

Serological response to mRNA and inactivated COVID-19 vaccine in healthcare workers in Hong Kong: preliminary results

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To the Editor—Healthcare workers (HCWs) in Hong Kong are among the priority groups to receive coronavirus disease 2019 (COVID-19) vaccination. We recruited HCWs who enrolled for COVID-19 vaccination from 22 February to 30 April 2021 for serial measurement of their anti-spike immunoglobulin M (IgM)/immunoglobulin G (IgG)/total antibody and surrogate neutralising antibody using Abbott SARS-CoV-2 IgM/IgG II Quant assay; Roche Elecsys® Anti-SARS-CoV-2 S, and GenScript cPass SARS-CoV-2 Surrogate Virus Neutralization Test Kit. The key exclusion criteria were history of polymerase chain reaction–confirmed COVID-19 or positive test for severe acute respiratory syndrome coronavirus 2–specific IgG or IgM in the serum. The

clinical trial protocol was approved by the Research Ethics Committee of Hong Kong Sanatorium and Hospital Medical Group (Ref: RC-2021-07).

Of the 457 HCWs recruited, 220 (48.1%) selected an inactivated vaccine (CoronaVac; Sinovac Life Sciences, Beijing, China) and 237 (51.9%) selected an mRNA vaccine (BNT162b2/Comirnaty; Fosun-BioNTech Pharma), based on their personal preference. The CoronaVac arm was older (mean age=49.11 vs 44.06 years; $P<0.0001$) and had a higher prevalence of having at least one medical comorbidity (31.6% vs 22.22%; $P=0.0318$) [Table 1].

At the time of writing, 210 participants have received two doses of CoronaVac and 92 have received two doses of BNT162b2. After dose 1, more BNT162b2 recipients had positive anti-spike IgG than did CoronaVac recipients (99.1% vs 64.7%; $P<0.0001$). However, the majority developed anti-spike IgG after dose 2 with no significant difference between the two arms (100% vs 99%; $P=1$) [Table 2]. Of 289 samples taken after receiving dose 2, only two were negative for anti-spike IgG. These two non-responders were both immunocompromised, one with psoriatic arthritis receiving methotrexate treatment, and the other with chronic lymphocytic leukaemia. The IgG and total antibody levels induced by BNT162b2 were higher than those induced by CoronaVac after dose 1 ($P<0.0001$) and after dose 2 ($P<0.0001$) [Fig]. After dose 2, more BNT162b2 recipients had positive surrogate neutralising antibody (100% vs 94%; $P<0.0194$).

Both CoronaVac and BNT162b2 are immunogenic in these HCWs. Our findings underscore the importance of maintaining social distancing and other infection control measures until 4 weeks after completing the two-dose regimen. Although most vaccine recipients developed antibodies after the second dose, the level of antibody or neutralising activity required to confer protection against future infection is currently not well defined. More research is needed for a better understanding of serology after vaccination. Data collection is ongoing and new findings will be published when available.

Author contributions

JST Zee drafted the letter. All authors contributed to the concept or design of the study, acquisition of the data, analysis or interpretation of the data, and critical revision of the letter for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version

TABLE 1. Characteristics of the study cohort*

Assumptions	CoronaVac (n=212)	BNT162b2 (n=234)	P value†
Age, y	49.11 ± 9.87	44.06 ± 11.03	<0.0001
Sex			0.0136
Male	83 (39.15%)	119 (50.85%)	
Female	129 (60.85%)	115 (49.15%)	
Medical co-morbidities			
None	145 (68.40%)	182 (77.78%)	0.0318
Diabetes mellitus	10 (4.72%)	10 (4.27%)	0.8237
Hypertension	24 (11.32%)	16 (6.84%)	0.1345
Hyperlipidaemia	26 (12.26%)	21 (8.97%)	0.2821
Cardiovascular disease	3 (1.42%)	1 (0.43%)	0.3504
Asthma	2 (0.94%)	7 (2.99%)	0.1801
Chronic renal disease	1 (0.47%)	1 (0.43%)	1
Chronic liver disease or cirrhosis	6 (2.83%)	5 (2.14%)	0.7633
History of malignancy‡	10 (4.72%)	1 (0.43%)	0.0041
Systemic lupus erythematosus	1 (0.47%)	0	0.4753
Other autoimmune disease	8 (3.77%)§	1 (0.43%)	0.0156
Medication			
Steroid	1	0	0.4753
Non-Steroid Immunosuppressant	2	0	0.2254

* Data are shown as mean ± standard deviation or No. (%), unless otherwise specified

† No. of positive test results was tested using Fisher's exact test. Means were tested using *t* test. A *P* value of <0.05 was considered statistically significant

‡ All without chemotherapy or radiotherapy in the past 6 months

§ One case of immunoglobulin A nephropathy, two cases of non-specific arthritis receiving hydroxychloroquine, one case of psoriatic arthritis receiving methotrexate and upadacitinib, one case of ankylosing spondylitis receiving ixekizumab, one case of rheumatoid arthritis receiving hydroxychloroquine, and two cases of ocular myasthenia gravis

|| Ulcerative colitis receiving treatment with mesalazine

TABLE 2. Antibody levels after vaccination with CoronaVac or BNT162b2*

	CoronaVac		BNT162b2		P value† (CoronaVac vs BNT162b2)	
	After dose 1 (≥26 days)	After dose 2 (≥28 days)	After dose 1 (≥19 days)	After dose 2 (≥28 days)	After dose 1	After dose 2
No. of serum samples available for analysis‡	207	198	226	91		
Roche Elecsys® total antibody						
Antibody positive results	157 (75.8%)	197 (99.5%)	224 (99.1%)	91 (100%)	<0.0001	1
Antibody level, U/mL, mean (95% CI)	9.6 (5.5-13.8)	141.7 (129.7-153.6)	104.2 (93.3-115.3)	244.1 (237.2-251.1)	<0.0001	<0.0001
Abbott SARS-CoV-2 IgG						
Antibody positive results	134 (64.7%)	196 (99.0%)	224 (99.1%)	91 (100%)	<0.0001	1
Antibody level, AU/mL, mean (95% CI)	157.6 (105.8-209.5)	1005.2 (850.3-1160.0)	1618.0 (1430.0-1806.0)	11 572.6 (9928.8-13 216.4)	<0.0001	<0.0001
GenScript cPass surrogate neutralising antibody						
Antibody positive results	40 (19.3%)	187 (94.4%)	213 (94.2%)	91 (100%)	<0.0001	<0.0194
Antibody level, % signal inhibition, mean (95% CI)	15.59 (12.8-18.3)	66.7 (63.9-69.6)	66.0 (63.4-68.6)	94.5 (92.6-96.4)	<0.0001	<0.0001

Abbreviations: 95% CI = 95% confidence interval; IgG = immunoglobulin G; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2

* Data are shown No. (%), unless otherwise specified

† No. of positive was tested using Fisher's exact test. Means were tested using t test. A P value of <0.05 was considered statistically significant

‡ Samples that were not collected according to protocol were excluded from analysis: sera were collected ≥19 days after dose 1 of BNT162b2, ≥26 days after dose 1 of CoronaVac and ≥28 days after dose 2 of either vaccine

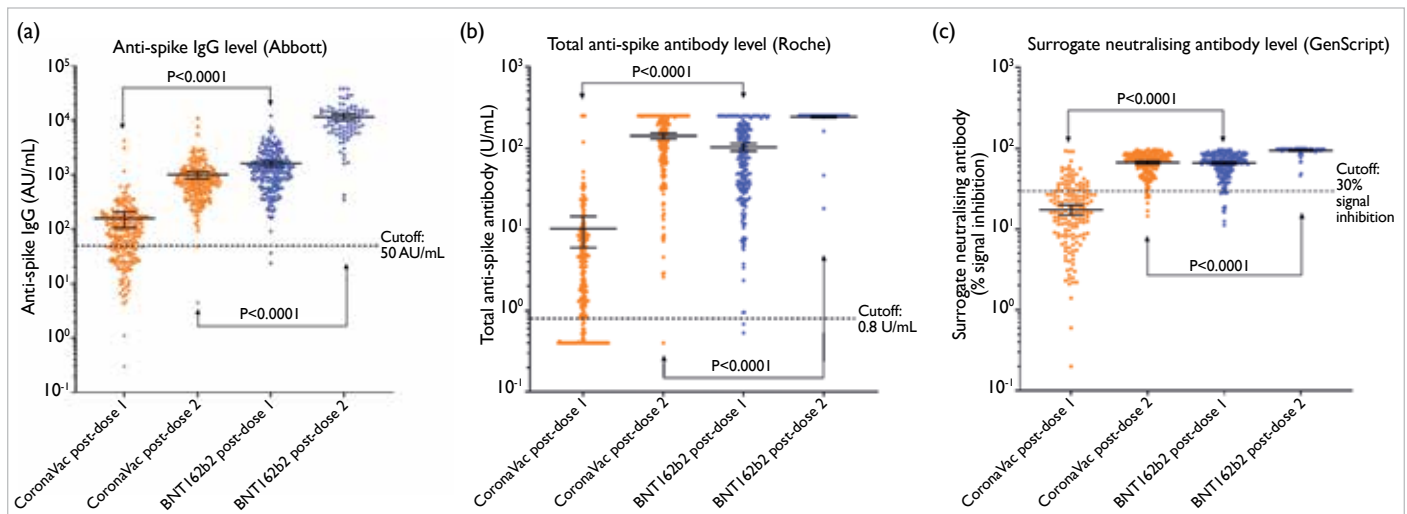


FIG. (a) Anti-spike immunoglobulin G (IgG) level, (b) total anti-spike antibody level, (c) surrogate neutralising antibody level after dose 1 and 2 of CoronaVac and BNT162b2. Each dot represents the antibody level of a participant after dose 1 or dose 2 of CoronaVac or BNT162b2. Sera were collected ≥19 days after dose 1 of BNT162b2, ≥26 days after dose 1 of CoronaVac, and ≥28 days after dose 2 of either vaccine. Long horizontal bars indicate mean values, error bars indicate 95% confidence intervals, and dotted lines indicate cut-off values for positive test results. Means were compared using t test

for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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