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Self-administered, remote assessment of SARS-CoV-2 seroprevalence in health care workers

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ABSTRACT

Background: Our objective was to safely and remotely assess longitudinal SARS-CoV-2 seroprevalence in at-risk health care workers at the onset of the epidemic.

Methods: Self-administered serologic testing was performed every 30 days up to 5 times using a point-of-care, lateral flow SARS-CoV-2 nucleocapsid IgG immunoassay in a cohort of at-risk health care workers (n = 339) and lower-risk controls (n = 100).

Results: Subjects were enrolled between 4/14/20–5/6/20 and most were clinicians (41%) or nurses (27%). Of 20 subjects who reported confirmed SARS-CoV-2 infection prior to (n = 5, 1%) or during the study (n = 15, 3%), half (10/20) were seropositive. Five additional subjects were seropositive and did not report documented infection. Estimated infection rates in health care workers did not differ from concurrent community rates.

Conclusions: This remotely conducted, contact-free study did not identify serologic evidence of widespread occupational SARS-CoV-2 infection in health care workers. **[Am J Med Sci 2022;364(3):281–288.]**

INTRODUCTION

At the onset of the SARS-CoV-2 pandemic, the predominant routes of viral transmission and the risks of occupational acquisition of infection were unclear. Subsequent studies alternatively suggested that health care workers (HCWs) could have either increased infection risk due to occupational exposure[1,2] or reduced risk due to routine use of personal protective equipment and workplace protocols.[3,4] Serologic testing can provide evidence of prior SARS-CoV-2 infection and has been used to assess seroprevalence in the general public and HCWs.[1,2,4–7] Measuring seroprevalence can evaluate incidence of asymptomatic or minimally symptomatic infection in individuals who may not pursue SARS-CoV-2 viral testing to detect active infection.[7–9]

At the onset of local SARS-CoV-2 epidemic, we designed and implemented a contact-free, longitudinal SARS-CoV-2 seroprevalence study in at-risk health care workers to establish occupational infection risk relative to rates in the local community. A secondary aim was to assess the feasibility of conducting a serologic study entirely remotely, with the intent to avoid any potential for infection risk while conducting the study, and to compare subjects' interpretations of their serologic test result to the interpretation of a clinician expert. To accomplish this goal, we utilized an investigational point-of-care, lateral flow SARS-CoV-2 nucleocapsid IgG immunoassay (RayBiotech) that was commercially available at the time of study initiation in April 2020. Serologic kits were mailed to subjects and self-administered at home using finger stick blood. Electronic questionnaires captured subject perceptions and symptoms.

METHODS WITH STATISTICAL CONSIDERATIONS

Study design

This observational cohort study utilized a point-of-care (POC) SARS-CoV-2 nucleocapsid IgG antibody test to measure longitudinal seroprevalence in two groups of health care workers at the Medical University of South

Carolina (MUSC) in Charleston, South Carolina. The Institutional Review Board at MUSC approved this study and all subjects provided written informed consent. Group 1 (n = 339) had risk factors for occupational exposure and included employees who provided direct care or services for patients with SARS-CoV-2 infection, worked in the emergency department or SARS-CoV-2 testing site, or worked where aerosolizing procedures were performed. Employees in this group included clinicians (physicians, physician's assistants, nurse practitioners), nurses, patient care technicians, respiratory therapists, social workers, environmental or food services staff, unit secretaries, occupational therapists, speech therapists, and pharmacists. Group 2 (n = 100) included MUSC employees without identifiable risk factors for occupational exposure and whose job duties did not involve direct patient care within the 6 months prior to enrollment. Participants had to be $\geq$ 18 years old and be able to take and transmit a picture of their test result. Participants were excluded if they had respiratory symptoms within the preceding 14 days (e.g., cough, fever, shortness of breath), had been tested for or diagnosed with SARS-CoV-2 infection in the prior 14 days, or if they had a bleeding disorder or were taking systemic anticoagulants. Participants reporting SARS-CoV-2 infection greater than 14 days before enrollment were eligible to participate.

Recruitment and enrollment

A recruitment email was sent to MUSC healthcare employees in Charleston utilizing listservs encompassing employees with the potential to comprise groups 1 and 2. The total number of potential participants who received the recruitment email was not assessed, nor were the reasons for non-response assessed. Enrollment occurred in the order of subject response until the enrollment target was reached, after which time interested participants were informed the study was closed to enrollment. Interested participants contacted the study coordinator, who confirmed eligibility, and consent forms were emailed if inclusion criteria were met. A member of the study team discussed the study with interested participants by phone and reviewed the electronic consent document using the REDCap platform, a secure, cloud-based file storage system.[10] Subjects choosing to participate and a study team member then electronically signed an electronic consent which was then emailed to each subject. Subjects enrolled between April 14th and May 6th, 2020 and included 339 subjects in Group 1 (enrollment of 340 was planned, however, 1 subject counted twice towards enrollment due to an initial screen failure) and 100 subjects in Group 2. While the study initially had 4 planned periods of testing, the protocol was amended to allow a 5th period of testing due to a community surge in cases. There were 6 screen failures due to not meeting eligibility criteria and 285 subjects participated in all 5 periods of testing. Subjects were contacted each month to confirm interest in continued participation in advance of mailing the next serologic kit, as described below. The primary reason subjects did not complete the study is they either did not respond to communication from the study team or did not complete a study questionnaire after having been mailed the kit.

Subjects were emailed a unique link each period to complete a data collection form in REDCap (Supplemental File 1) and were asked to upload a picture and their interpretation of the result. The data collection form and home testing kit were completed at the subject's home or location of choice. The serologic kits were stored at ambient temperature in an outpatient pharmacy at MUSC and shipped to participants via the United States Postal Service. Each shipment included the components of the serologic testing kit, an instruction sheet describing how to perform the test (Supplemental File 2), an instruction sheet describing proper disposal of kit reagents after test completion, and an informational sheet discussing the interpretation and limitations of the study results (Supplemental File 2). Subjects completed this process, including repeat testing and electronic questionnaires, every 30 days ($\pm$ 7 days) for up to 5 periods. The number of subjects completing each period of testing are shown in Table 1, and the window of each

Table 1. Cohort perceptions and workplace characteristics.

	Period 1 (n = 427)	Period 2 (n = 404)	Period 3 (n = 380)	Period 4 (n = 357)	Period 5 (n = 285)	p-value*
Foreign Travel?	21 (4.9)	0 (0.0)	0 (0.0)	2 (0.6)	1 (0.4)	<0.010
Travel Outside SC?	130 (30.4)	55 (13.6)	79 (20.8)	106 (29.7)	92 (32.2)	<0.010
Care for SARS-CoV-2 Patient?	145 (34.0)	103 (25.5)	154 (40.5)	179 (50.1)	143 (50.5)	<0.001
Concern for Work Exposure?	243 (56.9)	121 (30.0)	189 (49.7)	173 (48.5)	113 (39.9)	NS
Concern for Private Life Exposure?	98 (23.0)	44 (10.9)	100 (26.3)	91 (25.5)	63 (22.3)	<0.050
Think had SARS-CoV-2 Ever?	Not Asked	23 (5.7)	27 (7.1)	37 (10.4)	25 (8.8)	<0.001
Any Symptoms in Prior Month?	159 (37.2)	56 (13.9)	86 (22.6)	98 (27.5)	73 (25.6)	NS
Pursued Clinical Serologic Testing?	Not Available	50 (12.4)	19 (5.0)	8 (2.2)	9 (3.2)	<0.001
Prefer Home-Based Testing?	Not Asked	282 (69.8)	288 (76.0)	274 (76.8)	Not asked	<0.010

Shown are the numbers (percentages) of subjects reporting "yes" on the study questionnaire to each indicated question. * P-values were obtained from generalized linear mixed models treating period as a continuous effect, testing whether the probability of the outcome of interest trended upwards or downwards over time. NS = not significant.

testing period was a range due to rolling enrollment (period 1, 4/17-6/7; period 2, 5/12-7/7; period 3, 6/5-8/10; period 4, 7/2-9/14, period 5, 7/28-10/20; all dates 2020).

SARS-CoV-2 IgG Antibody test

The RayBiotech SARS-CoV-2 IgG Antibody Detection Kit (Colloidal Gold Method) for Finger Prick Samples was used as an at-home test kit for this study. This lateral flow immunoassay detects IgG to the SARS-CoV-2 nucleocapsid protein, but does have some potential for cross-reactivity with the same protein from endemic Coronaviruses (229E, OC43, HKU1, and NL63). IgM testing was not performed, as this study was not designed to detect acute infection. There was no approved clinical serologic test available at MUSC until May 2020. The RayBiotech IgG kit had not yet been FDA reviewed, but was cleared for distribution under the Section IV.C of the FDA's "Policy for Diagnostic Tests for Coronavirus Disease-2019" for *in vitro* use in a laboratory. An application for FDA Emergency Use Authorization of this test had been submitted in March 2020.

At-home testing was pursued in order to minimize subject and study team's potential exposure to infection. All uploaded test result photographs were interpreted as positive, negative, or indeterminant by a study investigator (EGM). During the first period of testing, 17% of results could not be interpreted due to bloodline migration that precluded test interpretation (Supplemental Fig. 1 for example test results). In subsequent periods of testing, subjects were asked to capture an earlier picture to facilitate the ability to render an interpretation (Supplemental File 3). De-identified serum from hospitalized patients with confirmed SARS-CoV-2 infection > 13 days prior or randomly selected patients without known or suspected SARS-CoV-2 infection was used to validate the immunoassay and estimate sensitivity and specificity.

Cumulative prevalence in the cohort was estimated by counting the number of subjects who either (1) tested positive on the immunoassay (via the clinician expert's interpretation) or (2) self-reported SARS-CoV-2 infection during the study time period and dividing that total by the number of subjects. Community prevalence was estimated by combining case data from the South Carolina Department of Health and Environmental Control (DHEC) website (https://scdhec.gov/covid19/south-carolina-county-level-data-covid-19) and U.S. Census population size estimates for people of similar age (20−69 years) living in Charleston County in 2019 (https://www.census.gov/quickfacts/fact/table/charlestoncountysouthcarolina,SC/PST045219).

Sample size justification

We did not have an accurate measure of anticipated seroconversion rate in the at-risk population but predicted that ~15% of subjects would become seropositive during the study. A sample of 339 subjects in the high-risk group allowed us to estimate a 95% confidence interval for the population proportion extending ± 4%. We predicted a seroconversion rate in HCWs not involved in patient care at ~7%. A sample of 100 subjects in the low-risk group allowed us to estimate a 95% confidence interval for the population proportion extending ± 5%.

Statistical analysis

Prevalence rates, with 95% confidence intervals, were determined for each phase and for the entire study period. Changes in prevelance and other binary measures were assessed over time using generalized linear mixed models (GLMMs) which included time period as a (fixed) main effect and a random subject effect to account for within-subject clustering over time. Kappa statistics were used to assess agreement between subjects' self-report of the diagnostic test result and the study team's determination of the same test.

RESULTS

We remotely enrolled 439 subjects between April 14th and May 6th, 2020, including a cohort of 339 health care workers at-risk for occupational SARS-CoV-2 exposure ("Group 1") and 100 normal risk controls ("Group 2"). Subjects were 68% female, 93% white (4% Asian, 2% African American), most were clinicians (41%) or nurses (27%), and the average subject age ± SD was 41 ± 11 years. The primary work area of subjects enrolled in Group 1 was the emergency department (29%), intensive care unit (20%), surgery (18%), anesthesiology (11%), hospital wards (9%), or respiratory specimen collection site (1.2%). Participants enrolled in Group 2 did not work in a patient care setting, but their exact location of work was not assessed. International travel in the study cohort was initially low and became more infrequent over the course of the study (Table 1) and did not differ significantly between Groups 1 and 2. Domestic travel outside of South Carolina was more frequent than foreign travel (Table 1), and after an initial decline increased over time but did not associate with self-report of infection (p = not significant (NS) by GLMM). On average, domestic travel outside the state was more common among Group 1 than Group 2 (27.4% vs. 16.9%, $p < 0.001$). The rate at which respondents reported having to care for a SARS-CoV-2 patient increased significantly during the study (from 34.0% to 50.5%, $p < 0.0001$, with Group 1 participants being much more likely than Group 2, on average, to report serving in this caregiving role (51.0% vs. 0.7%, $p < 0.0001$). Subjects had more concern for potential exposure to SARS-CoV-2 at work relative to concern for community exposure (Table 1). On average, these concerns were higher among Group 1 than Group 2 (work exposure concern: 57.1% vs 7.3%, $p < 0.0001$; community exposure: 24.6% vs. 11.0%, $p < 0.0001$). The number of subjects reporting concern for prior SARS-CoV-2 infection, whether they had received prior testing or not, increased over time (Table 1); this concern was similar between

groups 1 and 2 (8.7% vs, 5.3%, $p = 0.21$). Most subjects did not report any symptoms during each period of testing (Table 1); however, on average, members of Group 1 were more likely to report having symptoms than Group 2 (27.9% vs. 17.6%, $p = 0.001$). In subjects reporting symptoms, headache, rhinorrhea, and fatigue were the most frequently reported symptoms (Supplemental Table 1). Twenty subjects self-reported a confirmed SARS-CoV-2 diagnosis greater than 14 days prior to enrollment ($n = 5$) or during ($n = 15$) the course of the study, and 18 of these were in the at-risk group of HCWs (p = NS for difference between the groups). There was a clear temporal correlation between the timing of self-reported infections in the study cohort as compared to community incidence in Charleston County (Fig. 1).

Of 20 subjects reporting confirmed infection, 3 worked in the emergency department or SARS-CoV-2 testing sites, 6 reported caring for patients with SARS-CoV-2 infection, and 9 worked in settings where aerosolizing procedures were performed. These 20 subjects included 10 physicians, 1 physician's assistant, 1 nurse practitioner, 4 registered nurses, 1 respiratory therapist, 1 physical therapist, 1 medical coder, and 1 certified respiratory nurse anesthetist. One of these subjects reported foreign travel and 10 reported travel outside of South Carolina prior to their diagnosis.

We validated the serologic test using serum from hospitalized patients with or without confirmed SARS-CoV-2 infection. Of 30 serum samples tested from patients with PCR-proven infection >13 days prior, 23 were positive and 7 were negative by immunoassay. Only 1 of 26 persons without SARS-CoV-2 infection had a positive immunoassay result. In this population, the test's apparent sensitivity was 77% (95% C.I. 65–80%) and the specificity was 96% (95% C.I. 80–99%).

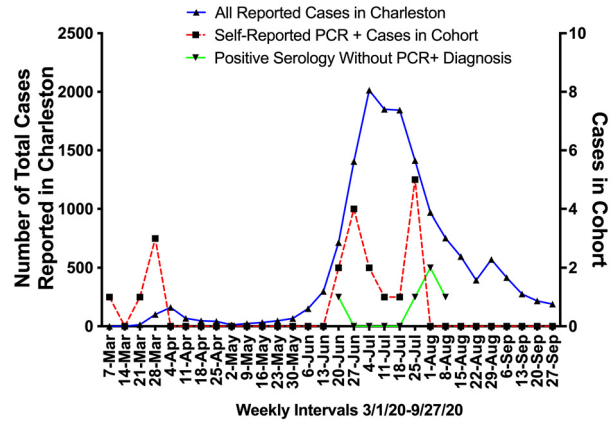

FIGURE 1. Epidemiology of SARS-CoV-2 in Charleston County and the study cohort. The total number of South Carolina Department of Health confirmed cases in Charleston County per week are shown by the solid line and left-sided y-axis. The number of self-reported, PCR-confirmed SARS-CoV-2 infection in the study cohort per week and the number of positive serologic tests in subjects not reporting infection are shown by dashed lines, with values on the right-sided y-axis.

On study questionnaires, the number of subjects reporting ease of kit use (Supplemental Table 2) and confidence they performed the kit correctly (Supplemental Table 3) increased with each period of testing ($p = 0.001$ and $p < 0.001$ by GLMM, respectively). There were no significant differences between Group 1 and 2 with respect to ease of kit use ($p = 0.53$) or confidence ($p = 0.58$). Most subjects did not pursue clinical serologic testing during the study and most endorsed a preference for home-based rather than clinical laboratory testing, if the test's performance characteristics were felt to be similar (Table 1).

Results of serologic testing as interpreted by study subjects and the study team are shown in Table 2. As

Table 2. Result interpretation by subjects and study team.

	Interpretation by Study Subjects				
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**
Positive	2 (0.5)	1 (0.2)	2 (0.5)	6 (1.7)	5 (1.8)
Negative	363 (90)	365 (90)	337 (89)	323 (90)	251 (88)
Inconclusive	32 (8)	27 (7)	29 (8)	22 (6)	25 (9)
Not Sure	7 (2)	11 (3)	12 (3)	6 (2)	4 (1)
	Interpretation by Study Team				
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**
Positive	3 (0.7)	2 (0.4)	5 (1.3)	13 (3.6)	4 (1.4)
Negative	410 (96)	388 (96)	350 (92)	328 (92)	254 (89)
Inconclusive	14 (3)	16 (4)	30 (8)	29 (8)	31 (11)
Kappa*	0.28	0.55	0.58	0.50	0.65
Overall	0.28	0.55	0.58	0.50	0.65
Group 1	0.27	0.51	0.61	0.48	0.68
Group 2	0.28	0.67	0.52	0.53	0.58

Shown are the number (percentages) of test result interpretations per study period as assessed by study subjects and the study team. *Kappa statistics for concordant interpretations assumed that "Inconclusive" and "Not Sure" were equivalent.

described in the methods section, if blood migration occurred during the test, thereby prohibiting interpretation after 8–10 min of incubation, either an earlier picture or a repeat test was used to render a final test result (a description of the data source used for final test determination is in Supplemental Table 4). Agreement between subjects and the study team was moderate at first (kappa = 0.28 in Phase 1) but improved over time (kappa = 0.65 in Phase 5) (Table 2). Overall, kappa values were comparable between the 2 study Groups (Table 2). Among 24 tests assessed as positive by the study team, subjects agreed 54% of the time, and among 1591 tests assessed as negative by the study team, subjects agreed 96% of the time. Among 212 tests assessed as inconclusive by the study team, subjects agreed 47% of the time; of these 212 inconclusive tests, subjects interpreted 112 (53%) as negative.

Serologic testing results for the 20 subjects who self-reported SARS-CoV-2 infection before or during the study are shown in Table 3. Fifty percent of these subjects (10/20) had a positive serologic testing result on at least one test, and the duration of seropositivity differed by subject (Table 3). Fifty percent of subjects (10/20) did not have a positive serologic test at any time point tested (Table 3). Self-reported rates of SARS-CoV-2 infection were not significantly different between Groups 1 and 2 (5.3% vs. 2.0%, risk difference = 3.3%, 95% CI = [−0.3% to 6.9%], $p = 0.27$). Throughout the study, only 5 subjects had a positive serologic result in the absence of reporting a confirmed infection (Table 4), meaning they either never received testing or never tested positive. Most of these positive results occurred when community cases were surging (Fig. 1), and several subjects reported prior symptoms consistent with possible SARS-CoV-2 infection (Table 4).

A total of 25 subjects either tested positive by immunoassay during the study or self-reported SARS-CoV-2 infection, yielding a cumulative estimated prevalence of 5.6%. This infection rate was not significantly different between Groups 1 and 2 (6.4% vs. 2.9%, risk difference = 3.5%, 95% CI = [−0.7% to 7.7%], $p = 0.23$). During this same period, an estimated 11,957 cases were documented in Charleston County, out of 275,074 estimated residents of similar age, yielding a cumulative prevalence of 4.4%, a rate that did not differ significantly from the study cohort (p = NS).

Most subjects reported moderate or high concern about acquiring SARS-CoV-2 infection in the future, although concern declined between periods 4 and 5 of the study (Supplemental Table 5). If allowed to continue testing after completion of the study, subjects reported: “yes, with this kit” (65%), “yes, with a better kit” (22%), “no” (5%), or “unsure” (8%).

Table 3. Serologic results in subjects reporting confirmed SARS-CoV-2 infection.

Subject	Period 1	Period 2	Period 3	Period 4	Period 5
1				9+	
2	30+				
3	27+	54+	84+	117+	149+
4				18+	42-
5			11+	41+	87+
6				27+	
7				26+	
8	43+	77-	102+	130-	156-
9			18+	56+	87+
10				8+	52-
11			15-	34-	
12				6-	
13					23-
14	31-				
15				24-	52-
16			12-	43-	
17				35-	
18	47-				
19			3-	34-	58-
20				26-	

Each row represents data for an individual study subject. “Period” refers to the monthly period of testing. White cell = negative serologic test prior to a future proven infection. Numbers indicate the number of days after a self-reported infection that a serologic test was performed. “+” = a positive serologic test. “-” = a negative serologic test. Shaded cells indicate = testing was either not performed or was inconclusive. Subjects 1–10 had at least 1 positive serologic test; subjects 11–20 never had a positive serologic test.

Table 4. Positive serologic result in subjects not reporting SARS-CoV-2 infection.

Period 1	Period 2	Period 3	Period 4	Period 5	Symptoms Reported by Subjects
X					Fever, chills, headache, nausea period 4
					No symptoms during study
					Fatigue, runny nose, loss of smell period 4
					No symptoms during study
X				X	No symptoms during study

White cell = negative serologic test, shaded cells = positive serologic test, “X” = test was either not performed or was inconclusive.

DISCUSSION

At the onset of the SARS-CoV-2 epidemic when the risk of occupational exposure and routes of transmission were unclear, we designed and conducted a seroprevalence study utilizing longitudinal at-home, self-administered serologic testing that was entirely contact-free Although the test utilized for this study was not optimally sensitive relative to currently available tests, we did not identify serologic evidence of widespread occupational SARS-CoV-2 infection in this cohort of at-risk HCWs. While the study's estimated prevalence rate did not differ significantly from concurrent community rates, it is likely the true infection rate in our cohort was lower than the general population because testing is likely less commonly pursued in the community. These results differ from other seroprevalence studies in HCWs that identified higher than expected seropositivity rates and suggested that asymptomatic spread was occurring.[1,2] Our results are consistent with studies that identified community acquisition of infection as a greater risk factor for HCWs than occupational exposure,[3,4,6,11] suggesting personal protective equipment and other workplace measures to reduce occupational exposure to infection are effective.

Previous studies suggested asymptomatic spread may occur in HCWs given the identification of higher serologic rates compared to confirmed cases by viral load testing in communities.[1,2,12–14] The different result in our study could be explained in part by suboptimal sensitivity of the test, given that half of subjects reporting confirmed infection were seronegative using this immunoassay. Alternatively, masking and occupational prevention measures and a stay at-home order implemented in Charleston between April 7th 2020 and May 4th, 2020 could have limited community spread during the earlier months of the study.[15,16] Because antibodies are detectable in most subjects somewhere between 5 and 19 days after infection[17–19] and because our study involved repeat testing approximately every 30 days, it is unlikely that subjects who were truly seropositive in our study were missed, even if antibody decay occurred more rapidly in less symptomatic subjects.[20,21]

Validation of the immunoassay using serum from hospitalized patients with confirmed SARS-CoV-2 infection yielded a sensitivity and specificity of the test similar to the package insert (April 11th, 2020 package insert 84% sensitivity and 92% sensitivity for the IgG/IgM kit). Importantly, the study only used the IgG assay, so the calculated sensitivity and specificity cannot be directly compared to data in the package insert. As described above, due to unexpected blood migration noted in the first period of testing, we altered the instructions to encourage analysis of their test result earlier than the recommended time (Supplemental Table 4), an approach that could have reduced sensitivity.[22] It is possible that the actual sensitivity of the IgG test in our study, conducted in an outpatient population, was lower than that measured in hospitalized patients, given that asymptomatic and mildly symptomatic patients can have lower antibody levels and faster antibody decay compared to patients with more severe disease requiring hospitalization.[8,9,20,21,23,24]

Most subjects in the study reported concern for acquiring SARS-CoV-2 infection, interest in regular serologic testing to assess for potential exposure, as well as satisfaction with self-administering the serologic assay at home (Table 1, Supplemental Table 5). Furthermore, there was good, albeit imperfect, concordance between subjects' interpretation of their serologic result and the investigators, concordance which improved over the course of the study and which did not differ between Group 1 and Group 2 (Table 2). Subjects' ease with performing the test and confidence in interpreting the result also increased during the study (Supplemental Tables 2 and 3). These observations suggest the viability of making at-home serologic testing available in the community in the event an approved product for use in this setting becomes available. A caveat to this observation is that most subjects in this study were HCWs and thus may have greater ease with completing the steps required to self-administer a serologic test at home, although ease of use and confidence in performing the test correctly did not differ by Group.

At the time of study initiation, a surge in disease incidence was anticipated and much was unknown about the epidemiology of SARS-CoV-2 transmission, so there was an impetus to design a novel, contact-free epidemiology study to minimize the possibility of disease transmission while conducting research. In addition to added safety, the interest we observed in using at-home testing in this study was consistent with a rising interest in at-home testing for other conditions, such as monitoring anti-coagulation or testing for HIV[25,26] that predated the SARS-CoV-2 epidemic. Rapid recruitment was made possible through the utilization of institutional list-serves. The study removed the need for an in-person coordinator by utilizing electronic consents and questionnaire distribution through REDCap, as well as partnering with the MUSC Outpatient Pharmacy to utilize kit shipments through the US Postal Service. The study team maintained secure study communication between team members with use of a secure, cloud-based file storage system. Together, utilization of these approaches demonstrate that it is feasible to conduct a study utilizing longitudinal at-home, self-administered serologic testing entirely contact-free.

CONCLUSIONS

We did not identify higher than expected rates of SARS-CoV-2 seropositivity in at-risk HCWs, suggesting widespread occupational acquisition of infection did not occur.

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AUTHOR CONTRIBUTIONS

L.C.: conceptualization, data curation, investigation, project administration, writing- review and editing; C.M.L.: investigation; S.C.: writing-review and editing; E.H.M.: conceptualization, writing-review and editing; P.N.: formal analysis; E.G.M.: conceptualization, data curation, formal analysis, investigation, writing- original draft.

DECLARATION OF COMPETING INTEREST

The author has no financial or other conflicts of interest to disclose.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amjms.2022.01.025.

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