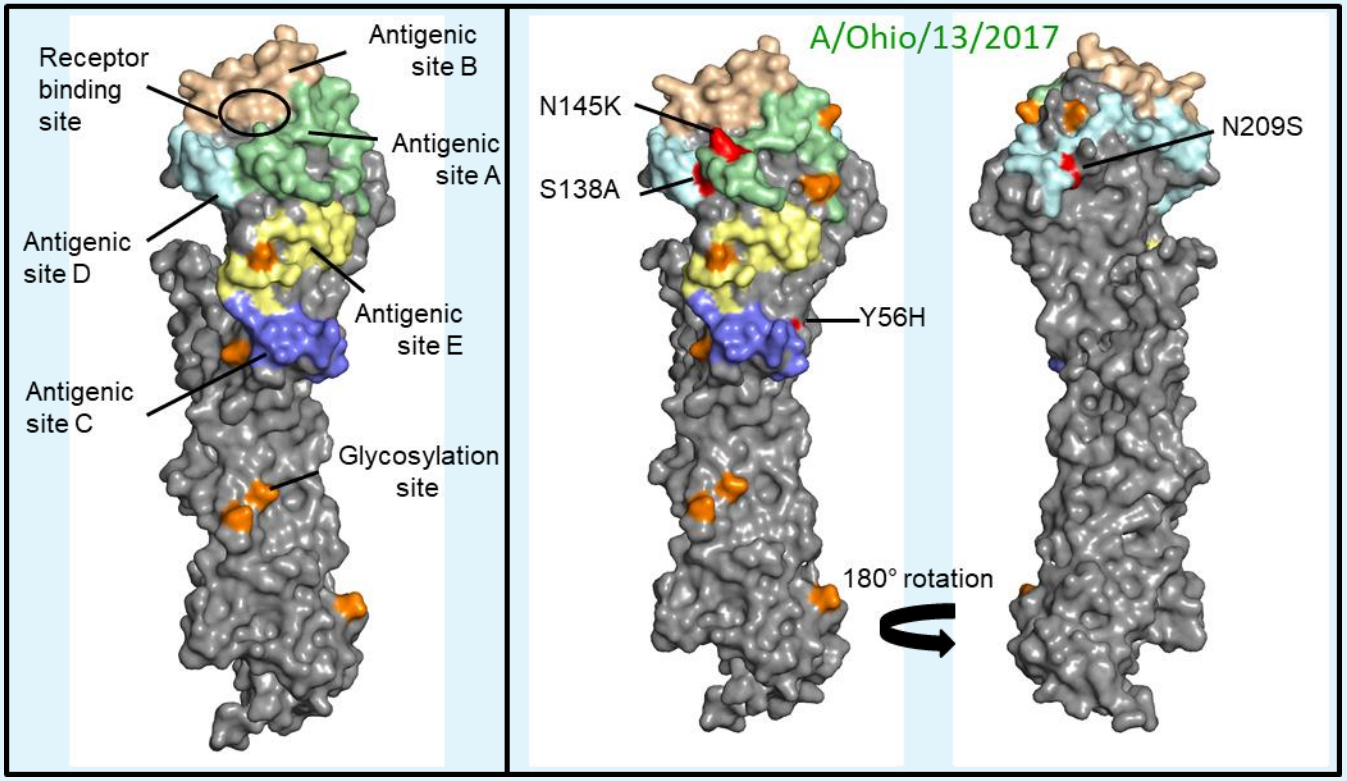



Evolutionary Relationships Among Influenza A(H3N2)v HA, 2018
H3N2v vaccine candidate in red
CDC H1 reference viruses in blue
Recent H3N2v virus cases
Previous 2017 H3N2v viruses
Sequences shared by USDA/OSU
Viruses tested by HI marked with a yellow square
Amino acid differences are relative to
2010.1 – A/Ohio/15/2017
2010.2 – A/Singapore/INFIMH-16-0019/2016
Seasonal human-like H3 (2010.1)
Seasonal human H3 (2010.2)



Seasonal human-like H3 (2010.1)

2017 H3N2v '2010 human-like' hemagglutinin changes compared to A/Ohio/28/2016 CVV



			Reference Antisera											
			Seas	Seas	Seas	IV-A	IV-A	2010.1	2010.1	2010.1				
			59414852	2015-032	2018-012	2017-034	2017-032	2016-115	2017-047	2017-117	17/18	17/18		
	REFERENCE ANTIGENS		Perth/16	MI/15	Sing	MN/11	MN/11 X203	OH/27	RG55C	OH/13	Child pool#	Adult Pool*	MN/11 Adult ^	MN/11 Elderly &	PASSAGE
1	A/Perth/16/2009	Seas	**80**	320	80	<20	<20	80	20	80	1280	640	320	640	E3/E3 (2/29/2016)
2	A/Michigan/15/2014	Seas	80	**640**	320	<20	<20	20	<20	80	1280	320	320	640	M1/S2(10/19/17)
3	A/Singapore/INFIMH-16-0019/2016	Seas	40	160	**640**	<20	<20	<20	<20	<20	1280	80	80	160	E5/E2(8/1/18)
4	A/Minnesota/11/2010	IV-A	80	<20	<20	**2560**	2560	40	20	<20	80	80	1280	1280	E2(7/22/13)
5	A/Minnesota/11/2010 X-203	IV-A	160	40	40	2560	**2560**	<20	20	<20	80	80	1280	1280	EX/E1 (2/25/11)
6	A/Ohio/27/2016	2010.1	640	20	20	<20	<20	**5120**	2560	1280	80	160	320	640	C1S2 (10/3/16)
7	A/Ohio/28/2016 IDCDC RG55C	2010.1	80	<20	<20	<20	<20	2560	**1280**	320	40	160	160	320	V1E3 (5/25/17)
8	A/Ohio/13/2017	2010.1	1280	40	20	40	<20	640	160	**2560**	80	320	320	640	C1(2/13/18)
	TEST ANTIGENS														
9	A/Indiana/27/2018	2010.1	160	40	<20	40	20	80	80	1280	40	160	640	320	S1(7/1/18)
10	VPT 18-v68.1 (A/Ohio/13/2017-like)	2010.1	640	80	160	80	<20	320	160	1280	80	160	320	320	p1E3(8/17/18)
12	A/swine/Oklahoma/A02218157/2017	2010.2	640	640	640	80	<20	640	80	1280	1280	640	1280	1280	C1/C1(6/28/18)
13	A/swine/Arkansas/A01678528/2017	2010.2	80	80	160	<20	<20	80	20	160	1280	320	320	320	C1
14	A/swine/Oklahoma/A01678529/2017	2010.2	ND	ND	160	ND	ND	ND	ND	ND	ND	ND	ND	ND	C1

#2017-2018 post-vaccine immune serum pool from child (0-3 yrs) vaccinees (A/Hong Kong/4801/2014 vaccine)

*2017-2018 post-vaccine immune serum pool from adult (19-49 yrs) vaccinees (A/Hong Kong/4801/2014 vaccine)

Test performed in presence of 20 nM Oseltamivir using guinea pig RBCs

^post-vaccine immune serum pool from adult (19-49 yrs) vaccinees (A/Minnesota/11/2010 vaccine)

&post-vaccine immune serum pool from elderly vaccinees (A/Minnesota/11/2010 vaccine)

								NEW	NEW	NEW	NEW
			Seas	Seas	Seas	2010.1	2010.1	2010.1		2010.2	
			59414852	2018-012	2019-001	2017-047	2017-117	2019-011	2019-012	2018-105	2018-106
REFERENCE ANTIGENS			Perth/2009	Sing/2016	Switz/2017	RG55C	OH/2017	IN/2018	IN/2018	SW/OK/2017	SW/OK/2017
1	A/Perth/16/2009	Seas	**2560**	160	80	<20	40	20	20	80	160
2	A/Singapore/INFIMH-16-0019/2016	Seas	80	**640**	160	<20	<20	<20	<20	160	320
3	A/Switzerland/8060/2017	Seas	80	1280	**5120**	<20	<20	80	<20	160	640
4	A/Ohio/28/2016 IDCDC RG55C	2010.1	80	80	20	**2560**	320	80	80	80	160
5	A/Ohio/13/2017	2010.1	80	40	40	80	**1280**	640	640	80	320
6	A/Indiana/27/2018	2010.1	<20	<20	40	640	640	**5120**	**5120**	ND	2560
7	A/swine/Oklahoma/A02218157/2017	2010.2	320	2560	1280	40	320	40	40	**1280**	**2560**
TEST ANTIGENS											
8	A/Ohio/13/2017-like CVV VPT 18-v68.1 1.5b1 non GLP		160	160	40	80	1280	160	40	40	160
9	A/Ohio/13/2017-like CVV VPT 18-v68.1 1.5b3 non GLP		320	320	80	160	5120	320	160	160	320
10	A/Ohio/13/2017-like CVV VPT 18-v68.1 non GLP		80	40	40	160	2560	640	640	80	320
11	A/swine/Iowa/18Tosu0373/2018	2010.1	<20	<20	<20	<20	<20	5120	2560	<20	80
12	A/swine/Iowa/18Tosu0394/2018	2010.1	<20	<20	<20	<20	20	2560	640	<20	80

H3N2v

Genetic characterization

- The 2010.1 lineage swine viruses had 4 conserved amino acid changes in putative antigenic sites A and B in HA1 relative to A/Ohio/13/2017, the wt strain of the recommended CVV.
- 2010.2 lineage swine viruses from Oklahoma and Arkansas were closely related to human, seasonal A/Singapore/INFIMH-16-0019/2016-like viruses. These viruses had six conserved amino acid differences in HA1 compared to this seasonal vaccine virus. Glycosylation in 2010.2 viruses change inhibition of seasonal viruses.

Antigenic characterization

- Ferret antiserum raised to the closest wt strain of the recommended CVV (A/Ohio/13/2017) reacted with the variant virus , A/Indiana/27/2018, with a heterologous titer within 2-fold of the homologous virus titer.
- Ferret antisera raised to A/Indiana/27/2018 well inhibited the 2010.1 lineage swine viruses.
- Ferret antisera raised to seasonal A/Singapore/INFIMH-16-0019/2016 and A/Switzerland/8060/2017 viruses well inhibited the 2010.2 lineage swine virus, but not the opposite.
- Adult vaccinees have higher titers than children vaccinees.
- MN/11 CVV vaccine recipients are cross-reactive with 2010.1 and 2010.2 viruses

Candidate vaccine viruses

- Non-GLP A/Ohio/13/2017-like CVVs were tested by one-way analysis and were well inhibited by antisera raised to A/Ohio/13/2017.
- Two-way analysis of one or more of these CVVs is pending.

- NYMC X-203, A/Minnesota/11/2010	North American; cluster IV-A
- NYMC X-213, A/Indiana/10/2011	North American; cluster IV-A
- IDCDC-RG55C, A/Ohio/28/2016-like	2010.1 human-like
- IDCDC-RG, A/Ohio/13/2017-like	2010.1 human-like (Pending)

Updated surveillance data and research activities since April 2018

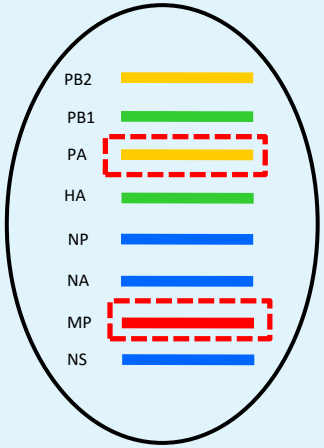
Strains of concern:

- H1N2v

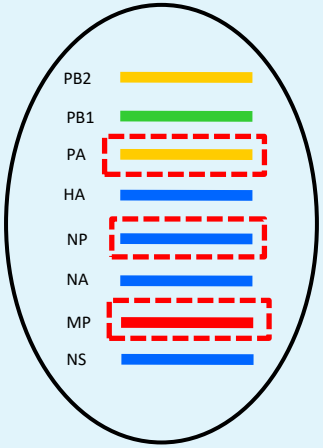
Summary of human infections with influenza A(H1N2)v virus

Country	Subtype	State	Age	Sex	Onset Date	Exposure	Confirmed/ reported	Isolate available	HI test (date)	Strain Designation
USA	H1N2v (delta 2; 1B.2)	CA	12 y	M	7/26/18	Exposure to swine	CDC, USA	not attempted		A/California/58/2018
USA	H1N2v (delta 2; 1B.2)	CA	12 y	M	7/30/18	Exposure to swine	CDC, USA	not attempted		A/California/59/2018
USA	H1N2v (delta 2; 1B.2)	CA	11 y	M	7/27/18	Exposure to swine	CDC, USA	VNR		A/California/60/2018
USA	H1N2v (delta 2; 1B.2)	CA	12 y	M	unk	Exposure to swine	CDC, USA	VNR		A/California/61/2018
USA	H1N2v (delta 2; 1B.2)	CA	9 y	M	8/03/18	Did not attend fair; no exposure to swine	CDC, USA	C1 (8-17-18)		A/California/62/2018
USA	H1N2v (delta 2; 1B.2)	CA	2 y	F	8/03/18	Exposure to swine	CDC, USA	C1 (8-17-18)		A/California/63/2018
USA	H1N2v (delta 2; 1B.2)	MI	14 y	M	7/27/18	Exposure to swine	CDC, USA	C1 (8-10-18)	8/16/18	A/Michigan/382/2018
USA	H1N2v (delta 2; 1B.2)	MI	5 y	M	7/29/18	Exposure to swine	CDC, USA	C1 (8-10-18)	8/16/18	A/Michigan/383/2018
USA	H1N2v (delta 2; 1B.2)	MI	21 y	F	7/27/18	Exposure to swine	CDC, USA	C1 (8-12-18)	8/16/18	A/Michigan/384/2018
USA	H1N2v (delta 2; 1B.2)	OH	3 y	F	8/06/18	Attended fair, no exposure to swine	CDC, USA	C1 (8-12-18)	8/16/18	A/Ohio/24/2018
USA	H1N2v (delta 2; 1B.2)	OH	9 y	F	8/08/18	Exposure to swine	CDC, USA	C1 (8-17-18)		A/Ohio/25/2018
USA	H1N2v (delta 2; 1B.2)	OH	16 y	M	8/06/18	Exposure to swine	CDC, USA	VNR		
USA	H1N2v (delta 2; 1B.2)	OH	14 y	M	8/18/18	Exposure to swine	CDC, USA	C1 (8/25/2018)		A/Ohio/28/2018

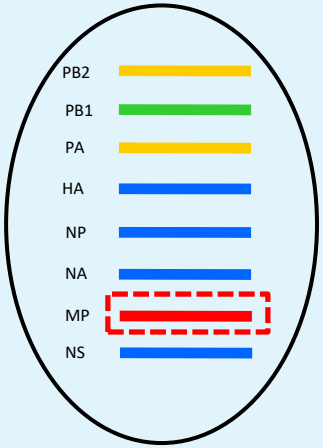
A/Missouri/12/2012
H1N1v - delta



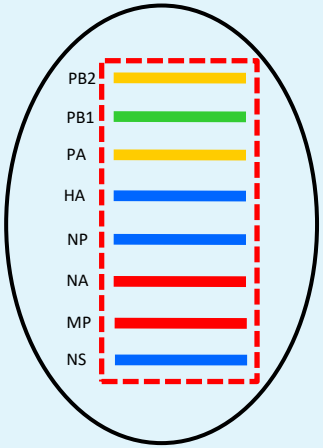
A/Arkansas/14/2013
A/Iowa/39/2015
A/Minnesota/46/2015
H1N1v - gamma



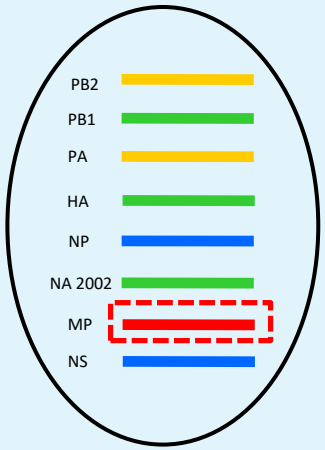
A/Minnesota/33/2014
A/Ohio/09/2015
H1N1v - gamma



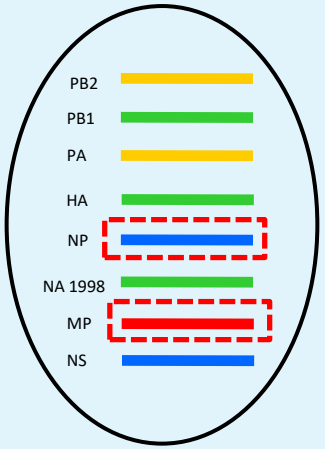
2009 Pandemic H1N1



A/Wisconsin/71/2016
A/Minnesota/70/2016
A/Iowa/32/2016 (H1N2v – delta 1)
A/Ohio/35/2017 (H1N2v - delta 2)



California, Michigan, Ohio
2018 cases (H1N2v - delta 2)



Classical Swine H1N1

Avian – North American Lineage

Human Seasonal Lineage

Eurasian Swine Lineage

Genes derived from
H1N1 pdm09 virus

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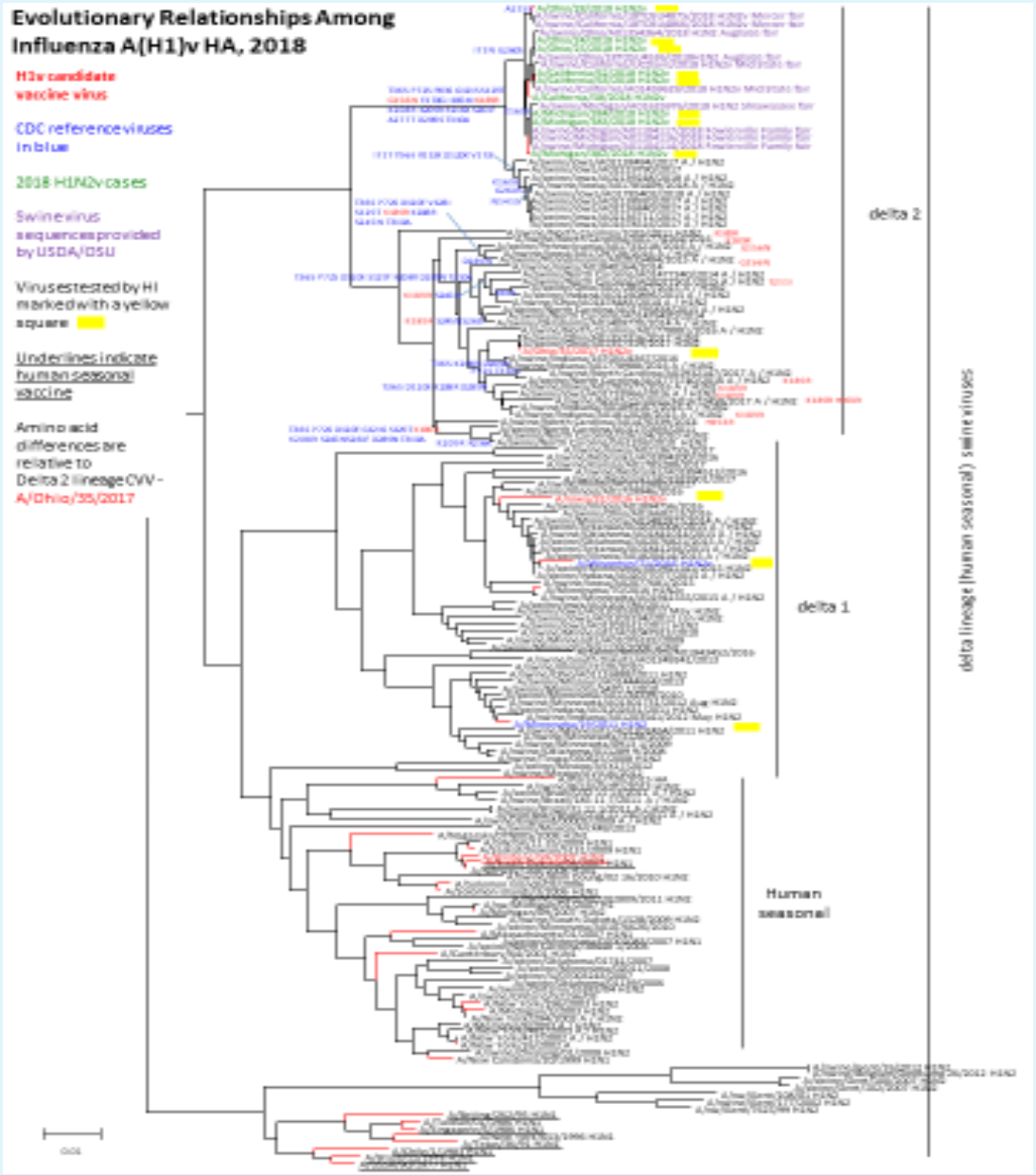

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Evolutionary Relationships Among Influenza A Variant (H1N2)v HA, 2018 Delta2

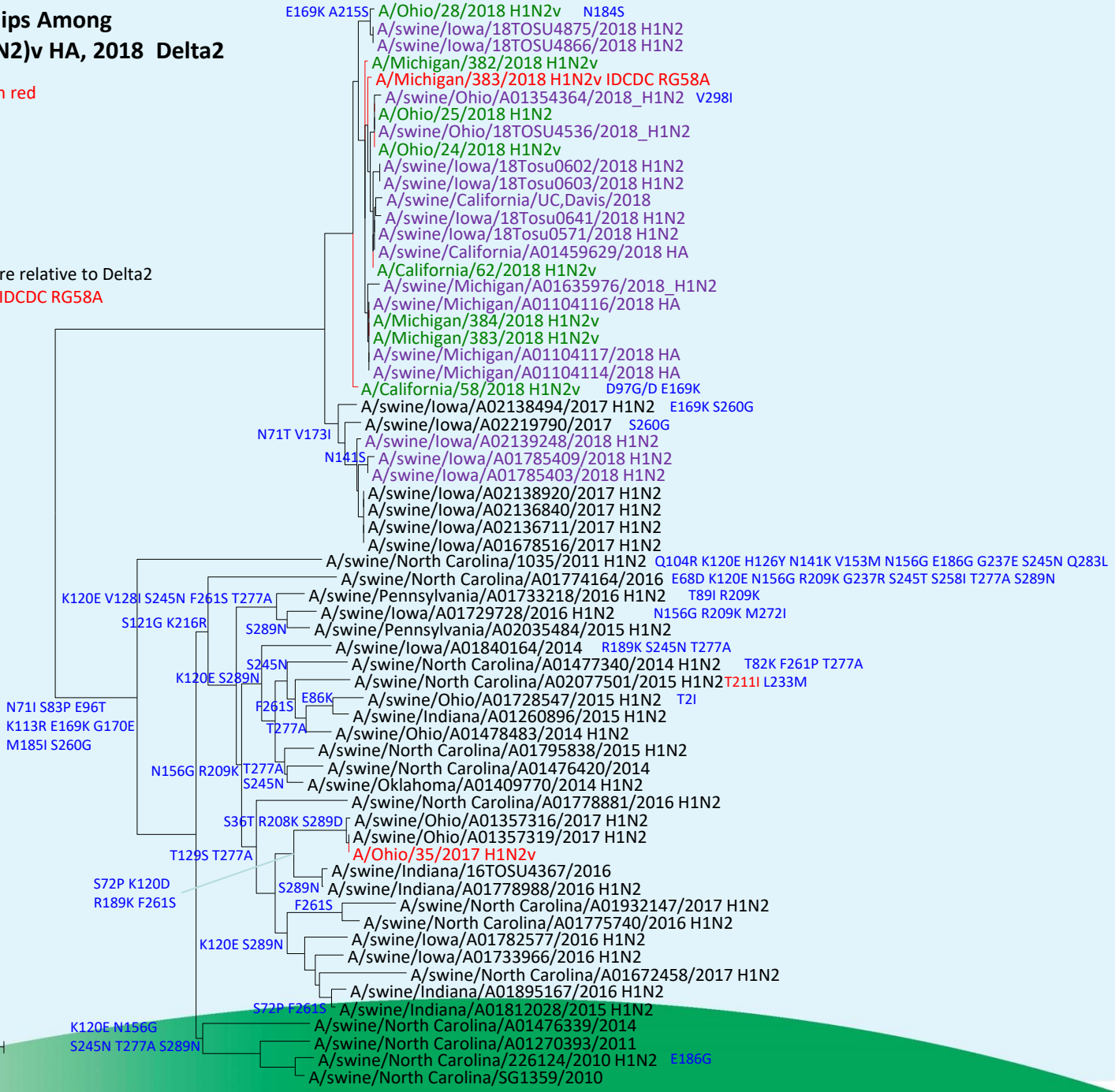
Reassortant vaccine candidate in red

CDC HI reference viruses in blue

2018 US H1v viruses

2018 Swine viruses

Amino acid differences shown are relative to Delta2 lineage - A/Michigan/383/2018 IDCDC RG58A



			Reference Antisera									
			pdm09	H1N1v (gamma)	H1N1v (gamma)	H1N2v (delta 1)	H1N2v (delta 1)	H1N2v (delta 2)				
			2017-094	2015-158	2016-010 (B)	2015-168 (B)	2016-016 (B)	2017-129	2017/2018	2017/2018		
REFERENCE ANTIGENS		**Lineage**	**MI/45**	**Ohio/9**	**RG48A**	**MN/19**	**WI/71**	**OH/35**	**Child pool#**	**Adult pool***	**Passage**	**Date collected**
1	A/Michigan/45/2015	pdm09	**5120**	80	<10	<10	<10	<10	80	1280	M1/C3(1/18/17)	9/7/2015
2	A/Ohio/9/2015	H1N1v (gamma)	40	**2560**	640	<10	<10	<10	<10	40	E2(11/23/15)	4/21/2015
3	A/Ohio/9/2015 CVV RG48A	H1N1v (gamma)	80	5120	**1280**	<10	<10	<10	<10	160	V1E3 (11/27/15)	Reassortant
4	A/Minnesota/19/2011	H1N2v (delta 1)	<10	<10	<10	**2560**	1280	10	<10	20	C2(12/19/11)	11/4/2011
5	A/Wisconsin/71/2016	H1N2v (delta 1)	<10	<10	<10	160	**2560**	10	<10	10	C1(6/20/16)	6/9/2016
6	A/Ohio/35/2017	H1N2v (delta 2)	<10	<10	<10	<10	80	**1280**	<10	<10	C1(8/25/17)	8/17/2017
TEST ANTIGENS												
7	A/Michigan/382/2018	H1N2v (delta 2)	<10	<10	<10	<10	40	160	<10	<10	C1(8/10/18)	7/28/2018
8	A/Michigan/383/2018	H1N2v (delta 2)	<10	<10	<10	<10	40	320	<10	<10	C1(8/10/18)	7/31/2018
9	A/Michigan/383/2018	H1N2v (delta 2)	<10	40	<10	<10	40	640	<10	<10	E1(8/16/18)	7/31/2018
10	A/Ohio/24/2018	H1N2v (delta 2)	<10	<10	<10	<10	20	160	<10	<10	C1(8/12/18)	8/7/2018
11	A/Michigan/384/2018	H1N2v (delta 2)	<10	<10	<10	<10	20	160	<10	<10	C1(8/12/18)	7/31/2018

#2017-2018 post-vaccine immune serum pool from child (0-3 yrs) vaccinees (A/Michigan/45/2015 vaccine)

TEST DATE: 8/16/2018

*2017-2018 post-vaccine immune serum pool from adult (19-49 yrs) vaccinees (A/Michigan/45/2015 vaccine)

(B) Ferrets were boosted 2 weeks post-infection

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA A(H1)v

					NEW	NEW	NEW	NEW		
			2016-010	2017-129	2019-015	2019-016	2019-017	2019-018		
REFERENCE ANTIGENS		**Lineage**	**RG48A**	**OH/35**	**MI 383 wt**	**MI 383 wt**	**RG58A GLP**	**RG58A GLP**	**Passage**	**Date collected**
1	A/Ohio/9/2015 CVV RG48A	H1N1v (gamma)	**5120**	10	80	80	40	40	V1E3 (11/27/15)	Reassortant
2	A/Ohio/35/2017	H1N2v (delta2)	<10	**1280**	160	160	80	40	C1 (8/25/17)	8/17/2017
3	A/Michigan/383/2018	H1N2v (delta2)	40	320	**1280**	**320**	320	320	C1 (8/10/18)	7/31/2018
4	A/Michigan/383/2018-like IDCDC-RG58A	H1N2v (delta2)	160	640	1280	640	**640**	**640**	V1E2 (9/7/18)	Reassortant
TEST ANTIGENS										
5	A/Ohio/25/2018	H1N2v (delta2)	40	160	320	320	320	320	C1 (8/10/18)	8/9/2018
6	A/Michigan/382/2018	H1N2v (delta2)	40	160	640	640	320	320	C1 (8/17/18)	7/28/2018
7	A/California/62/2018	H1N2v (delta2)	40	320	1280	640	320	640	C1 (8/17/18)	8/6/2018
8	A/swine/Iowa/18Tosu0641/2018	H1N2v (delta2)	40	320	640	640	320	320	C1/C1 (11/13/18)	6/7/2018
9	A/swine/Iowa/18Tosu0571/2018	H1N2v (delta2)	40	320	640	320	320	320	C1/C1 (11/13/18)	6/7/2018
10	A/swine/Iowa/18Tosu0602/2018	H1N2v (delta2)	40	320	640	320	320	320	C1/C1 (11/13/18)	6/7/2018
11	A/swine/Iowa/18Tosu0603/2018	H1N2v (delta2)	80	320	1280	320	320	320	C1/C1 (11/13/18)	6/7/2018

H1N2v

Antigenic characterization

- Ferret antiserum raised to the wt strain of a recommended delta 2 lineage CVV, A/Ohio/35/2017, inhibited the A(H1N2) swine and 2018 variant viruses, but with titers that were reduced 4 to 8-fold compared to the homologous virus titer

- Ferret antisera raised to either the delta 2 lineage wt A/Michigan/383/2018 or the IDCDC-RG58A CVV viruses, inhibited both variant and swine viruses with heterologous titers that were within 2-fold of homologous virus titers.

- new A(H1N2)v CVV (IDCDC-RG58A) passed two-way HI testing and is available for distribution.

Candidate vaccine viruses

• IDCDC-RG48A, A/Ohio/09/2015-like	Classical gamma lineage
• CNIC-42443, A/Hunan/42443/2015	Eurasian avian-like
• IDCDC-RG, A/Iowa/32/2016-like	Delta 1 lineage (pending)
• NIBRG, A/Netherlands/3315/2016	Eurasian avian-like (pending)
• NIBRG, A/Ohio/35/2017-like	Delta 2 lineage (pending)
• IDCDC-RG, A/Ohio/24/2017-like	Alpha lineage (pending)
• IDCDC-RG58A, A/Michigan/383/2018-like	Delta 2 lineage

Updated surveillance data and research activities since April 2018

Strains of concern:

- H1N1v

Country	Subtype	State	Age (yrs)	Sex	Onset date	Outcome	Exposure	Confirmed/ Reported	Isolate available	HI test date	Strain name
USA	H1N1v (pdm09)	IA	33y	F	10/21/2017	Recovered	Exposure to swine	CDC, USA	yes	11/17/2017	A/Iowa/33/2017
Switzerland	H1N1v (EA avian-like)		48y	M	12/20/2017	Recovered	Exposure to swine	WHO	unknown	N/A	unknown

- The patient from Iowa with A(H1N1)v reported direct exposure to swine at a swine premises in the week preceding illness onset. The patient was not hospitalized and fully recovered.

- On 20 December 2017, a case of influenza A(H1N1)v virus was detected in Switzerland in a farm worker with mild acute respiratory symptoms.

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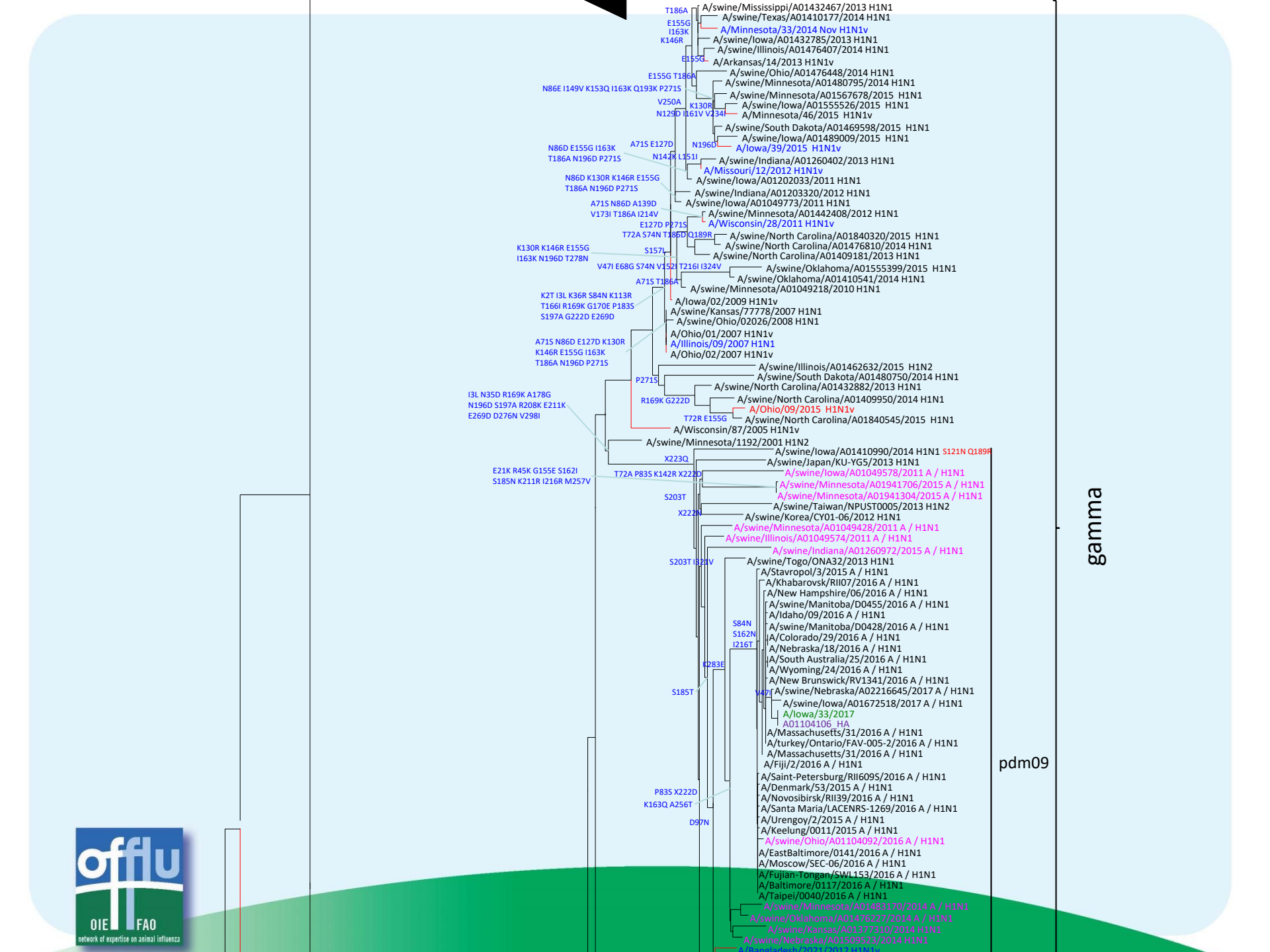
A/swine/Mississippi/A01432467/2013 H1N1
T186A
A/swine/Texas/A01410177/2014 H1N1
E155G
A/Minnesota/33/2014 Nov H1N1v
I163K
K146R
A/swine/Iowa/A01432785/2013 H1N1
A/swine/Illinois/A01476407/2014 H1N1
E155G
A/Arkansas/14/2013 H1N1v
E155G T186A
A/swine/Ohio/A01476448/2014 H1N1
N86E I149V K153Q I163K Q193K P271S
A/swine/Minnesota/A01480795/2014 H1N1
A/swine/Minnesota/A01567678/2015 H1N1
V250A
K130R
A/swine/Iowa/A01555526/2015 H1N1
N129D I161V V234I
A/Minnesota/46/2015 H1N1v
A/swine/South Dakota/A01469598/2015 H1N1
A/swine/Iowa/A01489009/2015 H1N1
A71S E127D
N196D
A/Iowa/39/2015 H1N1v
N86D E155G I163K
T186A N196D P271S
N142K L151I
A/swine/Indiana/A01260402/2013 H1N1
A/Missouri/12/2012 H1N1v
A/swine/Iowa/A01202033/2011 H1N1
N86D K130R K146R E155G
T186A N196D P271S
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A/swine/Iowa/A01049773/2011 H1N1
A71S N86D A139D
V173I T186A I214V
A/swine/Minnesota/A01442408/2012 H1N1
A/Wisconsin/28/2011 H1N1v
E127D P271S
T72A S74N T186D Q189R
A/swine/North Carolina/A01840320/2015 H1N1
A/swine/North Carolina/A01476810/2014 H1N1
K130R K146R E155G
I163K N196D T278N
S157L
A/swine/North Carolina/A01409181/2013 H1N1
V47I E68G S74N V152I T216I I324V
A/swine/Oklahoma/A01555399/2015 H1N1
A/swine/Oklahoma/A01410541/2014 H1N1
A71S T186A
A/swine/Minnesota/A01049218/2010 H1N1
A/Iowa/02/2009 H1N1v
K2T I3L K36R S84N K113R
T166I R169K G170E P183S
S197A G222D E269D
A/swine/Kansas/77778/2007 H1N1
A/swine/Ohio/02026/2008 H1N1
A/Ohio/01/2007 H1N1v
A71S N86D E127D K130R
K146R E155G I163K
T186A N196D P271S
A/Illinois/09/2007 H1N1
A/Ohio/02/2007 H1N1v
A/swine/Illinois/A01462632/2015 H1N2
A/swine/South Dakota/A01480750/2014 H1N1
P271S
A/swine/North Carolina/A01432882/2013 H1N1
I3L N35D R169K A178G
N196D S197A R208K E211K
E269D D276N V298I
R169K G222D
A/swine/North Carolina/A01409950/2014 H1N1
A/Ohio/09/2015 H1N1v
T72R E155G
A/swine/North Carolina/A01840545/2015 H1N1
A/Wisconsin/87/2005 H1N1v
A/swine/Minnesota/1192/2001 H1N2
A/swine/Iowa/A01410990/2014 H1N1
S121N Q189R
X223Q
A/swine/Japan/KU-YG5/2013 H1N1
A/swine/Iowa/A01049578/2011 A / H1N1
E21K R45K G155E S162I
S185N K211R I216R M257V
T72A P83S K142R X222D
A/swine/Minnesota/A01941706/2015 A / H1N1
A/swine/Minnesota/A01941304/2015 A / H1N1
S203T
A/swine/Taiwan/NPUST0005/2013 H1N2
X222N
A/swine/Korea/CY01-06/2012 H1N1
A/swine/Minnesota/A01049428/2011 A / H1N1
A/swine/Illinois/A01049574/2011 A / H1N1
A/swine/Indiana/A01260972/2015 A / H1N1
S203T I322V
A/swine/Togo/ONA32/2013 H1N1
A/Stavropol/3/2015 A / H1N1
A/Khabarovsk/RII07/2016 A / H1N1
A/New Hampshire/06/2016 A / H1N1
A/swine/Manitoba/D0455/2016 A / H1N1
A/Idaho/09/2016 A / H1N1
S84N
S162N
I216T
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P83S X222D
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K163Q A256T
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D97N
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A/Moscow/SEC-06/2016 A / H1N1
A/Fujian-Tongan/SWL153/2016 A / H1N1
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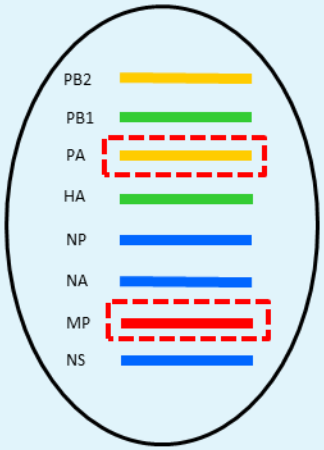
A/swine/Oklahoma/A01476227/2014 A / H1N1
A/swine/Kansas/A01377310/2014 H1N1
A/swine/Nebraska/A01509523/2014 H1N1
gamma
pdm09

A/Missouri/12/2012
H1N1v - delta



A/Arkansas/14/2013
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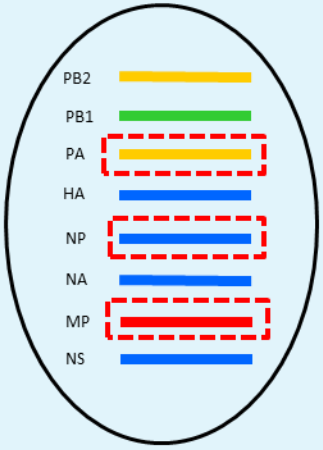
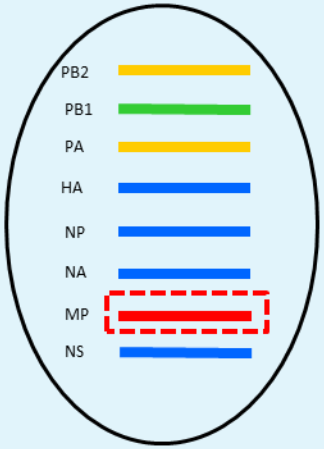
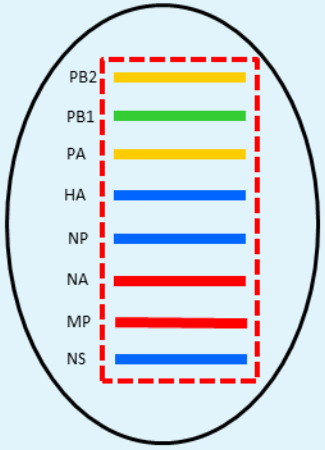
H1N1v - gamma



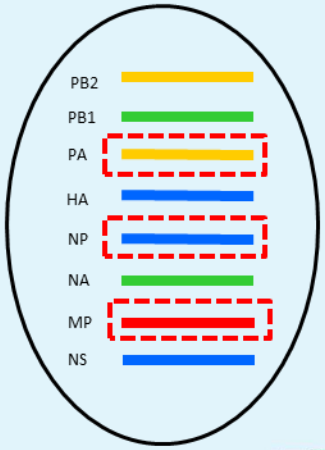
A/Minnesota/33/2014
A/Ohio/09/2015
H1N1v - gamma



2009 Pandemic H1N1



A/Minnesota/45/2016
A/Ohio/24/2017
H1N2v - alpha



A/Wisconsin/71/2016
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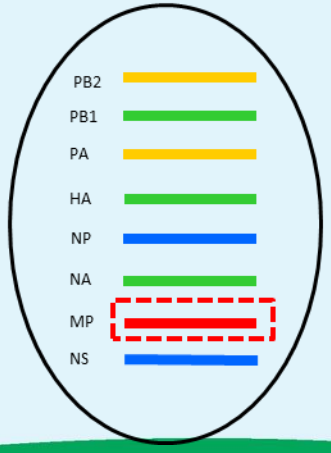
A/Iowa/32/2016
H1N2v – delta 1



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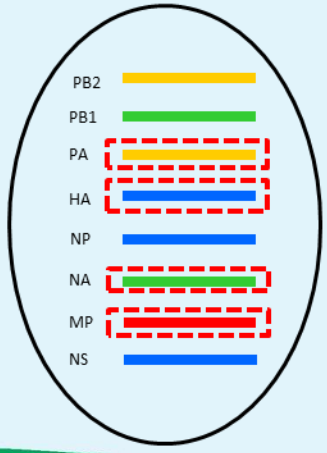

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						seasonal H1N1	pdm09 H1N1	pdm09 H1N1	H1N1v (gamma)	H1N2v (delta1)	H1N2v (delta1)	2016/2017 vaccinees	2016/2017 vaccinees
						2009-165	2009-172	2017-094	2010-132	2015-168	2016-106		
REFERENCE ANTIGENS		**Lineage**	**STRAIN DESIGNATION**	**CDC ID#**	**Date of collection**	**Bris/07**	**CA/179**	**MI/45**	**Ohio/9**	**MN/19**	**Wis/71**	**Child pool**	**Adult pool**
1	AU	seasonal H1N1	A/Brisbane/59/2007	2008704388	7/1/2007	**320**	<10	<10	320	320	320	320	80
2	NY	pdm09	A/California/7/09 X-179	2009713113	Reassortant	<10	**160**	160	160	<10	20	320	320
3	MI	pdm09	A/Michigan/45/2015	3000413713	9/7/2015	<10	1280	**5120**	80	<10	80	80	640
4	GA	H1N1v (gamma)	A/Ohio/9/2015 CVV RG48A (155E)	3000411138	Reassortant	<10	<10	<10	**5120**	<10	<10	10	320
5	MN	H1N2v (delta1)	A/Minnesota/19/2011	2012701623	11/4/2011	40	<10	<10	10	**640**	640	20	80
6	WI	H1N2v (delta1)	A/Wisconsin/71/2016	3000414182	6/9/2016	<10	<10	<10	20	320	**5120**	80	80
TEST ANTIGENS													
7	IA	H1N1v(gamma pdm09)	A/Iowa/33/2017	3025631276	10/22/2017	<10	640	5120	160	<10	10	40	640

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