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Novel correlates of protection against pandemic H1N1 influenza A virus infection

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Supplementary Materials

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Table S1. Participant characteristics, including 300 members of 88 households.

		n	%
Age	0-14 years old (mean 8 years old)	101	33.7%
	15-85 years old (mean 35 years old)	199	66.3%
Sex	Male	101	33.7%
	Female	199	66.3%
Vaccinated for the study season	Yes	10	3.3%
	No	290	96.7%
Study season	2013	102	34.0%
	2015	198	66.0%
Secondary attack rate	PCR-confirmed infection	84	28%
	Symptomatic influenza	53	17.7%

Table S2. Crude 50% and 80% protection levels for PCR confirmed infection.

	HI	Full-length HA	HA stalk	NA
All ages				
50% protective level	1:27	37	52	28
80% protective level	1:167	483	107	254
Children				
50% protective level	1:45	46	34	32
80% protective level	1:227	820	89	307
Adults				
50% protective level	1:20	53	69	22
80% protective level	1:99	483	96	142

Table S3. Crude 50% and 80% protection levels for symptomatic influenza.

	HI	Full-length HA	HA stalk	NA
All ages				
50% protective level	1:35	1:18	1:31	1:15
80% protective level	1:284	1:99	1:75	1:59
Children				
50% protective level	1:81	1:30	1:26	1:20
80% protective level	1:209	1:301	1:60	1:97
Adults				
50% protective level	1:17	1:18	1:71	1:16
80% protective level	1:77	1:101	1:88	1:23

Table S4. False discovery rates for multiple assay comparisons (combined seasons)
(n=300 individuals).

False discovery rates (FDR) were calculated using the two-stage step-up method of Benjamini, Krieger and Yekutieli.

Age	Outcome	Assay	p-value	5% FDR		1% FDR	
				q-value	Discovery?	q-value	Discovery?
All ages	PCR-confirmed influenza virus infection	HI	1.210E-08	6.988E-08	Yes	9.166E-08	Yes
		Full-length HA ELISA	1.8E-11	2.079E-10	Yes	2.727E-10	Yes
		HA stalk ELISA	2.560E-06	8.778E-06	Yes	1.151E-05	Yes
		NA ELISA	0.0010	0.0012	Yes	0.0016	Yes
	Symptomatic influenza	HI	0.3964	0.2001	No	0.2625	No
		Full-length HA ELISA	0.0501	0.0413	Yes	0.0542	No
		HA stalk ELISA	0.0066	0.0076	Yes	0.0100	No

		NA ELISA	0.1232	0.0837	No	0.1098	No
Children	PCR-confirmed influenza virus infection	HI	0.0002	0.0003	Yes	0.0004	Yes
		Full-length HA	3.77E-06	8.778E-06	Yes	1.151E-05	Yes
		HA stalk	0.0002	0.0003	Yes	0.0004	Yes
		NA	0.0103	0.0099	Yes	0.0130	No
	Symptomatic influenza	HI	0.0956	0.0690	No	0.0905	No
		Full-length HA ELISA	0.2253	0.1370	No	0.1797	No
		HA stalk ELISA	0.3129	0.1807	No	0.2370	No
		NA ELISA	0.3984	0.2001	No	0.2625	No
	Adults	PCR-confirmed influenza virus infection	HI	5.25E-06	1.011E-05	Yes	1.326E-05
Full-length HA ELISA			3.8E-06	8.778E-06	Yes	1.151E-05	Yes
HA stalk			0.0080	0.0084	Yes	0.0110	No

		ELISA					
		NA ELISA	0.0135	0.0120	Yes	0.0157	No
	Symptomatic influenza	HI	0.3985	0.2001	No	0.2625	No
		Full-length HA ELISA	0.4944	0.2379	No	0.3121	No
		HA stalk ELISA	0.1763	0.1131	No	0.1484	No
		NA ELISA	0.0874	0.0673	No	0.0883	No

Table S5. False discovery rates for multiple assay comparisons (2015 season; n=198 individuals).

False discovery rates (FDR) were calculated using the two-stage step-up method of Benjamini, Krieger and Yekutieli.

Age	Outcome	Assay	p-value	5% FDR		1% FDR	
				q-value	Discovery?	q-value	Discovery?
All ages	PCR-confirmed influenza virus infection	HI	0.0001	0.0002	Yes	0.0003	Yes
		Full-length HA ELISA	5.33E-10	5.596E-09	Yes	7.537E-09	Yes
		HA stalk ELISA	1.35E-06	9.545E-06	Yes	7.088E-06	Yes
		NA ELISA	0.0013	0.0019	Yes	0.0026	Yes
	Symptomatic influenza	HI	0.8385	0.3828	No	0.5155	No
		Full-length HA ELISA	0.0154	0.0115	Yes	0.0155	No
		HA stalk ELISA	0.0028	0.0032	Yes	0.0043	Yes

		NA ELISA	0.5340	0.2607	No	0.3510	No
Children	PCR-confirmed influenza virus infection	HI	0.0037	0.0038	Yes	0.0052	Yes
		Full-length HA ELISA	9.36E-06	3.276E-05	Yes	4.412E-05	Yes
		HA stalk ELISA	2.84E-05	7.455E-05	Yes	0.0001	Yes
		NA ELISA	0.0135	0.0109	Yes	0.0146	No
		HI	0.1717	0.0995	No	0.1340	No
	Symptomatic influenza	Full-length HA ELISA	0.3622	0.1901	No	0.2560	No
		HA stalk ELISA	0.5461	0.2607	No	0.3510	No
		NA ELISA	0.9241	0.4043	No	0.5444	No
	PCR-confirmed influenza virus infection	HI	0.0023	0.0031	Yes	0.0041	Yes
		Full-length HA ELISA	4.94E-05	0.0001	Yes	0.0001	Yes

		HA stalk ELISA	0.0108	0.0099	Yes	0.0134	No
		NA ELISA	0.0113	0.0099	Yes	0.0134	No
	Symptomatic influenza	HI	0.0723	0.0475	Yes	0.0639	No
		Full-length HA ELISA	0.1222	0.0755	No	0.1016	No
		HA stalk ELISA	0.0465	0.0326	Yes	0.0438	No
		NA ELISA	0.1801	0.0995	No	0.1340	No

Table S6. False discovery rates for multiple assay comparisons
(2013 season; n=102 individuals).

False discovery rates (FDR) were calculated using the two-stage step-up method of Benjamini, Krieger and Yekutieli.

Age	Outcome	Assay	p-value	5% FDR		1% FDR	
				q-value	Discovery?	q-value	Discovery?
All ages	PCR-confirmed influenza virus infection	HI	0.0005	0.0130	Yes	0.0130	No
		Full-length HA ELISA	0.0119	0.0955	No	0.0959	No
		HA stalk ELISA	0.2871	0.5495	No	0.5516	No
		NA ELISA	0.2177	0.5259	No	0.5278	No
	Symptomatic influenza	HI	0.3136	0.5495	No	0.5516	No
		Full-length HA ELISA	0.4717	0.6702	No	0.6727	No
		HA stalk ELISA	0.9662	0.9723	No	0.9759	No
		NA ELISA	0.0453	0.2736	No	0.2746	No
	PCR-confirmed influenza virus	HI	0.0793	0.2957	No	0.2968	No
		Full-length	0.1235	0.3369	No	0.3381	No

	infection	HA ELISA					
		HA stalk ELISA	0.6757	0.7417	No	0.7445	No
		NA ELISA	0.2589	0.5495	No	0.5516	No
	Symptomatic influenza	HI	0.5770	0.6967	No	0.6993	No
		Full-length HA ELISA	0.8644	0.9076	No	0.9110	No
		HA stalk ELISA	0.6150	0.7072	No	0.7098	No
		NA ELISA	0.0857	0.2957	No	0.2968	No
	Adults	HI	0.0041	0.0491	Yes	0.0493	No
		Full-length HA ELISA	0.0668	0.2957	No	0.2968	No
		HA stalk ELISA	0.4493	0.6702	No	0.6727	No
		NA ELISA	0.5261	0.6967	No	0.6993	No
		HI	0.5601	0.6967	No	0.6993	No
	Symptomatic influenza	Full-length HA ELISA	0.1255	0.3369	No	0.3381	No
		HA stalk ELISA	0.3290	0.5495	No	0.5516	No
		NA ELISA	0.3413	0.5495	No	0.5516	No