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BRIEF COMMUNICATION

Seroprevalence of SARS-CoV-2 antibodies in health-care workers at a tertiary paediatric hospital

Globally, health-care workers (HCWs) have experienced a disproportionate burden of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection that causes coronavirus disease 2019 (COVID-19), reflecting their increased risk of exposure.[1] In Victoria, 20 502 people (as of 29 April 2021) have been infected with SARS-CoV-2, of which 17% of cases are HCWs.[2,3]

Despite the Australian Government advocating for serosurveys as part of the national COVID-19 Surveillance Plan,[4] few have been undertaken.[5,6] A meta-analysis from several countries indicated a seroprevalence of 8.7% (range 0–45.3%) in HCWs.[7] There is likely to be less workplace SARS-CoV-2 exposure in paediatric hospitals due to the lower incidence of paediatric hospitalisations[8,9]; however, there are few published surveys in this setting[10] and none amongst paediatric HCWs in Australia.

The aim of this study was to investigate the presence of SARS-CoV-2 antibodies in HCWs employed at the Royal Children's Hospital (RCH), Melbourne, Australia.

All RCH HCWs were invited to participate between 21 and 30 October 2020. Participants reported demographics, risk factors and previous SARS-CoV-2 testing via a web-based REDCap questionnaire. Serum samples were analysed by the DiaSorin (Diasorin S.p.A., Saluggia (VC) - Italy) LIAISON SARS-CoV-2 S1/S2 IgG assay. Samples with positive or equivocal results were also tested by the Victorian Infectious Diseases Reference Laboratory

Table 1 Participant characteristics ($n = 318$)

Characteristic	Level	*n*	%
Gender	Male	48	15.1
	Female	268	84.3
	Other	2	0.6
Age (years)	Median (IQR)	35 (22–62)	—
Overseas travel since December 2019	Yes	82	25.8
Employment group	Nursing	151	47.5
	Medical	65	20.4
	Allied health professionals	32	10.1
	Other health professionals	34	10.7
	Management or administrative	31	9.8
	Support services	5	1.6
Location of RCH work	Respiratory infection clinic	51	12.8
	Emergency department	93	23.3
	Short stay unit medical – Dolphin	45	11.3
	Short stay unit surgical – Possum	1	0.3
	Sugar glider	25	6.3
	Intensive care unit	35	8.8
	Another inpatient ward	23	5.8
	Hospital in the home	6	1.5
	Outpatient clinics	42	10.5
	Laboratory micro/molecular	26	6.5
	Laboratory not micro/molecular	20	5.0
	Other[†]	10	2.5
	Day medical unit	6	1.5
	Theatre	5	1.3
	Multiple locations[‡]	5	1.3
	Office based	6	1.5
Employed elsewhere	Yes	52	16.4
Direct patient contact	Yes	259	81.5
Contact with SARS-CoV-2	Yes	133	41.8
Of those with contact ($n = 133$)	Member of household	1	0.7
	Non-household member (community)	3	2.1
	Clinical contact	122	86.5
	Workplace non-clinical contact[§]	15	10.6
AGPs	Yes	192	60.4
Tested for SARS-CoV-2	Yes	271	85.2
Number of SARS-CoV-2 tests[¶]	Median (range)	2 (1–9)	—
Participant in BRACE trial	Yes	63	19.8

[†]Included paramedic, equipment distribution, RCH reception and screening research.

[‡]Not a specific category but some respondents indicated that they worked across areas.

[§]Defined as other staff and/or parents.

[¶]Of those tested ($n = 271$).

— Not applicable.

AGPs, aerosol-generating procedures; IQR, interquartile range; RCH, Royal Children's Hospital; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Table 2 Results across platforms of participants with a positive or equivocal SARS-CoV-2 IgG (DiaSorin assay) ($n = 7$)

Age group (years)	Gender	LGA-COVID-19 hot spot[†]	HCW type	Location of RCH employment	Any symptoms[‡] of COVID-19 since March 2020	Contact with SARS-CoV-2	AGPs	Tested for SARS-CoV-2 (no. of times tested)	First sample							Second sample						
									DiaSorin	EUROIMMUN (S1 IgA)	EUROIMMUN (S1 IgG)	Wantai	MCRI in-house	Genscript	ICPMR – in-house	DiaSorin	EUROIMMUN (S1 IgA)	EUROIMMUN (S1 IgG)	Wantai	MCRI in-house	Genscript	ICPMR in-house
45–54	F	No	Nursing	Research	No	Yes[§]	No	No (–)	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🔴[¶]	🟢	🟢	🟢	🟢	🟢	🟢
45–54	F	No	Other	Laboratory M/M	Yes	No	Yes	Yes (1)[††]	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢
35–44	F	No	Allied health	Laboratory M/M	No	Yes[‡‡]	Yes	Yes (2)	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢
25–34	F	Yes	Nursing	Medical SS/COVID-19 clinic	Yes	No	Yes	Yes (1)	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢
65–74	M	No	Man/admin	PIPER	Yes	No	No	Yes (5)	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢
25–34	F	Yes	Other	Laboratory not M/M	No	No	No	Yes (1)	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢
45–54	M	Yes	Man/admin	O/P Clinics and COVID-19 clinic	Yes	No	No	Yes (7)	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢

[†]LGA 'hot spots' at the beginning of Victoria's second wave with high COVID-19 prevalence included any of the following: Darebin, Moreland, Brimbank, Hume, Cardinia and Casey.

[‡]Symptoms included any of the following: fever (>37.5), cough, loss of smell, chills or shakes, stuffy or runny nose, diarrhoea, sore throat, breathing difficulties, loss of appetite, altered or loss of taste, headache, muscle ache, abdominal pain and nausea.

[§]Clinical contact.

[¶]When tested in parallel with first sample, there was no change with the previous result, that is, equivocal.

[††]Recorded positive nasopharyngeal swab on 7 October 2020.

[‡‡]Workplace non-clinical contact.

🔴, Positive; 🟡, equivocal; 🟢, negative/non-reactive result.

Allied health: Man/admin, management or administrative staff; AGPs, aerosol-generating procedures; COVID-19, coronavirus disease 2019; COVID-19 clinic, COVID-19 respiratory infection testing clinic; F, female; HCW, health-care worker; ICPMR, Institute of Clinical Pathology & Medical Research; laboratory M/M, laboratory micro/molecular; laboratory not M/M, laboratory not micro/molecular; LGA, local government area; M, male; medical SS, medical short stay unit; MCRI, Murdoch Children's Research Institute; O/P clinics, outpatient clinics; other, other health professionals; PIPER, paediatric infant perinatal emergency retrieval; RCH, Royal Children's Hospital; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

(VIDRL) using the EUROIMMUN (EUROIMMUN AG, Lübeck, Germany) Anti-SARS-CoV-2 enzyme-linked immunosorbent assay (S1; IgA, IgG), Wantai (Beijing Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China) SARS-CoV-2 Ab Rapid Test (total SARS-CoV-2 antibodies) and GenScript (GenScript Biotech, Piscataway NJ, USA) SARS-CoV-2 Surrogate Virus Neutralisation Test Kit at the Murdoch Children's Research Institute (MCRI) using an in-house enzyme-linked immunosorbent assay based on the Mount Sinai method[11] (receptor-binding domain and S1; IgG) and Westmead Institute of Clinical Pathology & Medical Research (ICPMR) in-house SARS-CoV-2 IgA/IgM/IgG immunofluorescence. Staff with positive or equivocal serology results underwent further testing with a combined oropharyngeal/ deep nasal swab and repeat serology testing after 14 days. Approval was obtained from the RCH Human Research Ethics Committee (69911).

A total of 318 HCWs were tested (Table 1), with 7 (2.2%) returning a positive ($n = 3$) or equivocal ($n = 4$) DiaSorin result. Repeat testing 14 days later demonstrated identical results and combined oropharyngeal/ deep nasal swab were negative. The DiaSorin-positive and equivocal samples yielded non-reactive SARS-CoV-2 antibody responses across all other assays at VIDRL, MCRI and ICPMR (Table 2).

Of the three HCWs who returned positive SARS-CoV-2 results, two resided in COVID-19 'hot spot' postcodes during Victoria's second wave. One HCW, diagnosed with COVID-19 20 days prior, had equivocal results by the DiaSorin assay on both initial and repeat testing while their colleague, classified as a close contact during contact tracing, returned positive DiaSorin serology results. The other two HCWs, who returned positive results, reported additional risk factors (Table 2).

Our study in a paediatric hospital identified a very low rate of SARS-CoV-2 antibodies in HCWs; 2.2% using the DiaSorin assay. It is interesting to note that serology testing with alternative assays (including two in-house) was negative, including for the staff member with confirmed COVID-19. The difference in results likely reflects the limitations of each assay's specificity and sensitivity, particularly in the context of a low prevalence setting. The DiaSorin assay measures antibodies to S1 and S2 and as the S2 subunit is a more conserved coronavirus region, this may result in antibody cross reactivity.[12,13]

Although there are no published paediatric Australian HCW serosurveys, one tertiary Victorian public health network[10] reports a seroprevalence of 2.17%. Studies from Denmark, Germany and the USA report SARS-CoV-2 seroprevalence in HCWs in the range of 2–9%,[7,14–17] which is higher compared to the general community and in HCWs working in dedicated COVID-19 areas.[14] The few paediatric health-care setting serosurveys reported from high prevalence settings (India, Spain and Italy) have found a prevalence of 4–16.8% in paediatric HCWs.[18–20]

This study identified a low percentage of seropositive HCWs despite community transmission, which reasonably reflects the low prevalence of symptomatic paediatric cases and potentially the lower transmissibility of COVID-19 in children. Our findings support the use of infection control procedures, including convenient access to onsite screening of visitors, COVID-19 testing and a dedicated COVID-19 response team.

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The wonders of space by Alice Nham (9) from WOW Art Competition, SCHN