

S2 Table. Amino acid substitutions at the HA antigenic sites in avian, human*, and pandemic H1N1 IAVs

Year isolated	Antigenic Site	Amino Acid Position and Substitutions												
		141	142	170	171	172	173	174	176	177	178	179	180	181
	Sa	141	142	170	171	172	173	174	176	177	178	179	180	181
1918		P	N	K	K	G	S	S	P	K	L	S	K	S
1934		P	N	E	K	E	G	S	P	K	L	K	N	S
1942		P	K	E	K	D	G	S	P	N	L	N	N	S
1950		P	K	E	K	N	G	S	P	N	L	K	K	S
1977		P	K	E	K	N	G	S	P	N	L	S	K	S
1986		P	N	K	K	N	G	S	P	N	L	S	K	S
1991		P	N	K	K	N	G	L	P	N	V	S	K	S
1998		P	N	E	K	N	G	L	P	N	L	S	K	S
2007		P	N	G	K	N	G	L	P	N	L	S	K	S
2009		P	N	K	K	G	N	S	P	K	L	S	K	S
Char		P	N	K	K	G	N	S	P	K	I	S	K	S
Anser		P	N	K	K	G	T/N	S	P	K	L	S	K	S

	Ca	154	155	156	157	158 [†]	159	183	184	185	186	187	220	221	222	238	239	252	253	254
1918		S	Y	A	G	A	S	V	N	N	K	G	S	S	K	R	D	E	P	G
1934		S	H	E	G	K	S	V	N	K	K	G	T	S	N	R	D	K	P	G
1942		S	H	A	G	K	C	V	N	K	K	G	S	S	N	R	G	E	P	G
1950		S	H	K	G	K	S	V	N	N	K	E	S	S	N	R	G	E	P	G
1977		S	H	K	G	K	S	V	N	N	K	E	S	S	N	R	G	E	P	G
1986		S	H	K	G	R	S	V	N	N	K	E	S	S	H	R	D	E	P	G
1991		S	H	N	G	K	S	V	N	N	K	E	S	S	H	R	D	E	P	G
1998		S	H	N	G	K	S	V	N	N	K	E	S	S	H	R	D	E	P	G
2007		S	H	N	G	E	S	A	N	N	K	E	S	S	H	R	D	E	P	G
2009		P	H	A	G	A	K	I	N	D	K	G	S	S	R	R	D	E	P	G
Char		P	Y	S	G	V	S	T	N	N	K	G	S	S	K	R	G	D	Q	G
Answer		S	Y	S	G	A	S	T	N	N	K	G	S	S	K	R	G	D	Q	G

	Sb	201	202	203	204	205	206	207	208	209	210	211	212 [†]
1918		T	G	T	D	Q	Q	S	L	Y	Q	N	A
1934		N	S	K	E	Q	Q	N	I	Y	Q	N	E
1942		N	I	K	D	Q	Q	T	L	Y	Q	K	E
1950		N	I	E	D	Q	K	T	L	Y	R	K	E
1977		N	I	E	D	Q	K	T	I	Y	R	K	E
1986		N	I	G	D	Q	R	A	I	Y	H	T	E
1991		N	I	G	D	Q	R	A	I	Y	H	T	E
1998		N	I	G	D	Q	R	A	I	Y	H	T	E
2007		N	I	G	D	Q	K	A	L	Y	H	T	E
2009		T	S	A	D	Q	Q	S	L	Y	Q	N	A
Char		T	T	S	E	Q	Q	S	L	Y	Q	N	I
Answer		T	T	S/N	E	Q	Q	S	L	Y	Q	N	T/A

	Cb	87	88	89	90	91	92
1918		L	L	T	A	S	S
1934		L	L	P	V	R	S
1942		L	L	S	E	R	S
1950		L	F	S	K	K	S
1977		L	F	S	K	K	S
1986		L	F	S	K	K	S
1991		L	F	S	K	E	S
1998		L	I	S	K	E	S
2007		L	I	S	K	E	S
2009		L	S	T	A	S	S
Char		L	L	T	A	N	S
Anser		L	L	T	A	N	S

- fully conserved
- largely conserved[#]
- 1918 & 2009 avian-like
- 1918-like only
- 2009-like only
- avian-like

*The antigenic sites seen in human viruses between 1918 and 2009 were acquired from Igarashi et al [24].

†Positions 158 in Ca and 212 in Sb are “pandemic-like only” in the H1N1 IAVs of Anseriformes origin but not in those of Charadriiformes origin (shown in light blue).

[#]Residues were considered largely conserved when the same amino acid residue observed in many isolates over the years.