

Severe Acute Respiratory Syndrome Coronavirus 2 Seropositivity among Healthcare Personnel in Hospitals and Nursing Homes, Rhode Island, USA, July– August 2020

Appendix

Appendix Table 1. Questionnaire administered to respondent healthcare personnel, Rhode Island, USA, July–August 2020

Section	Question/item	Response categories
1.	Name	First Last
2.	Home address	Street City State Zip
3.1	Phone number (mobile)	Area code, phone number
3.2	Verify phone number (mobile)	Area code, phone number
4.1	Email address	(fill)
4.2	Verify email address	(fill)
5.	Date of birth	MM/DD/YYYY
6.	Sex at birth	Male Female
7.	Current gender	Man Woman Transgender man/trans man Transgender woman/trans woman Genderqueer/gender nonconforming neither exclusively male nor female Other (fill) Decline to answer
8.	Sexual orientation	Gay Straight Bisexual Something else/not sure Decline to answer
9.	Are you Hispanic or Latino/Latina?	Yes No Don't know Decline to answer
10.	What is your race? (select all that apply)	White Black/African American Asian American Indian or Alaska Native Native Hawaiian or other Pacific Islander Other Decline to answer
Added	Please select your age group	18–29 y 30–39 y 40–49 y 50–59 y 60–64 y 65–69 y 70–79 y

Section	Question/item	Response categories
11.1	Select your primary agency or work category:	Hospital/healthcare agency Fire agency Law enforcement/police agency EMS agency Nursing home Corrections (Go to 11.3) RI National Guard (Go to 11.3) RI Department of Health (Go to 11.3)
11.2	What is your primary work facility?	Hospitals (FULL LIST – 15 locations) Fire (FULL LIST – Will split in half if needed – 47 locations) Law Enforcement (FULL LIST – Will split in half if needed – 43 locations) EMS (Split list in half – 79 locations) Nursing homes (Split list in half – 85 locations)
11.3	Since March 1, did your work involve in-person interaction with members of the general community and/or patients?	Yes No
12.1	What were your main workplaces since March 1st? (Select all that apply)	Administrative office (any facility) Corrections—Intake Corrections—Minimum Security Corrections—Medium Security Corrections—Maximum Security Corrections—High Security Corrections—Probation and Parole Corrections—Women’s Facility Department of Health—Cannon Building Department of Health—State Health Laboratory Department of Health—Medical Examiner’s Office EMS- EMT/Paramedic Fire Department Law enforcement/Police Healthcare—Ambulatory/Dental/Outpatient Clinic Healthcare—Hospital general inpatient unit Healthcare—Hospital COVID-19 unit Healthcare—Hospital intensive care unit Healthcare—Hospital surgical unit Healthcare—Laboratory Nursing home—COVID-19 unit Nursing home—non-COVID-19 unit RI Emergency Management Agency RI alternate hospital setup site RI remote COVID-19 testing site RI state warehouses Traffic and perimeter control Other (any facility)
12.2	Which of the following best describes your occupation?	Administrative/business office staff/clerk Clinical technician (e.g., cardiac, renal, surgical) Clinical researcher/scientist Corrections officer/staff COVID-19 testing site staff Dentist/dental hygienist/dental assistant Diagnostic imaging staff Dietician/dietary services staff Dispatcher Emergency medical technician (EMT)/paramedic Engineer/maintenance/mechanic/repair staff Environmental services/cleaning staff Epidemiologist/infection control Firefighter/fire inspector/fire marshal Information/computer technologist Laboratory technologist/technician Law enforcement/police officer Medical examiner/mortuary technician/forensic staff Medical records/health information technician Military servicemember Nurse (e.g., CRNA, RN, LPN) Nurse assistant (e.g., CNA, CSA, aide, medication technician) Nurse midwife Nurse practitioner Occupational/physical/speech therapist

Section	Question/item	Response categories
		Patient aide/technician Pharmacist/pharmacist assistant Phlebotomist/medical technician Physician (e.g., MD, DO) Physician assistant Receptionist/medical assistant/patient registration Recreation specialist/therapist Respiratory therapist Security guard Social worker/case manager/counselor Surgical technician/technologist Supply chain/materials management (e.g., PPE) Supervisor/manager Other (fill)
14.	Since March 1, on average, how many times per shift did you participate in any aerosol-generating procedures for suspected or confirmed COVID-19 patient(s)? Examples: Open suctioning of airways Sputum induction Cardiopulmonary resuscitation Endotracheal intubation and extubation Noninvasive ventilation (e.g., BiPAP, CPAP) Bronchoscopy Manual ventilation	More than 25 times 11- 25 times 6–10 times 1–5 times 0 Not applicable
13.1	CDC recommends “complete” PPE when in contact with suspected or confirmed COVID-19: <ul style="list-style-type: none"> • Surgical face mask or respirator • Goggles or face shield • Gown • Gloves When aerosol generating or surgical procedures are performed, an N95 or higher-level respirator should be used instead of a surgical facemask. On average since March 1, in your workplace, how often were you in a situation where you needed complete PPE?	Never (Go to 15.1) Less than once a week A few times a week Every day
13.2	Since March 1, because of a PPE shortage, have you extended use of PPE (wearing the same PPE throughout an entire workday) or reused PPE at your workplace?	Yes, extended use of PPE Yes, reused PPE Yes, both extended use and reused No shortage
13.3	At any time since March 1, which PPE did you NOT have/use when you were in contact with a person with suspected or confirmed COVID-19 at your workplace? (Select all that apply)	Gown Gloves Goggles/face shield Surgical facemask N95 respirator/PAPR/other respirator NA
13.4	Have you been trained on how to properly put on and take off (don and doff) PPE in the past year?	Yes No Don't know
15.1	Did you spend more than 10 min within 6 feet of a co-worker who tested positive for COVID-19?	Yes No Don't know
15.2	Did you spend more than 10 min within 6 feet of a household member who tested positive for COVID-19?	Yes No Don't know
15.3	Did you spend more than 10 min within 6 feet of a patient who tested positive for COVID-19?	Yes, with appropriate PPE at all times Yes, without appropriate PPE at least once No Don't know

Section	Question/item	Response categories
15.4	Did you spend more than 10 min within 6 feet of any other person who tested positive for COVID-19?	Yes No Don't know
<p>PREAMBLE: Next, we will be asking you about two different types of testing—testing for current COVID-19 infection or testing for past infection (antibody).</p>		
16.1	Thinking about COVID-19, how many times were you tested for infection using a nasal, throat, or saliva sample?	[indicate 0 if none] (if 0 go to 17.1)
16.2	Have you ever had a positive nasal, throat, or saliva result for COVID-19?	Yes No (go to 17.1)
16.3	Approximately, what was the date of your first positive test using a nasal, throat, or saliva sample in 2020?	MM/DD Don't know
17.1	Now, thinking about testing for past infection, have you ever had a positive antibody test result using a blood sample?	Yes No (GO TO 18)
17.2	Approximately, when was the date of your first positive antibody test using a blood sample in 2020?	MM/DD Don't know
18.0	Since March 1, have you experienced any of the following symptoms? (select all that apply)	No symptoms Fever/chills Cough (new onset or worsening of chronic cough) Sore throat Shortness of breath or difficulty breathing Diarrhea Nausea or vomiting Fatigue/tiredness Nasal congestion or runny nose Muscle or body aches New loss in sense of smell or taste Headache (new onset or worsening headache) Other symptoms
19.	When did these symptoms start? (estimate as well as possible)	MM/DD Don't know
20.	Did you receive healthcare for these symptoms?	Yes No
21.	Were you hospitalized for COVID-19 illness?	Yes No
22.	Do you live in a single unit (e.g., house) or multiunit housing (e.g., an apartment)?	Single unit Multiunit
23.	Number of household members currently in the residence including yourself (resident, family, live-in staff, roommates, and long-term visitors)	Specify (scroll)
24.	What is your height?	Feet Inches
25.	What is your weight?	Weight in pounds
26.1	Do you have any of the following chronic medical conditions? (choose all that apply)	No conditions Asthma Cerebrovascular disease (affects blood vessels and blood supply to the brain) Chronic kidney disease Chronic liver disease COPD/emphysema/chronic bronchitis Diabetes HIV Hypertension or high blood pressure Immunocompromised condition (e.g., autoimmune disease, solid organ transplant, sickle cell disease) Immune weakening medication or therapy (e.g., cancer treatment) Serious heart conditions, such as heart failure, coronary artery disease, or cardiomyopathies Other chronic conditions
26.2	Do you currently smoke tobacco or vape nicotine or electronic cigarettes? (Select all that apply)	Yes, current smoker Yes, currently use electronic cigarettes No, former smoker

Section	Question/item	Response categories
		Never smoked
27.	Since March 1, have you been or are you currently pregnant?	Yes No Don't know

Appendix Table 2. Sample eligibility criteria

Included health workplaces	Included health occupations
Administrative office	Administrative/business office staff/clerk
Ambulatory healthcare/dental office	Diagnostic imaging staff
Hospital general inpatient	Dietician/dietary services staff
Hospital COVID-19 unit	Engineer/maintenance/mechanic/repair staff
Hospital intensive care unit	Environmental services/cleaning staff
Hospital surgical unit	Laboratory technologist/technician
Hospital other location	Nurse (e.g., CRNA, RN, LPN)
Hospital emergency room	Nurse assistant (e.g., CNA, CSA, aide, medication technician)
Nursing home COVID-19 unit	Occupational/physical/speech therapist
Nursing home nonCOVID-19 unit	Other healthcare*
	Pharmacist/pharmacist assistant
	Physician (e.g., MD, DO)
	Physician assistant
	Receptionist/medical assistant/patient registration
	Social worker/case manager/counselor
	Supervisor/manager
Excluded health workplaces	Excluded health occupations
Corrections	Corrections officer
Department of Health	Emergency medical technician/paramedic
Emergency medical system	Fire fighter/inspector/marshal
Fire department	Law enforcement/police officer
Law enforcement	Military servicemember
Military base	Research/epidemiologist
Rhode Island emergency management	
Rhode Island alternative hospital set up	
Rhode Island remote COVID-19 testing site	
Rhode Island state warehouses	
Traffic and perimeter control	

*Includes clinical technician (e.g., cardiac, renal, surgical), dentist/dental hygienist/dental assistant, medical examiner/mortuary technician/forensic personnel, patient aide/technician, phlebotomist/medical technician, recreation specialist/therapist, respiratory therapist, surgical technician/technologist, and security guards and COVID-19 testing personnel in hospital and nursing home settings.

Appendix Table 3. Adjusted odds ratios and 95% confidence intervals for seropositivity, Rhode Island, USA, July–August 2020*

Category	Hospital personnel n = 9,836		Nursing home personnel n = 1,494	
	Adjusted odds ratio	95% CI	Adjusted odds ratio	95% CI
Sex				
Female (ref Male)	0.846	0.590–1.213	0.657	0.458–0.941
Age group				
18–24 y	ref		ref	
25–34 y	0.533	0.310–0.916	1.272	0.593–2.732
35–44 y	0.461	0.205–1.037	1.214	0.438–3.368
45–59 y	0.498	0.258–0.961	1.608	0.684–3.780
60–64 y	0.476	0.232–0.974	1.938	0.891–4.214
≥65 y	0.258	0.106–0.628	1.751	0.590–5.198
Race/ethnicity				
Non-Hispanic white	ref		ref	
Non-Hispanic Black	2.827	1.767–4.521	1.597	0.837–3.047
Non-Hispanic Asian	1.155	0.583–2.287	1.903	0.991–3.655
Hispanic	1.697	1.350–2.131	1.903	0.991–3.655
Other	1.937	0.890–4.215	1.520	0.636–3.632
Decline	0.376	0.115–1.229	2.570	1.252–5.276
Exposure to person testing positive for COVID-19				
Co-worker (ref not exposed)	1.873	1.362–2.577	1.103	0.706–1.723
Household member (ref not exposed)	11.911	8.427–16.835	9.373	4.750–18.497

Category	Hospital personnel n = 9,836		Nursing home personnel n = 1,494	
	Adjusted odds ratio	95% CI	Adjusted odds ratio	95% CI
Patient, no PPE (ref not exposed)	1.282	0.887–1.853	1.055	0.537–2.073
Patient, with PPE (ref not exposed)	1.408	0.991–2.001	2.185	1.256–3.803
Other person (ref not exposed)	1.626	1.018–2.599	1.917	1.265–2.906
Interpersonal interaction (vs none)	3.375	1.345–8.470	1.237	0.607–2.522
Housing				
Multiunit (ref single family)	0.911	0.671–1.236	1.399	0.878–2.230
Average frequency of aerosol generating procedures per shift per week				
0 times	ref		ref	
1–5 times	1.115	0.765–1.624	1.589	0.866–2.916
6–10 times	1.597	0.875–2.915	1.463	0.662–3.235
11–25 times	0.713	0.364–1.396	0.959	0.248–3.713
>25 times	1.239	0.699–2.199	1.312	0.629–2.739
Not applicable	0.931	0.554–1.565	1.259	0.789–2.008
PPE shortage protocol use				
No shortage	1.229	0.672–2.247	0.942	0.458–1.938
Reuse	0.546	0.284–1.052	0.886	0.421–1.867
Extended use	0.662	0.421–1.043	1.486	0.769–2.870
Extended and reuse	0.838	0.556–1.263	1.305	0.659–2.583
Never used PPE	ref		ref	
N95 respirator/PAPR shortage				
Yes	1.064	0.667–1.697	0.709	0.449–1.119
No shortage	ref		ref	
Not applicable	1.004	0.711–1.418	0.574	0.298–1.104
Occupation†				
Administrative/office staff/clerk	1.355	0.765–2.398	1.518	0.465–4.959
Diagnostic imaging staff	1.304	0.680–2.500	NA	NA
Dietician/dietary services staff	0.884	0.287–2.717	1.623	0.579–4.552
Engineer/maintenance staff	0.942	0.308–2.886	NA	NA
Environmental services/cleaning staff	1.104	0.304–4.014	1.420	0.512–3.937
Laboratory technologist/technician	1.066	0.439–2.593	NA	NA
Nurse (e.g., CRNA, RN, LPN)	1.660	1.073–2.568	1.782	0.929–3.419
Nurse assistant (e.g., CNA, CSA, Aide)	1.440	0.854–2.427	2.055	1.057–3.998
Occupational/physical/speech therapist	1.531	0.547–4.284	ref	
Other healthcare	0.708	0.401–1.249	0.785	0.264–2.329
Other nursing home‡	NA	NA	1.741	0.637–4.759
Pharmacist/pharmacist assistant	1.754	0.762–4.036	NA	NA
Physician (e.g., MD, DO)	ref		NA	NA
Physician assistant	0.678	0.217–2.118	NA	NA
Receptionist/medical assistant	2.038	1.179–3.522	NA	NA
Social worker/case manager	0.719	0.445–1.162	3.284	1.119–9.638
Supervisor/manager	0.996	0.513–1.935	0.669	0.213–2.108
Workplace (ref did not work in this setting)§				
Administrative office	0.765	0.485–1.208	0.771	0.345–1.724
Ambulatory healthcare/dental office	0.804	0.595–1.086	–	–
Hospital general inpatient unit	1.039	0.739–1.462	1.758	0.379–8.154
Hospital COVID-19 unit	1.286	0.884–1.870	0.198	0.035–1.121
Hospital intensive care unit	0.799	0.491–1.299	NA	NA
Hospital surgical unit	0.612	0.410–0.912	NA	NA
Other hospital location	0.965	0.541–1.723	NA	NA
Hospital emergency room	0.487	0.184–1.292	NA	NA
Nursing home COVID-19 unit	3.946	1.392–11.186	2.860	1.606–5.095
Nursing home non-COVID-19 unit	0.989	0.362–2.701	0.808	0.508–1.284

*The adjusted models were estimated using generalized estimating equations including all variables shown. Bolded adjusted odds ratios and 95% confidence intervals are those for which the 95% confidence interval excludes the value of 1.0. NA, not applicable; NH, non-Hispanic; PAPR, powered air purifying respirator; PPE = personal protective equipment.

†For hospital model, physicians were the referent occupation group. For nursing home model, occupational/physical/speech therapists were the referent occupation group.

‡Includes 4 categories with low sample size: engineer/maintenance staff, pharmacist, receptionist/medical assistant, and physician.

§Workplace was represented by non-mutually exclusive dummy variables entered simultaneously into the model. Participants in workplaces with sample size <30 or with 0% seropositivity were included in the model but the workplace was not entered into the model. Some participants worked in facilities in the other agency category. That is, 84 hospital personnel also worked in nursing home COVID-19 and non-COVID-19 units, and 239 nursing home personnel also worked in hospital administrative offices, COVID-19 units and general inpatient units. Results for these categories are shown in this table, but not in the main manuscript.

Appendix Table 4. SARS-CoV-2 seropositivity by resident cases, staff cases, and outbreak status among participants who worked primarily in nursing home settings, Rhode Island, USA, July–August 2020*

Category	n	Seropositive, n	Seropositive, %
Total	1,462	191	13.1
Cases per 100 residents			
0 to <2.3	400	5	1.3
2.3 to <16.3	369	19	5.2
16.3 to <55.9	323	58	18.0
55.9 to 83.7	370	109	29.5
Cases per 100 staff			
0 to <2.1	380	5	1.3
2.1 to <11.5	346	16	4.6
11.5 to <19.9	359	44	12.3
19.9 to 43.2.7	126	126	33.4
Outbreak status			
No	1146	128	10.1
Yes	125	63	33.5
<p>*Note: 32 participants (2.1%) worked in facilities for which case and outbreak status data were not available. Outbreak defined as ≥ 2 contacts within a facility having active COVID-19 or ≥ 2 persons with COVID-19 linked outside a case investigation. Resident and staff case count obtained from Rhode Island Department of Health COVID-19 Data Tracker: Congregate Care: https://ri-department-of-health-covid-19-response-testin-1d583-rihealth.hub.arcgis.com</p>			