

## Supplementary Material\*

Nelson KN, Baker JM, Overton E, et al. Quantification of Occupational and Community Risk Factors for SARS-CoV-2 Seropositivity Among Health Care Workers in a Large U.S. Health Care System. *Ann Intern Med.* 2021. doi:10.7326/M20-7145

*Supplement Figure. Number of Study Participants (A) and Cumulative Incidence of COVID-19 (B) by ZIP Code*

*Supplement Table 1. Details of Data Sources and Factor Descriptions*

*Supplement Table 2. Additional Descriptive Statistics for Survey Participants (n = 9610)*

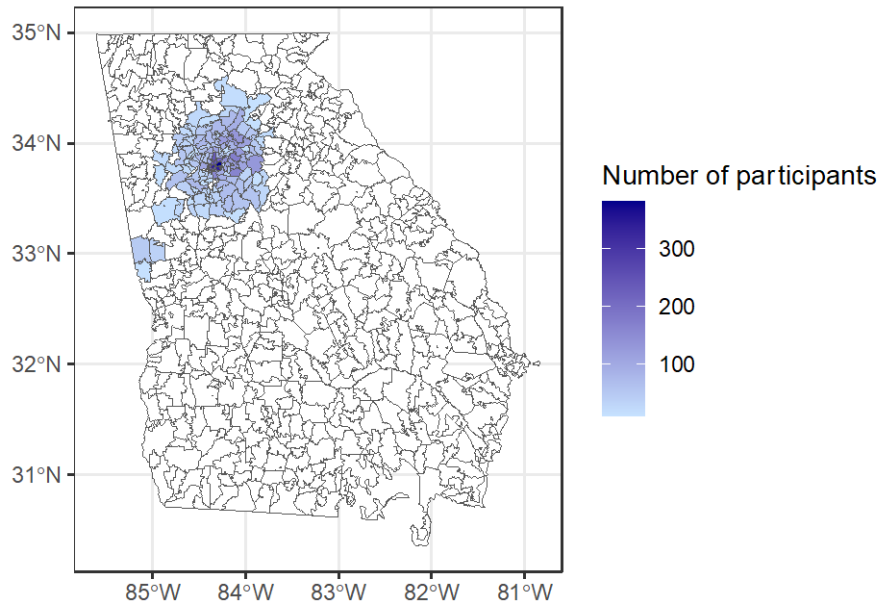
*Supplement Table 3. Association of Demographic, Community, and Occupational Risk Factors With Seropositivity Incorporating Cumulative Incidence of COVID-19 by Residential ZIP Code Into Weights (n = 8582)*

*Supplement Table 4. Association of Demographic, Community, and Occupational Risk Factors With Seropositivity Limited to Participants With No Known Community Exposure to COVID-19 (n = 7887)*

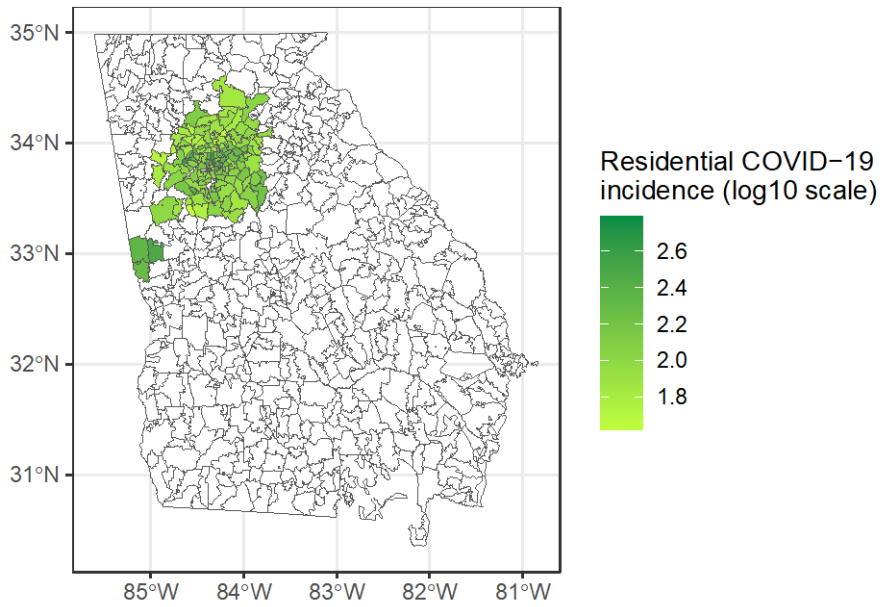
\* This supplementary material was provided by the authors to give readers further details on their article. The material was reviewed but not copyedited.

**Supplement Figure. Number of study participants (A) and cumulative incidence per 10,000 of COVID-19 (B) by ZIP code <sup>a</sup>**

**A**



**B**



<sup>a</sup> Data for zip codes with fewer than 10 study participants are excluded from the figure.

**Supplement Table 1. Details of Data Sources and Factor Descriptions**

<b>Factor</b>	<b>Data source</b>	<b>Survey question</b>	<b>Possible responses</b>	<b>Additional information</b>
<b>Demographic and community factors</b>				
Age group	Employment records	NA	NA	Categorized into deciles
Race	Employment records	NA	NA	Self-reported
Ethnicity	Employment records	NA	NA	Self-reported
Contact with confirmed/suspected positive individual(s)	Survey	Since February 1, 2020, have you had close contact (>10 minutes of face to face) with someone with confirmed or suspected COVID-19 outside of work?	1. Yes exposed to someone with COVID-19; 2. Yes; 3. No; 4. Not sure	Categorized into yes/no (not sure categorized as "no")
Residential COVID-19 incidence	Georgia Department of Public Health and employment records (residential zip code)	NA	NA	Cumulative incidence of persons under investigation for COVID-19 linked with zip code data and week of serology test. Cumulative incidence two weeks prior to week of serology test was used to account for lag between infection and testing.
<b>Occupational factors</b>				
Caring for COVID-19 positive patient(s)	Survey	While at work, did/do you provide direct patient care for any patient(s) known (confirmed) to be positive for COVID-19, regardless of location in the facility?	Yes; No; Not sure	Not sure categorized as "no"

**Supplement Table 1. *continued***

Factor	Data source	Survey question	Possible responses	Additional information
Caring patient(s) found to be COVID-19 positive while not on isolation precautions	Survey	While at work, did you care for patient(s) who, while not on isolation precautions, were tested and found to be COVID-19 positive?	Yes; No; Not sure	Not sure categorized as "no"
Contact with other healthcare worker found to be COVID-19 positive	Survey	While at work, did you have close contact (>10 minutes face to face) to other healthcare worker(s) who were found to have COVID-19 infection during the time period you were exposed to them?	Yes; No; Not sure	Not sure categorized as "no"
Workplace location	Survey	Where do/did you spend most time at work in the hospital during the COVID-19 pandemic? (may check more than one if you split your time equally)	<ol style="list-style-type: none"> <li>1. Emergency department;</li> <li>2. Medical-surgical focused on COVID-19 patients;</li> <li>3. Medical-surgical-not focused on COVID-19 patients;</li> <li>4. ICU focused on COVID-19 patients;</li> <li>5. ICU-not focused on COVID-19 patients</li> <li>6. Clinic focused on COVID-19 patients;</li> <li>7. Clinic not focused on COVID-19 patients;</li> <li>8. OR or peri-operative area;</li> <li>9. Other procedure area;</li> <li>10. Other hospital area;</li> <li>11. Non-clinical area of hospital/clinic</li> <li>12. Not in hospital or clinic;</li> <li>13. Work from home: worked from home</li> </ol>	<p>Hierarchy to classify participant into one category (even if multiple job locations were selected) in the order below. Order based on anticipated encounters with COVID-19 positive patients.</p> <ol style="list-style-type: none"> <li>1. Emergency department: emergency department</li> <li>2. COVID-19 focused: medical-surgical focused on COVID-19 patients; ICU focused on COVID-19 patients; clinic focused on COVID-19 patients</li> <li>3. Inpatient not COVID-19 focused: medical-surgical-not focused on COVID-19 patients; ICU-not focused on COVID-19 patients</li> <li>4. Outpatient clinical: clinic not focused on COVID-19 patients</li> <li>5. OR/procedure: OR or peri-operative area; other procedure area</li> <li>6. Other hospital area: other hospital area</li> <li>7. No patient contact: non-clinical area of hospital/clinic; not in hospital or clinic</li> <li>8. Work from home: worked from home</li> <li>9. Not specified: no job location selected in survey</li> </ol>

**Supplement Table 1. *continued***

Factor	Data source	Survey question	Possible responses	Additional information
Workplace role	Survey	What is your job role?	<ol style="list-style-type: none"> <li>1. Advanced practice provider</li> <li>2. Environmental services</li> <li>3. Nurse</li> <li>4. Nurse technician</li> <li>5. Other direct care provider</li> <li>6. Other with no patient contact</li> <li>7. Physician</li> <li>8. Radiology technician</li> <li>9. Respiratory therapist</li> </ol>	
PPE use	Survey	While at work, please assess your use of workplace recommended personal protective equipment (PPE) while caring for patients with suspected or known COVID-19.	<ol style="list-style-type: none"> <li>1. Had numerous situations where I was not using recommended PPE;</li> <li>2. Wore PPE but unsure if I was always using properly;</li> <li>3. Always used recommended PPE and paid close attention to donning and doffing</li> </ol>	

NA: not applicable; ICU: intensive care unit; OR: operating room; PPE: personal protective equipment

**Supplement Table 2. Additional Descriptive Statistics for Survey Participants (n = 9610)**

<b>Factor</b>	<b>Total sample N. (%)</b>	<b>Seropositive N. (%)</b>
<b>SARS-CoV-2 testing</b>		
Week of serology testing		
4/19/2020	852 (8.9)	40 (4.7)
4/26/2020	1060 (11.0)	40 (3.8)
5/3/2020	874 (9.1)	52 (5.9)
5/10/2020	1954 (20.3)	126 (6.4)
5/17/2020	2270 (23.6)	172 (7.6)
5/24/2020	1721 (17.9)	57 (3.3)
5/31/2020	569 (5.9)	52 (9.1)
6/7/20 - 6/21/20	310 (3.2)	16 (5.2)
<b>Prior illness (fever or respiratory symptoms) since February 1, 2020 &amp; symptoms</b>		
Prior illness, no COVID-19 test		
No	7969 (82.9)	449 (5.6)
Yes	1641 (17.1)	106 (6.5)
Prior illness, negative COVID-19 test		
No	8882 (92.4)	511 (5.8)
Yes	728 (7.6)	44 (6.0)
Previous positive COVID-19 test		
No	9477 (98.6)	431 (4.5)
Yes	133 (1.4)	124 (93.2)
Previous illness (regardless of COVID-19 testing status)		
No	7191 (74.8)	298 (4.1)
Yes	2419 (25.2)	257 (10.6)
Any symptoms		
No	129 (1.3)	12 (9.3)
Yes	2290 (23.8)	245 (10.7)
Not applicable	7191 (74.8)	298 (4.1)
<b>Detailed job location</b>		
Job location (dichotomous)		
Medical-surgical- focused on COVID-19 patients	1160 (12.1)	83 (7.2)
Medical-surgical- not focused on COVID-19 patients	2024 (21.1)	120 (5.9)
ICU- focused on COVID-19 patients	1320 (13.7)	87 (6.6)
ICU- not focused on COVID-19 patients	1445 (15.0)	99 (6.9)
OR or peri-operative area	877 (9.1)	51 (5.8)
Other procedure area	609 (6.3)	40 (6.6)
Emergency department	1007 (10.5)	67 (6.7)
Other hospital area	1716 (17.9)	102 (5.9)
Clinic- focused on COVID-19 patients	267 (2.8)	16 (6.0)
Clinic- not focused on COVID-19 patients	2190 (22.8)	115 (5.3)
Non-clinical area of hospital or clinic	1582 (16.5)	84 (5.3)
Not in hospital or clinic	239 (2.5)	12 (5.0)
Work from home	895 (9.3)	42 (4.7)

ICU: intensive care unit; OR: operating room

**Supplement Table 3. Association of Demographic, Community, and Occupational Risk Factors With Seropositivity Incorporating Cumulative Incidence of COVID-19 by Residential ZIP Code Into Weights (*n* = 8582)**

<b>Factor</b>	<b>Adjusted (weighted, to adjust for participation)<sup>a</sup> OR (95% CI)</b>
<b>Demographic and community factors</b>	
Age group	
60+	1.0 (ref)
50-59	0.9 (0.5, 1.4)
40-49	1.1 (0.7, 1.8)
30-39	1.1 (0.7, 1.7)
<30	1.2 (0.7, 1.9)
Sex	
Female	1.0 (ref)
Male	1.2 (0.9, 1.7)
Race	
White	1.0 (ref)
Black	2.0 (1.6, 2.6)
Asian	1.3 (0.9, 1.8)
Multiracial	1.8 (0.8, 3.9)
American Indian/Alaska Native	2.7 (0.5, 14.2)
Native Hawaiian/Pacific Islander	-- <sup>c</sup>
Not specified	--
Ethnicity	
Non-Hispanic	1.0 (ref)
Hispanic	1.0 (0.5, 1.9)
Community contact with confirmed/suspected positive individual(s)	
No	1.0 (ref)
Yes	2.2 (1.5, 3.3)
Residential COVID-19 incidence <sup>b</sup>	1.6 (1.1, 2.4)
<b>Occupational factors</b>	
Caring for COVID-19 positive patient(s)	
No	1.0 (ref)
Yes	1.1 (0.7, 1.6)
Caring for patient(s) found to be COVID- 19 positive while not on isolation precautions	
No	1.0 (ref)
Yes	1.0 (0.6, 1.4)



**Supplement Table 3. *continued***

<b>Factor</b>	<b>Adjusted (weighted, to adjust for participation)<sup>a</sup> OR (95% CI)</b>
Contact with other healthcare worker found to be COVID-19 positive	
No	1.0 (ref)
Yes	1.4 (1.0, 1.9)
Workplace location	
No patient contact	1.0 (ref)
Work from home	1.5 (0.7, 3.6)
Other hospital area	1.2 (0.7, 2.2)
OR/procedure	1.0 (0.5, 1.9)
Outpatient clinical	1.4 (0.8, 2.4)
Inpatient not COVID-19 focused	1.2 (0.7, 2.1)
COVID-19 focused	1.2 (0.7, 2.3)
Emergency department	1.1 (0.6, 2.1)
Not specified	--
Workplace role	
Other with no patient contact	1.0 (ref)
Nurse	1.0 (0.6, 1.5)
Physician	1.2 (0.7, 2.1)
Other direct care provider	1.3 (0.8, 2.1)
Advanced practice provider	0.8 (0.4, 1.6)
Nurse technician	1.1 (0.5, 2.1)
Radiology technician	1.4 (0.6, 3.2)
Respiratory therapist	0.9 (0.2, 3.0)
Environmental services	2.5 (0.6, 9.5)
Not specified	--
Personal protective equipment use	
As recommended	1.0 (ref)
Not as recommended	0.8 (0.4, 1.8)
Unsure	0.5 (0.3, 1.0)
Not specified/not applicable <sup>d</sup>	1.1 (0.8, 1.5)

<sup>a</sup> Adjusted for all other factors shown in table and accounting for participation bias using inverse probability of participation weighting for age group, race, sex, and cumulative incidence of COVID-19 by residential zip code. Cumulative incidence of COVID-19 was divided by tertiles to assign participants into one of three categories.

<sup>b</sup> The base-10 logarithm of cumulative COVID-19 incidence in a participant's zip code two weeks prior to the date they were tested.

<sup>c</sup> Odds ratio suppressed due to small sample size

<sup>d</sup> The survey question about personal protective equipment use applied only to those in the clinical setting while caring for patients with suspected or known COVID-19. This question was therefore not applicable to some healthcare workers.

OR: odds ratio; CI: confidence interval, ref: reference group

**Supplement Table 4. Association of Demographic, Community, and Occupational Risk Factors With Seropositivity Limited to Participants With No Known Community Exposure to COVID-19 (*n* = 7887)**

<b>Factor</b>	<b>Adjusted (weighted, to adjust for participation)<sup>a</sup> OR (95% CI)</b>
<b>Demographic and community factors</b>	
Age group	
60+	1.0 (ref)
50-59	0.8 (0.6, 1.3)
40-49	1.1 (0.7, 1.6)
30-39	1.0 (0.7, 1.6)
<30	1.4 (0.9, 2.1)
Sex	
Female	1.0 (ref)
Male	1.3 (1.0, 1.8)
Race	
White	1.0 (ref)
Black	1.9 (1.5, 2.5)
Asian	1.2 (0.8, 1.7)
Multiracial	1.8 (0.9, 4.0)
American Indian/Alaska Native	1.5 (0.3, 6.9)
Native Hawaiian/Pacific Islander	-- <sup>c</sup>
Not specified	--
Ethnicity	
Non-Hispanic	1.0 (ref)
Hispanic	0.7 (0.3, 1.3)
Residential COVID-19 incidence <sup>b</sup>	1.6 (1.0, 2.3)
<b>Occupational factors</b>	
Caring for COVID-19 positive patient(s)	
No	1.0 (ref)
Yes	0.8 (0.6, 1.1)
Caring for patient(s) found to be COVID-19 positive while not on isolation precautions	
No	1.0 (ref)
Yes	1.2 (0.9, 1.7)

**Supplement Table 4. continued**

Factor	Adjusted (weighted, to adjust for participation) <sup>a</sup> OR (95% CI)
Contact with other healthcare worker found to be COVID-19 positive	
No	1.0 (ref)
Yes	1.3 (1.0, 1.8)
Workplace location	
No patient contact	1.0 (ref)
Work from home	1.1 (0.5, 2.5)
Other hospital area	1.5 (0.9, 2.5)
OR/procedure	1.1 (0.6, 1.9)
Outpatient clinical	1.4 (0.8, 2.4)
Inpatient not COVID-19 focused	1.3 (0.7, 2.2)
COVID-19 focused	1.9 (1.1, 3.3)
Emergency department	1.8 (1.0, 3.2)
Not specified	--
Workplace role	
Other with no patient contact	1.0 (ref)
Nurse	1.0 (0.7, 1.5)
Physician	1.0 (0.6, 1.5)
Other direct care provider	1.0 (0.6, 1.5)
Advanced practice provider	0.9 (0.5, 1.6)
Nurse technician	1.0 (0.5, 1.9)
Radiology technician	1.4 (0.7, 2.7)
Respiratory therapist	1.0 (0.4, 2.9)
Environmental services	0.6 (0.1, 2.8)
Not specified	--
Personal protective equipment use	
As recommended	1.0 (ref)
Not as recommended	1.0 (0.4, 2.2)
Unsure	0.8 (0.5, 1.4)
Not specified/not applicable <sup>d</sup>	1.0 (0.8, 1.4)

<sup>a</sup> Adjusted for all other factors shown in table and accounting for participation bias using inverse probability of participation weighting for age group, race, and sex.

<sup>b</sup> The base-10 logarithm of cumulative COVID-19 incidence in a participant's zip code two weeks prior to the date they were tested.

<sup>c</sup> Odds ratio suppressed due to small sample size

<sup>d</sup> The survey question about personal protective equipment use applied only to those in the clinical setting while caring for patients with suspected or known COVID-19. This question was therefore not applicable to some healthcare workers.

OR: odds ratio; CI: confidence interval, ref: reference group