Zoonotic/Variant Virus Updates

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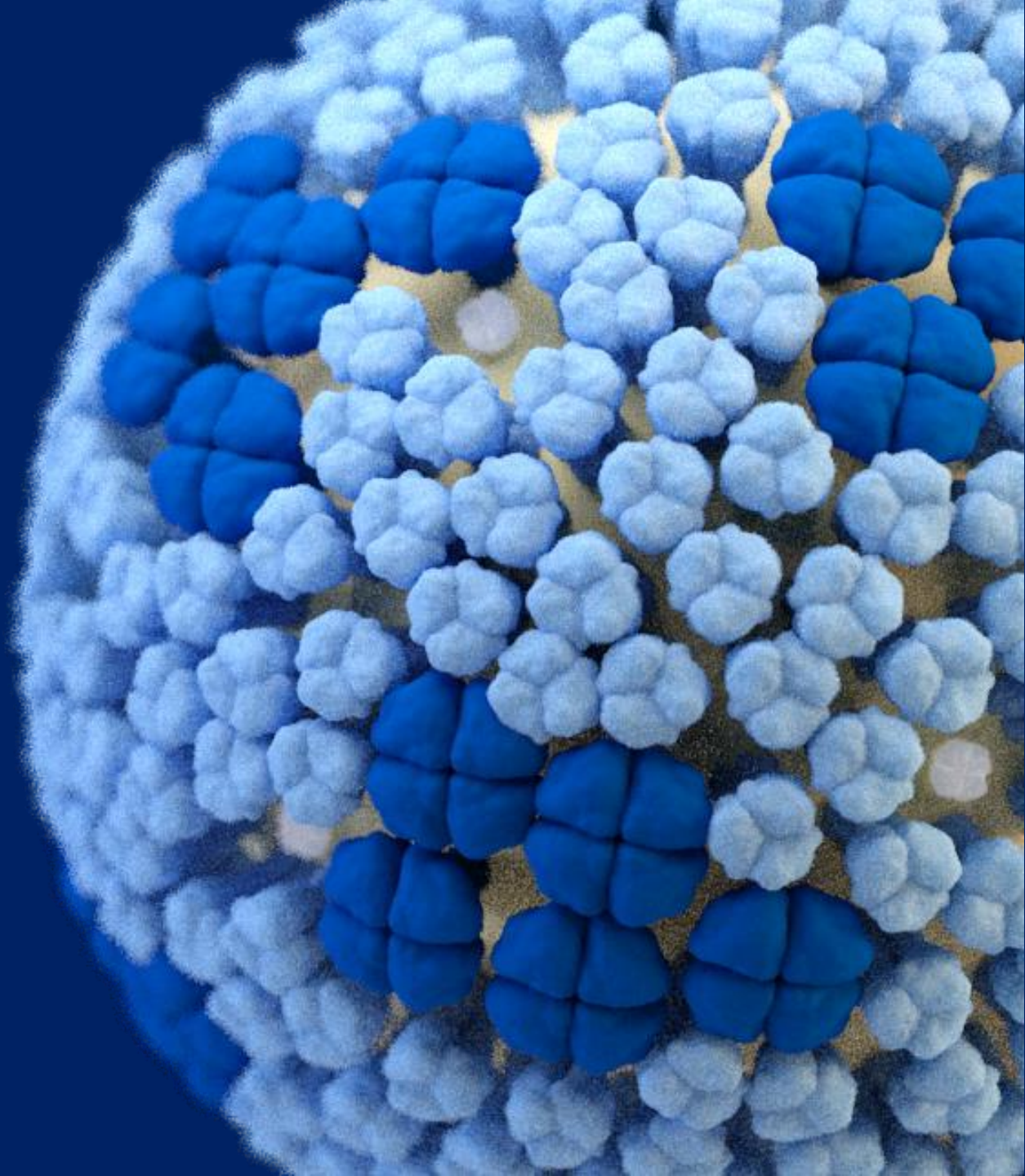


CDC Influenza

Influenza A(H1)v

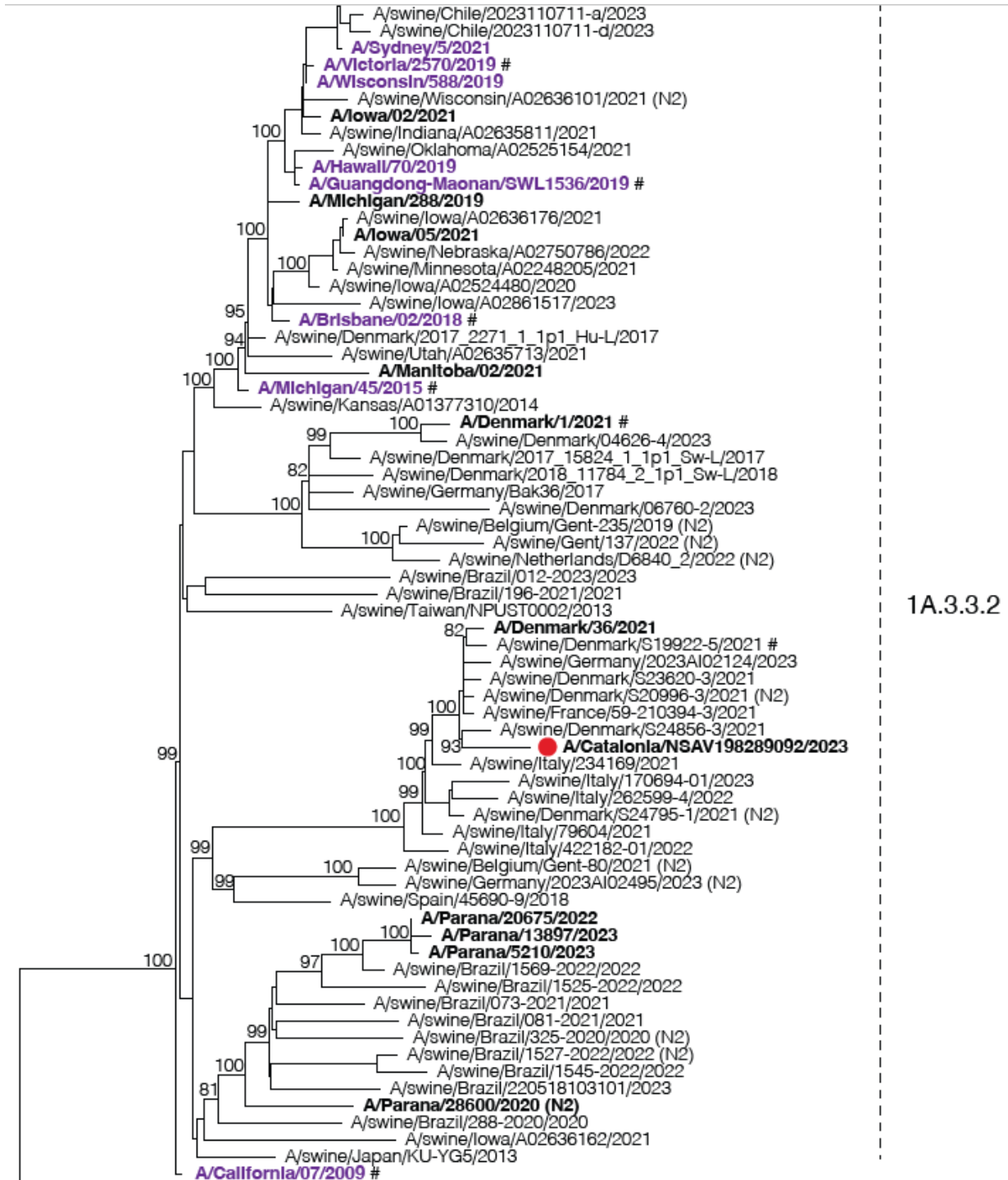
CDC Influenza

Human infections Sept 23 – Feb 24

Subtype (clade)	Country reporting	Cases	Clinical severity	Exposure	Age
H1N1v (1A.3.3.2)	Brazil Spain	1 1	Severe Mild	None reported Swine exposed	49 33
H1N1v (1C.2.2)	Switzerland	1	Mild	Swine exposed	unknown
H1N2v (1B.1.1.1)	United Kingdom	1	Mild	None reported	80

CDC Influenza

A(H1N1)v human infections



CDC Influenza

A(H1N1)v human infections

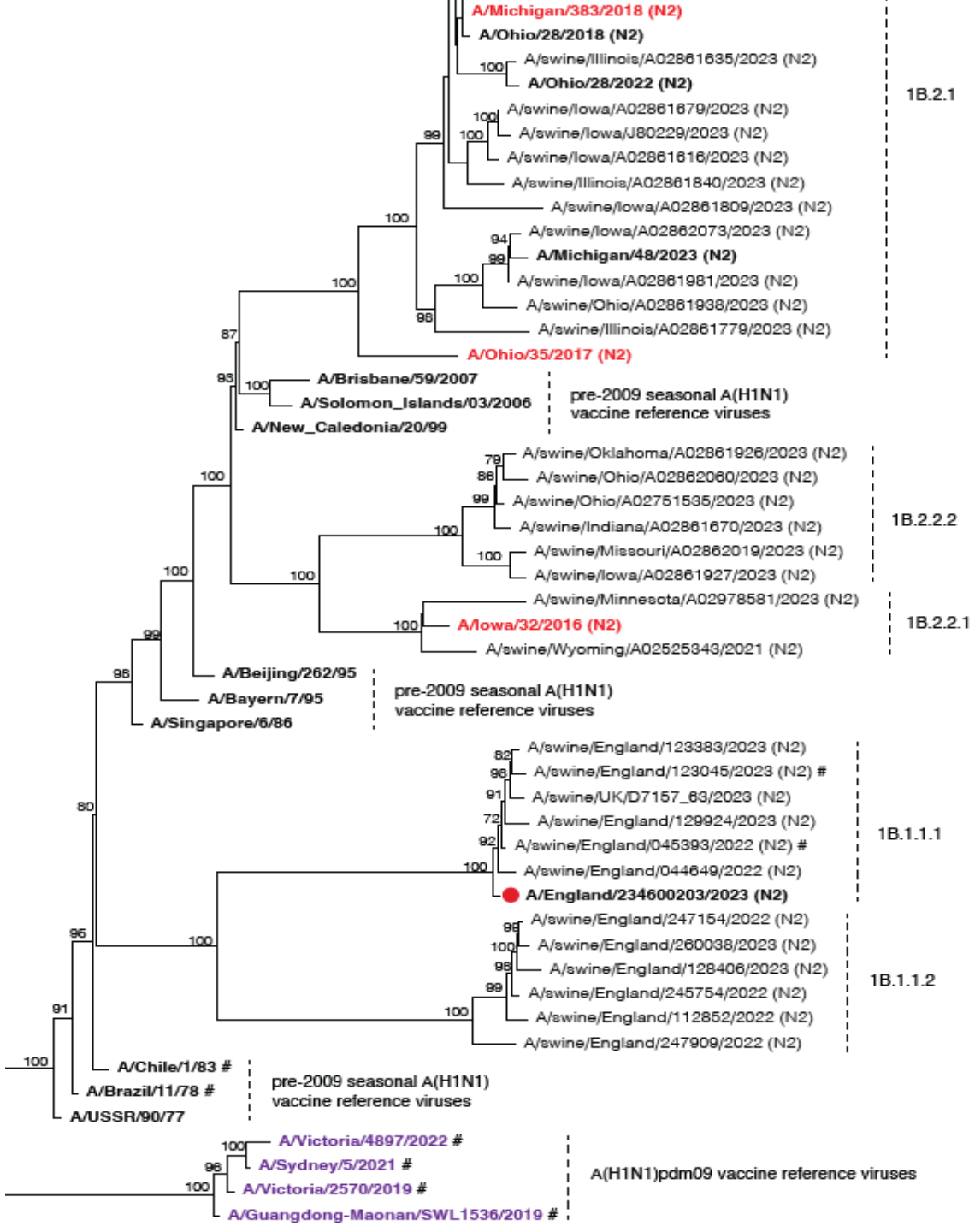
Table 5. Haemagglutination inhibition assay of A(H1N1)pdm09 viruses and a clade 1A.3.3.2 A(H1N1)v virus

		Post-infection ferret antisera				
Reference antigens	Clade	A/Cal	A/Mich	A/Bris	A/G-M	A/Vict
A/California/7/2009		**320**	1280	640	1280	80
A/Michigan/45/2015	6B.1	1280	**2560**	1280	2560	80
A/Brisbane/02/2018	6B.1A.1	1280	2560	**1280**	2560	80
A/Guangdong-Maonan/SWL1536/2019	6B.1A.5A.1	320	2560	1280	**2560**	80
A/Victoria/2570/2019 (IVR-215)	6B.1A.5A.2	<40	40	<40	80	**1280**
Test antigen						
A/Denmark/1/2021	1A.3.3.2	<40	<40	<40	<40	<40
A/swine/Denmark/S19922-5/2021	1A.3.3.2	<40	<40	<40	<40	<40

Recommendation: an A/Catalonia/NSAV198289092/2023-like CVV

CDC Influenza

A(H1N2)v human infections



CDC Influenza

A(H1N2)v human infections

Table 6. Haemagglutination inhibition assay of A(H1) viruses and clade 1B.1.1.1 A(H1N2) viruses

		Post-infection ferret antisera						Human adult
Reference antigens	Clade	Vic/19	A/Syd	Vict/22	A/G-M	A/Ch	A/Bra	serum pool
A/Victoria/2570/2019	5a.2	**5120**	2560	2560	160	40	40	320
A/Sydney/5/2021	6B.1A.5a.2a	5120	**5120**	5120	160	160	40	80
A/Victoria/4897/2022	5a.2a.1	5120	5120	**5120**	<40	<40	<40	40
A/Guangdong-Maonan/SWL1536/2019	5a.1	160	80	<40	**2560**	<40	<40	320
A/Chile/1/83		<40	<40	<40	<40	**40**	<40	<40
A/Brazil/11/78		<40	<40	<40	<40	10	**160**	<40
Test antigens								
A/swine/England/045393/2022	1B.1.1.1	<40	<40	<40	<40	<40	<40	<40
A/swine/England/123045/2023	1B.1.1.1	<40	<40	<40	<40	<40	<40	<40

Recommendation: an A/England/234600203/2023-like CVV

CDC Influenza

Human infections from Feb 2023 to Sept 2023

Subtype (clade)	Country reporting	Cases	Clinical severity	Exposure	Age
H1N1v (1A.3.3.2)	Brazil	1	Fatal	Swine exposed	42
H1N1v (1C.2.2)	Netherlands	1	Mild	None reported	>18
H1N2v (1A.1.4)	Taiwan, China	1	Mild	Swine exposed	16
H1N2v (1B.2.1)	USA	2	Mild	Swine exposed	15, 15

CDC Influenza

Influenza A(H1)v virus activity in humans Sept 22 – Feb 23

Subtype / clade	Country	Jurisdiction	Illness Onset	Age	Gender	Exposure	Severity	Outcome
H1N1v / 1A.3.3.2	Brazil	Parana	2022	NR	NR	Swine	Mild	Recovered
H1N1v / 1C.2.3	China	Sichuan	04.01.2023	3	F		Mild	Recovered
H1N1v / 1C.2.3		Jiangsu	30.01.2023	1	F		Mild	Recovered
H1N2v / 1C.2.2	Netherlands	Limburg	2022	26	F	Swine	Mild	Recovered
H1N2v / 1C.2.5	Taiwan	Taiwan	24.09.2022	7	F	Swine	Mild	Recovered
H1N1v / 1C.2.6	Spain	Navarra	14.10.2022	63	F	Swine	Mild	Recovered

Influenza A(H1) swine virus clade distribution

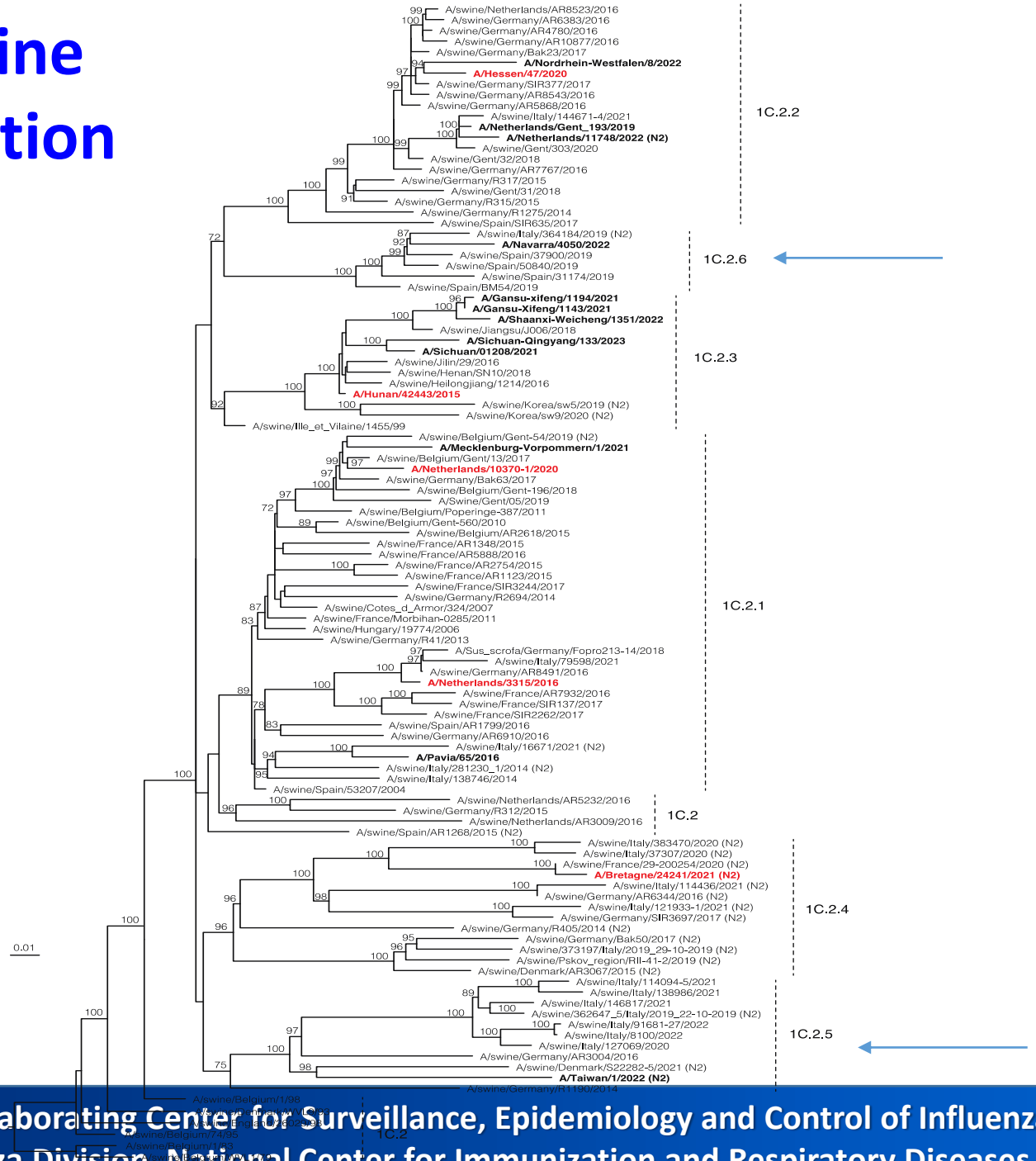
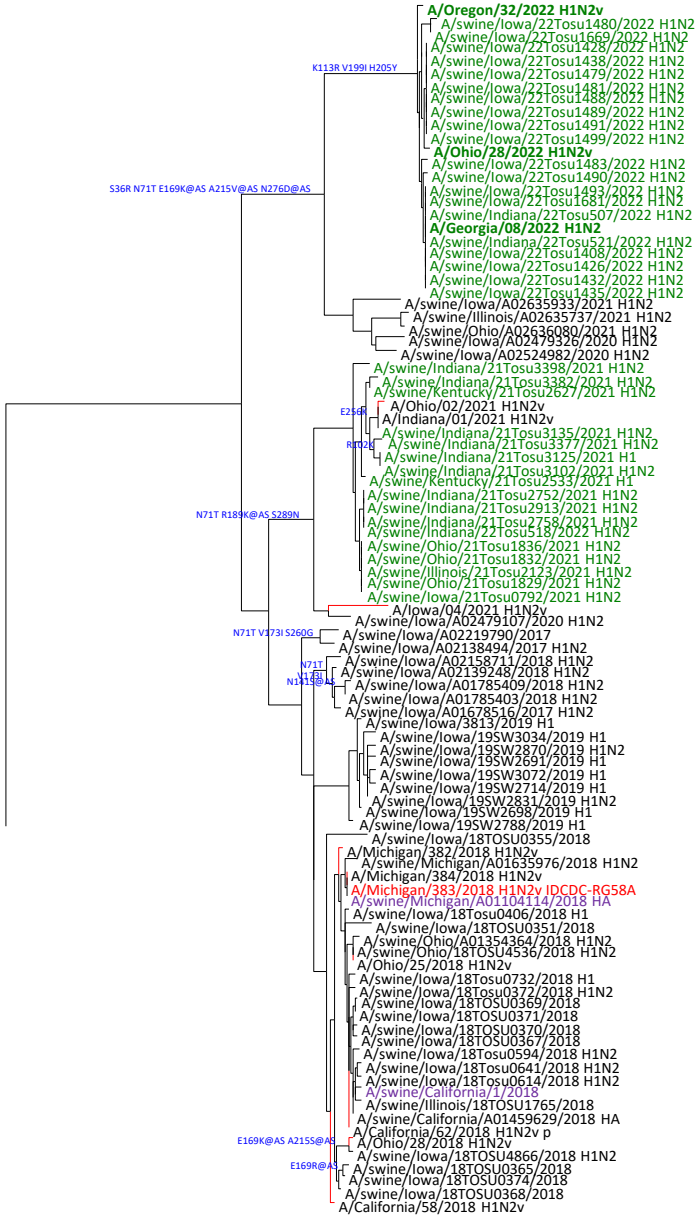


Figure 2. Phylogenetic relationships of influenza A(H1)v HA genes of 1C clades. CVVs that are available or in

A(H1)v activity in humans from Feb 22 - Sept 22

Country	WHO case #	Subtype	State	Age (yrs)	Sex	Onset date	Exposure	Confirmed/ Reported	Isolate available at CDC	HI test (date)	Strain name
Germany	1	H1N1v (1C.2.2)	North-Rhine-Westphalia	>18	M	21-Mar-2022	No exposure reported	Robert Koch Institute	no	no	A/Nordrhein-Westfalen/8/2022
Denmark	2	H1N1v (1A.3.3.2) pdm09	?	?	?	23-Nov-2021	Exposure to swine	IHR National Focal Point, Denmark	no	no	A/Denmark/36/2021
China	1	H1N1v (1C.2.3)	Shaanxi	6	F	08-April-2022	Exposure to swine	IHR National Focal Point, China	no	no	A/Shaanxi/1351/2022
USA	1	H1N2v (1A.1.1)	California	>18	M	27-Dec-2021	Exposure to swine	CDC, USA	Yes	Yes	A/California/71/2021
	2	H1N2v (1B.2.1)	Oregon	<18	M	28-July-2022	No exposure reported		Yes	Yes	A/Oregon/32/2022
	3	H1N2v (1B.2.1)	Ohio	<18	F	13-Aug-2022	Exposure to swine		yes	Yes	A/Ohio/28/2022
	4	H1N2v (1A.1.1)	Michigan	<18	F	17-Aug-2022	Exposure to swine		yes	pending	A/Michigan/42/2022
	5	H1N2v (1A.3.3.2)	Wisconsin	<18	F	24-Aug-2022	Exposure to swine		No	no	A/Wisconsin/51/2022
	6	H1N2v (1B.2.1)	Georgia	<18	F	1-Sept-2022	Unknown		No	no	A/Georgia/08/2022

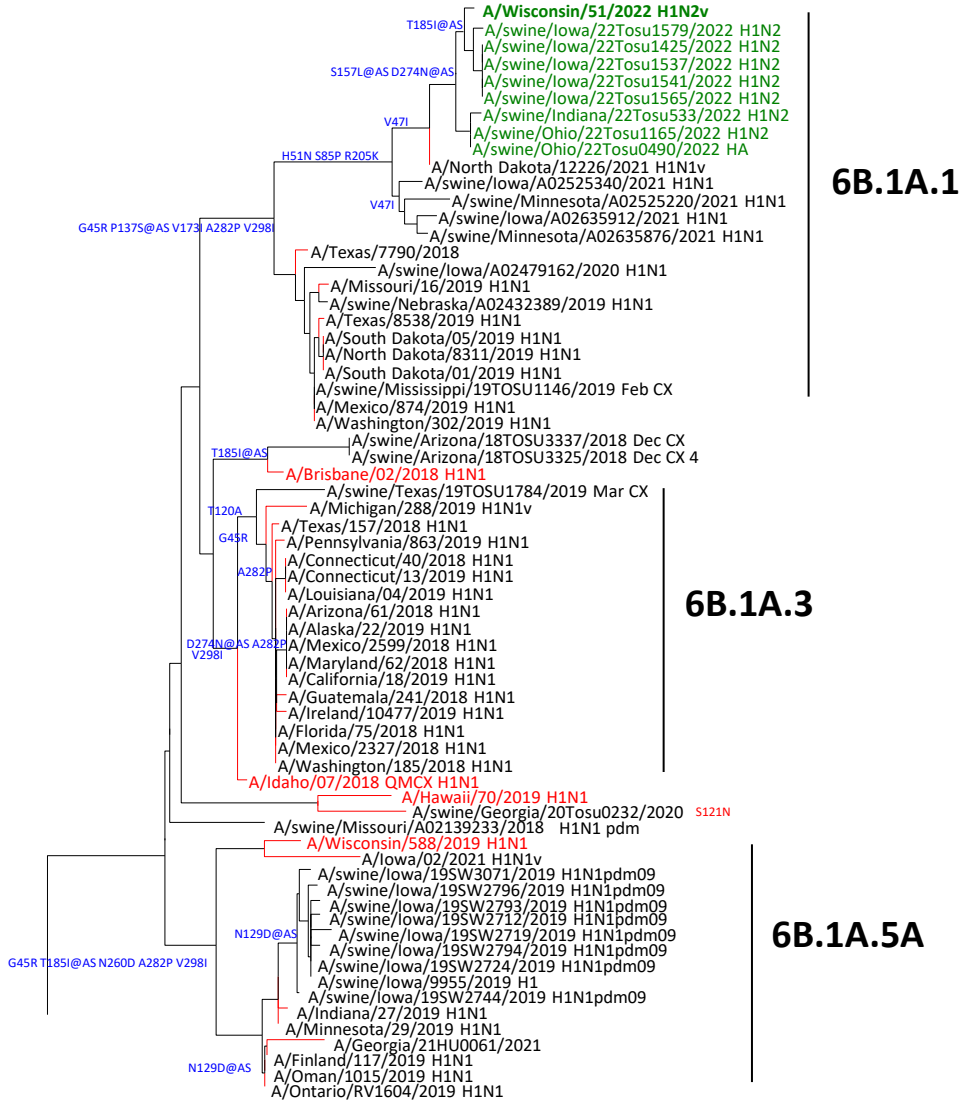
Evolutionary Relationships Among Influenza A(H1)v and swine viruses; 1B.2.1 (Delta 2)



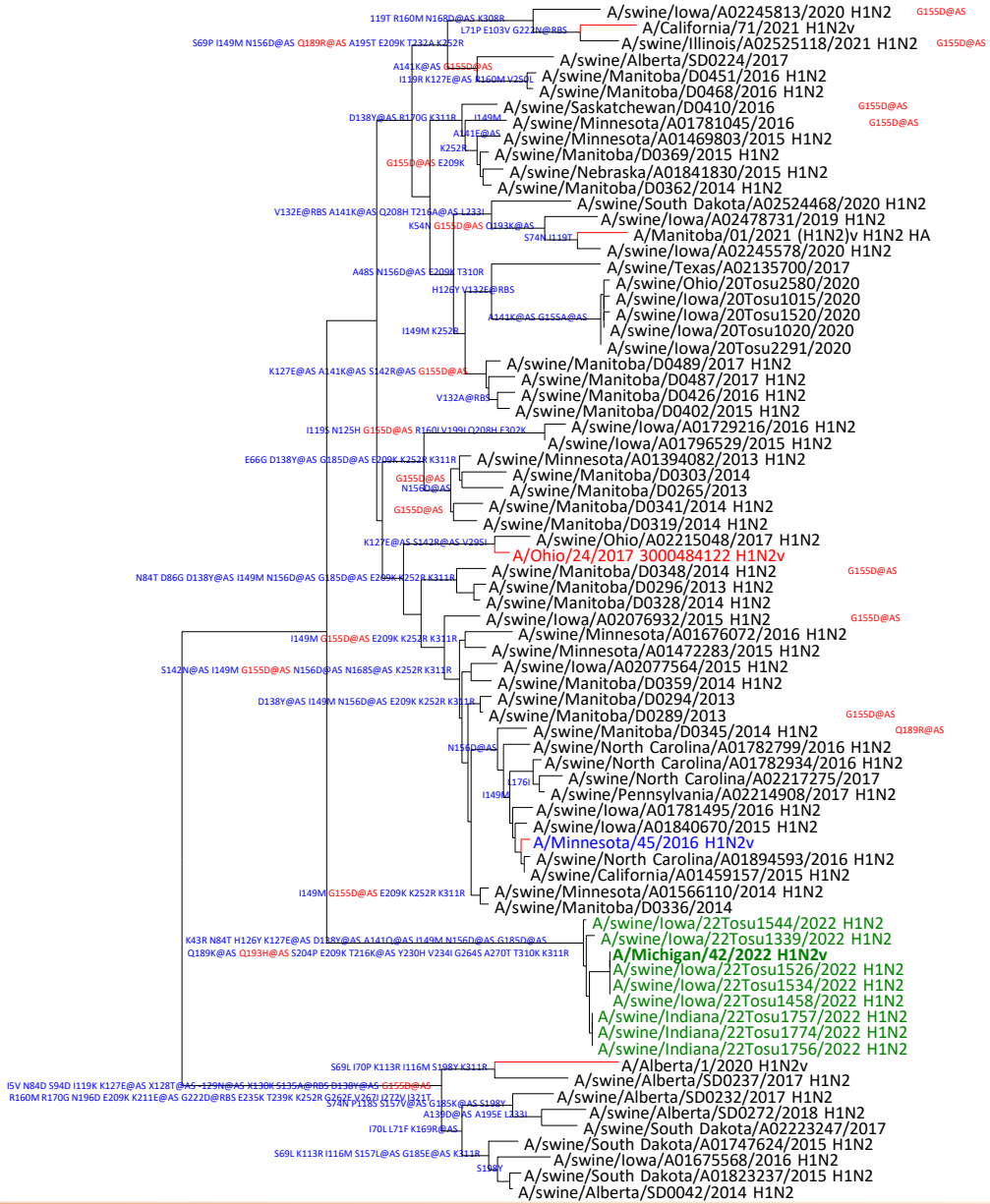
Antigenic properties of A(H1)v viruses

	REFERENCE ANTIGENS	Subtype	Lineage	Victoria/ 2579	Bris/02	MI/45	CA/71	OH/35	MI/383	RG58A	Adult *	Child^	Passage	Collected
1	A/Victoria/2570/2019	H1N1pdm09	seasonal	**5120**	2560	2560	80	320	2560	640	**5120**	**320**	E4/E3 (2/10/22)	11/22/2019
2	A/Brisbane/02/2018	H1N1pdm09	seasonal	80	**5120**	5120	<10	<10	<10	<10	2560	160	E3/E3 (6/12/19)	1/4/2018
3	A/Michigan/45/2015	H1N1pdm09	seasonal	160	2560	**5120**	<10	<10	<10	<10	5120	160	QMC2C4 (2/6/20)	9/7/2015
4	A/California/71/2021	H1N2v	1A.1.1 (Alpha)	<10	<10	<10	**5120**	<10	<10	<10	40	10	S1 (1/26/21)	12/27/2021
5	A/Ohio/35/2017	H1N2v	1B.2.1 (Delta 2)	<10	<10	<10	10	**2560**	320	10	40	<10	C2 (12/6/18)	8/17/2017
6	A/Michigan/383/2018	H1N2v	1B.2.1 (Delta 2)	<10	<10	<10	<10	320	**640**	80	20	<10	E2 (2/3/22)	7/31/2018
7	A/Michigan/383/2018 IDCDC-RG58A	H1N2v	1B.2.1 (Delta 2)	<10	<10	<10	<10	320	320	**80**	20	<10	V1E3 (11/29/18)	Reassortant
	TEST ANTIGENS													
8	A/Oregon/32/2022	H1N2v	1B.2.1 (Delta 2)	<10	<10	<10	<10	160	640	40	10	<10	C1(8/21/2022)	7/29/2022
9	A/Ohio/28/2022	H1N2v	1B.2.1 (Delta 2)	<10	<10	<10	<10	160	320	40	10	<10	C1(9/5/2022)	8/13/2022

Evolutionary Relationships Among Influenza A(H1)v and swine viruses, 1A.3.3.2 (pdm09-like)



Evolutionary Relationships Among Influenza A(H1)v and swine viruses, 1A.1.1 (alpha)



CVV development – H1v

H1v candidate vaccine viruses	
IDCDC-RG48A (A/Ohio/09/2015-like) H1N1v	Gamma (1A.3.3.3)
CNIC-1601 (A/Hunan/42443/2015) H1N1v	Eurasian avian (1C.2.3)
IDCDC-RG58A (A/Michigan/383/2018-like) H1N2v	Delta 2 (1B.2.1)
IDCDC-RG59 (A/Ohio/24/2017-like) H1N2v	Alpha (1A.1.1)
IDCDC-RG76A (A/Wisconsin/03/2021-like) H1N1v	Gamma (1A.3.3.3)
IDCDC-RG72A (A/Iowa/32/2016-like) H1N2v	Delta 1 (1B.2.2) (pending)
MHRA A/Netherlands/3315/2016 H1N1v	Eurasian avian (1C.2.1) (pending)
MHRA A/Ohio/35/2017-like H1N2v	Delta 2 (1B.2.1) (pending)
MHRA A/Hessen/47/2020-like H1N1v	Eurasian avian (1C.2.2) (pending)
MHRA A/Netherlands/10370-1b/2020 H1N1v	Eurasian avian (1C.2.1) (pending)
SJ A/Bretagne/24241/2021 H1N1v	Eurasian avian (1C.2.4) (pending)
IDCDC-RG81A (A/California/71/2021) H1N2v	Alpha (1A.1.1) (pending)
A/England/234600203/2023-like CVV	1B.1.1.1 (pending)
A/Catalonia/NSAV198289092/2023-like CVV	1A.3.3.2 (pending)

Influenza A(H3N2)v

CDC Influenza

Influenza A(H3)v virus activity in humans Feb 23 to Feb 24

H3N2v (unknown)	**USA**	**1**	**Mild**	**Swine exposed**	**11**

A(H3N2) SIV HI testing

Haemagglutination inhibition assay* of swine influenza A(H3N2) viruses

Reference Antigens	Lineage	Dar/9	Dar/6	RG60A	X-203	Adult#	Child^
A/Darwin/9/2021 (egg)	Seasonal	**1280**	640	<20	<20	1280	1280
A/Darwin/6/2021 (cell)	Seasonal	1280	**1280**	40	<20	1280	2560
IDCDC-RG60A (A/Ohio/13/2017-like)	2010.1	40	20	**2560**	<20	640	320
X-203 (A/Minnesota/11/2010-like)	1990.4.a	80	40	<20	**2560**	160	<20
Test antigens							
A/swine/Iowa/22Tosu3985/2022	2010.1	80	40	1280	<20	640	320
A/swine/Ohio/23Tosu0496/2023	2010.1	80	80	1280	<20	1280	640
A/swine/Iowa/23TOSU0845/2023	1990.4.a	<20	<20	80	320	320	20
A/swine/Iowa/23TOSU0850/2023	1990.4.a	<20	<20	40	320	320	20
A/swine/Iowa/23TOSU1494/2023	1990.4.a	<20	<20	80	320	320	20

Recommendation: an A/swine/Iowa/23TOSU0850/2023 -like CVV

CDC Influenza

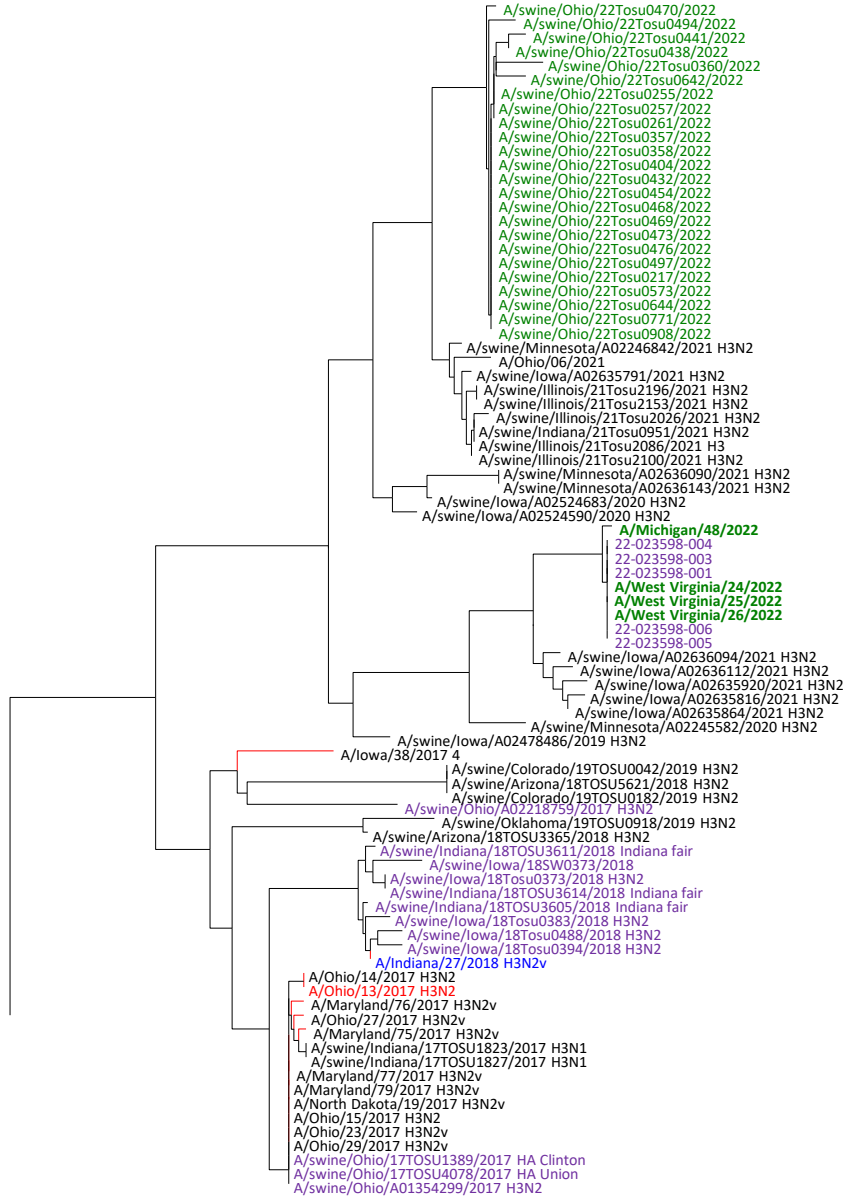
Influenza A(H3)v virus activity in humans Sept 22 – Feb 23

Subtype / clade	Country	Jurisdiction	Illness Onset	Age	Gender	Exposure	Severity	Outcome
H3N2v / 2010.1	USA	New Mexico	2022	<18	NR	Swine	Mild	Recovered

A(H3)v activity in humans from Feb 22-Sept 22

Country	Subtype	State	Age	Sex	Onset Date	Exposure	Confirmed / reported	Isolate available	HI test (date)	Strain Designation
USA	H3N2v (2010.1)	WV	<18	F	29-July-2022	Exposure to swine	CDC, USA	S1 (8/8/2022)	8-16-2022	A/West Virginia/24/2022 3003597120
	H3N2v (2010.1)	WV	<18	M	01-Aug-2022			S1 (8/8/2022)	8-16-2022	A/West Virginia/25/2022 3003597154
	H3N2v (2010.1)	WV	<18	M	01-Aug-2022			S1 (8/12/2022)	8-16-2022	A/West Virginia/26/2022 3003597187
	H3N2v (2010.1)	MI	<18	M	06-Sep-2022			VNR	N/A	A/Michigan/48/2022

Evolutionary Relationships Among Influenza A(H3)v and swine viruses, 2010.1 (human-like)



Antigenic properties of A(H3)v viruses

	REFERENCE ANTIGENS	Lineage	Seas Tas/503/20	IV-A MN/11/10	IV-A MN X203	2010.1 OH/27/16	2010.1 IDCDC-RG55C	2010.1 IDCDC-RG60A	MN X-203 Adult Strong Responder	Adult	Child	PASSAGE	Date Collected
1	A/Tasmania/503/2020	Seasonal	**640**	<20	<20	20	20	40	80	**320**	**160**	S2/S2(12/22/21)	2/16/2020
2	A/Minnesota/11/2010	IV-A	80	**1280**	5120	<20	80	40	1280	320	160	E2(7/22/13)	11/26/2010
3	A/Minnesota/11/2010 X-203	IV-A	160	1280	**5120**	40	160	160	**1280**	320	160	EX/E1 (2/25/11)	Reassortant
4	A/Ohio/27/2016	2010.1	<20	<20	<20	**5120**	2560	320	320	320	80	C1S2 (10/3/16)	7/31/2016
5	IDCDC-RG55C (A/Ohio/28/2016-like)	2010.1	<20	<20	<20	5120	**2560**	640	160	320	160	V1E3 (5/25/17)	Reassortant
6	IDCDC-RG60A (A/Ohio/13/2017-like)	2010.1	<20	40	<20	640	320	**2560**	640	640	320	V1E3(2/19/21)	Reassortant
TEST ANTIGENS													
7	A/West Virginia/24/2022	2010.1	<20	<20	<20	320	80	640	160	160	80	S1 (8/8/2022)	8/1/2022
8	A/West Virginia/25/2023	2010.1	<20	20	<20	320	80	640	320	320	160	S1 (8/8/2022)	8/3/2022
9	A/West Virginia/26/2023	2010.1	<20	40	<20	320	160	640	320	320	160	S1 (8/12/2022)	8/4/2022

CVV development – H3v

H3N2v candidate vaccine viruses	
NYMC X-203, A/Minnesota/11/2010	North American (1990.4.a)
NYMC X-213, A/Indiana/10/2011	North American (1990.4.a)
IDCDC-RG55C, (A/Ohio/28/2016-like)	North American (2010.1)
IDCDC-RG74A, (A/Ohio/13/2017-like)	North American (2010.1) (pending)
IDCDC-RG, (A/swine/Iowa/23TOSU0850/2023-like)	North American (1990.4.a) (pending)

Links

Genetic and antigenic characteristics of zoonotic influenza A viruses and development of candidate vaccine viruses for pandemic preparedness. February 2024
202402_zoonotic_vaccinvirusupdate.pdf (who.int)

Zoonotic influenza: candidate vaccine viruses and potency testing reagents
Global Influenza Programme (who.int)

A(H3N2) variant - Northern hemisphere 2024-2025

A(H1) variant - Northern hemisphere 2024-2025

CDC Influenza

Questions?