Multivariate analysis of the effect of previous seasonal influenza vaccination on the immunogenicity of seasonal influenza vaccine after twice-annual vaccination in older adults in Hong Kong

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Background

Hong Kong is a subtropical city which experiences prolonged periods of influenza activity in most years. The northern hemisphere (NH) formulation of the seasonal inactivated influenza vaccine (IIV) is used annually each autumn. In the winter of 2014-15, emergence of a drifted non-matched influenza A(H3N2) strain led the local Centre for Health Protection to procure and administer the 2015 southern hemisphere (SH) influenza vaccine which included an updated and matching H3N2 strain. An observational study was conducted to assess the immunogenicity of the SH SIV in 2015 among older adults in Hong Kong and its effect on the immunogenicity of subsequent NH SIV in 2015-16.

Methods

We enrolled older adults aged ≥75 years who were receiving 2015 SH IIV (twice-annual vaccination group), and collected sera immediately before and 1 month after vaccination. They were followed up through to the winter of 2015-16 when they received NH IIV and again collected pre- and post-vaccination sera. For comparison we enrolled a separate group of older adults who received NH IIV in winter 2015/16 without prior receipt of the 2015 SH IIV (once-annual vaccination group). Antibody titres against vaccine strains and lineages were measured by haemagglutination inhibition (HI) assays. Multivariate log-linear regression models were fitted to explore potential factors associated with vaccine responses to NH IIV 2015/16 in both group of older adults in terms of post-vaccination antibody titres and the rises from pre-vaccination to post-vaccination.

Results

We enrolled with 419 participants in the twice-annual and 408 participants in the once-annual vaccination group. Significantly lower post-vaccination titres and titre rises against influenza A strains but higher post-vaccination titres against B/Victoria were found among older age groups (Table). Female participants showed higher post-vaccination titres and titre rises against A(H1N1). We observed blunted HI responses in participants with recent prior vaccination which varied somewhat by strain (Figure 1 and Figure 2).

Table. The association between demographic factors with (a) post-vaccination titres against each vaccine component (b) titre rises from pre-vaccination to post-vaccination against each vaccine component

(a)	Post-vaccination HI titre against			
	A(H1N1)	A(H3N2)	B/Yamagata	B/Victoria
	Estimate (95% C.I.)	Estimate (95% C.I.)	Estimate (95% C.I.)	Estimate (95% C.I.)
Age 75-79yrs	1.00	1.00	1.00	1.00
Age 80-84yrs	0.74 (0.58, 0.93)	0.88 (0.68, 1.12)	1.10 (0.91, 1.33)	1.56 (1.24, 1.97)
Age 85yrs+	0.76 (0.56, 1.02)	0.69 (0.50, 0.94)	1.30 (1.02, 1.66)	2.21 (1.65, 2.97)
Male	1.00	1.00	1.00	1.00
Female	1.39 (1.11, 1.74)	1.14 (0.90, 1.44)	1.04 (0.87, 1.25)	0.91 (0.73, 1.13)

(b)	Ratio on post-vaccination HI titre versus pre-vaccination HI titre against			
	A(H1N1)	A(H3N2)	B/Yamagata	B/Victoria
	Estimate (95% C.I.)	Estimate (95% C.I.)	Estimate (95% C.I.)	Estimate (95% C.I.)
Age 75-79yrs	1.00	1.00	1.00	1.00
Age 80-84yrs	0.88 (0.73, 1.07)	0.73 (0.60, 0.88)	0.88 (0.77, 1.01)	0.86 (0.74, 1.00)
Age 85yrs+	0.78 (0.61, 0.99)	0.76 (0.59, 0.98)	0.97 (0.81, 1.15)	1.07 (0.88, 1.30)
Male	1.00	1.00	1.00	1.00
Female	1.32 (1.10, 1.58)	1.15 (0.96, 1.38)	1.04 (0.91, 1.18)	1.09 (0.94, 1.26)

Figure 1. The association between prior vaccination with post-vaccination titres against against each vaccine component

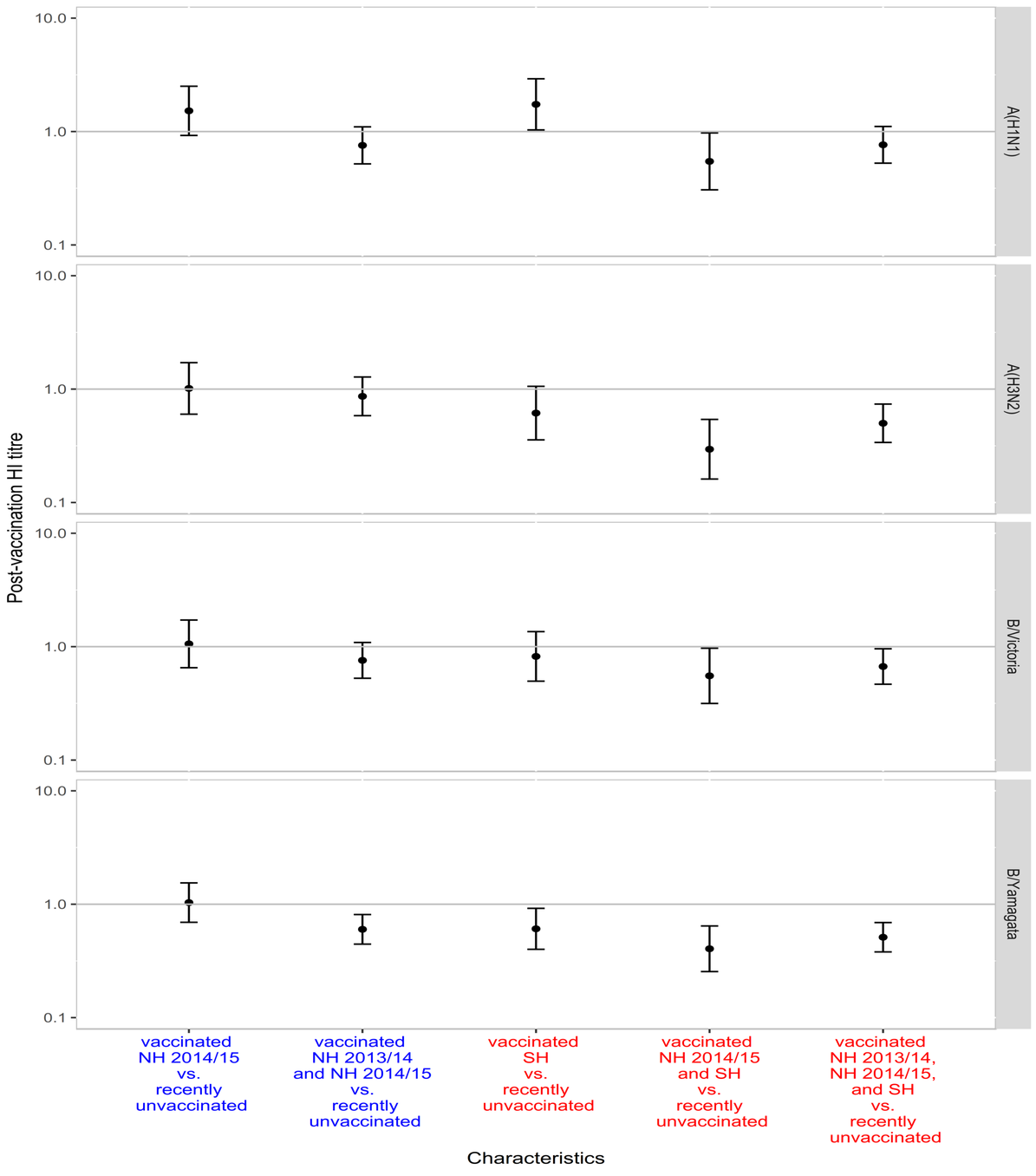
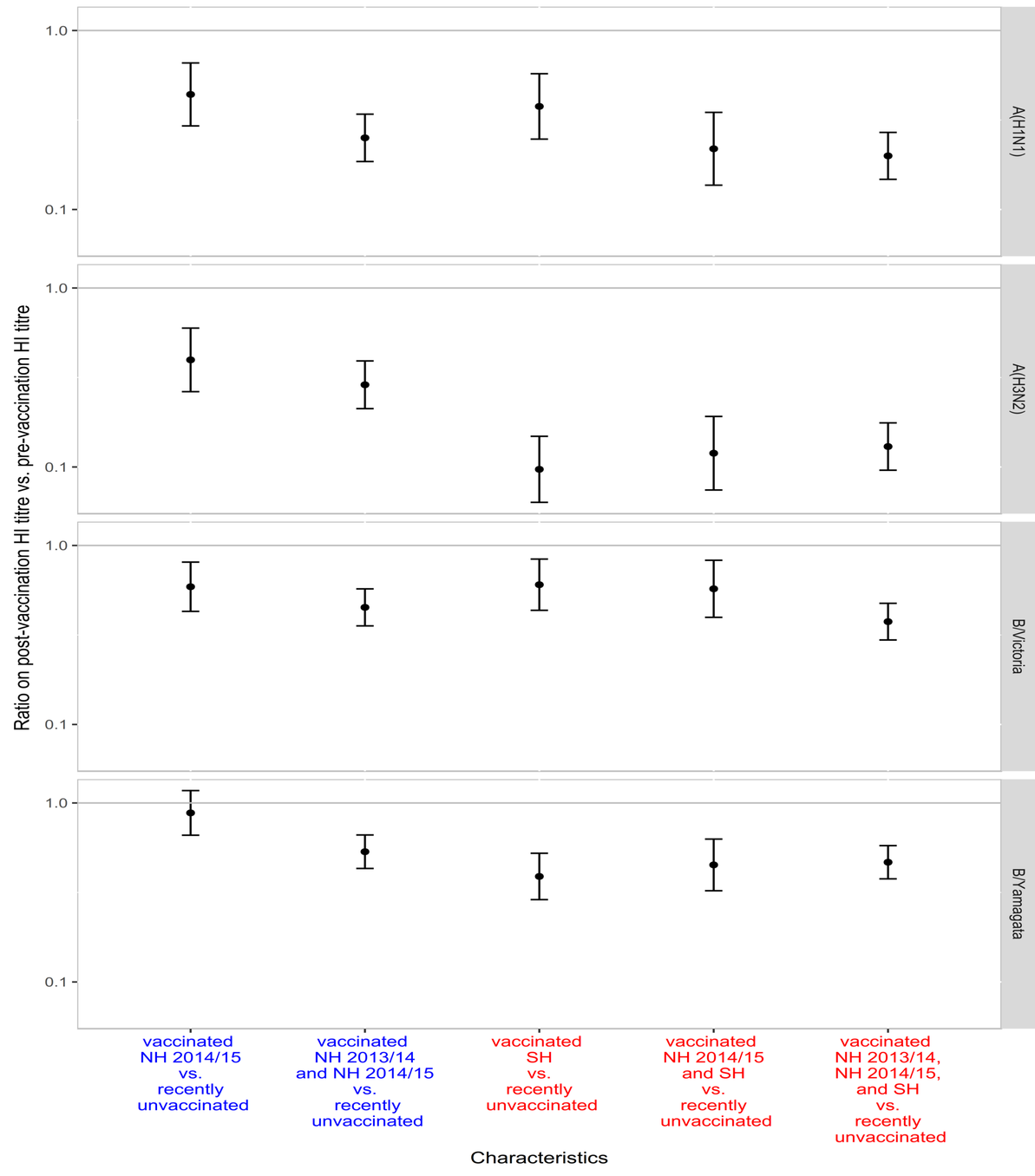


Figure 2. The association between prior vaccination with titre rises from pre-vaccination to post-vaccination against against each vaccine component



Conclusions

We observed some evidence of different humoral immune responses to NH IIV in 2015/16 between different ages, sexes, and vaccination histories. The response differences were likely to be associated with the pre-vaccination titres via previous vaccination or exposure to the virus, while different characteristics may also affect the variation in innate and adaptive immune responses among individuals.

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