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SARS-CoV-2 seroprevalence among health care workers in a New York City hospital: A cross-sectional analysis during the COVID-19 pandemic

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ABSTRACT

Background: New York City (NYC) has endured the greatest burden of COVID-19 infections in the US. Health inequities in South Bronx predisposed this community to a large number of infectious cases, hospitalizations, and mortality. Health care workers (HCWs) are at a high risk of exposure to the infection. This study aims to assess seroprevalence and the associated characteristics of consenting HCWs from an NYC public hospital.
Methods: This cross-sectional study includes serum samples for qualitative SARS-CoV-2 antibody testing with nasopharyngeal swabs for SARS-CoV-2; PCR and completion of an online survey capturing demographics, COVID-19 symptoms during the preceding months on duty, details of healthcare and community exposure, and travel history were collected from consenting participants in May 2020. Participants' risk of exposure to COVID-19 infection in the hospital and in the community was defined based on CDC guidelines. Travel history to high-risk areas was also considered an additional risk. The Odds Ratio with bivariable and multivariable logistic regression was used to assess characteristics associated with seroprevalence.
Results: A total of 500 HCW were tested, 137 (27%) tested positive for the SARS-CoV-2 antibody. Symptomatic participants had a 75% rate of seroconversion compared to those without symptoms. Subjects with anosmia and ageusia had increased odds of seroconversion in comparison to those without these symptoms. Community exposure was 34% among those who had positive antibodies.
Conclusion: Seroprevalence among HCWs was high compared to the community at the epicenter of the pandemic. Further studies to evaluate sustained adaptive immunity in this high-risk group will guide our response to a future surge.

Introduction

The United States currently has the highest number of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections globally, with the Bronx having the highest proportion of positive cases with an incidence of 850.2 hospitalizations per 100,000 persons in New York City (New York State Department of Health, 2020a). Black and Hispanic residents in the city had higher hospitalization rates and death due to COVID-19 (New York State Department of Health, 2020b). Older age and a higher number of comorbidities like chronic kidney disease, cancer, COPD, immune-compromised state, obesity, congestive heart failure, diabetes, and others increase the risk for adverse outcomes (Center for Disease Control and Prevention, 2020a). While most patients with SARS-CoV-2 infection have clinical presentations ranging from mild to severe respiratory illness, there is compelling evidence of asymptomatic and presymptomatic transmission of this infection, creating a breakdown of public health strategies to control the infection (Savvides and Siegel, 2020).

Antibodies to the spike (S) protein are considered to be the primary target of neutralizing activity following SARS-CoV-2

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infection, conferring protective immunity compared to the membrane (M), envelope (E), and nucleocapsid proteins (Buchholz et al., 2004). While there is a better understanding of the immunological response to SARS-CoV-2 infection, there is a lack of serological assays to specifically detect SARS-CoV-2 antibodies. There is data to suggest that in a high prevalence setting, the commonly available commercial assays can miss SARS-CoV-2 antibodies, and the sensitivity of these assays is insufficient to detect the neutralizing capacity of seropositive individuals (Mueller, 2020).

Following the first case of COVID-19 on March 1, 2020, in a matter of weeks, NYC hospitals experienced a surge in infections, straining resources and supplies, especially personal protective equipment (PPE), resulting in sub-optimal patient care situations for Health care workers (HCWs). Data about COVID-19 infections in US HCWs is limited. The CDC reported that about 55% of SARS-CoV-2 PCR positive HCWs reported exposure at work, with most of them being minimally symptomatic or asymptomatic (Center for Disease Control and Prevention, 2020b). Convenience sampling of 3000 people in NY State showed that 13.9–14.9% of the population have COVID-19 antibodies (New York State Department of Health and The Official website of New York State, 2020). A large cohort study of HCW in the greater NYC area showed a seroprevalence of SARS-CoV-2 antibodies at 13.7% (Moscola et al., 2020). A seroprevalence study of a representative sample of HCW from Spain during the pandemic peak showed 9.3% had antibodies to SARS-CoV-2, while a similar hospital-wide screening study from Belgium confirmed only 6.4% of the hospital staff had antibodies (Stadlbauer, 2020; Steensels et al., 2020). We present the results of a cross-sectional study to assess the seroprevalence of the SARS-CoV-2 IgG antibody among HCWs at a heavily impacted community hospital during the COVID-19 pandemic in NYC.

Methods

Study setting and population

The cohort included HCWs across all hospital services who worked at the level one trauma center in the South Bronx during the period from March 1 to May 1, 2020. The study received institutional review board approval (IRB # 20-009).

After informed consent was obtained, participants underwent qualitative serology testing (Abbott Architect SARS-CoV-2 IgG Assay, Abbott Park, IL 60064 USA) (Food and Drug Administration, 2020), a nasopharyngeal swab for SARS-CoV-2 (Bio-Reference Laboratories, Inc., Elmwood Park, NJ, USA) and completed an online survey. The Abbott Architect assay uses a qualitative Chemiluminescent microparticle immunoassay technology targeting the nucleocapsid antigen of the virus with a sensitivity of 100% (CI 95.8–100%) and specificity of 99.6 (CI 99–99.9%) (Food and Drug Administration, 2020). The online survey was accessed by a Unique Identification Number assigned to each participant, blinded to the research team to ensure confidentiality. The survey requested information on age, race/ethnicity, comorbidities, residential zip code, and healthcare and community exposure details. History, timing, and duration of symptoms of COVID-19 infection such as fever, cough, shortness of breath, anosmia, ageusia, myalgia, nausea, and/or diarrhea in the preceding 8–10 weeks were also requested.

The risk of exposures in the healthcare setting and community exposure was determined based on CDC guidelines (Centers for Disease Control and Prevention, 2020). Close contact for healthcare exposures is defined as being within approximately six feet of a person with COVID-19 for a prolonged period (such as caring for the patient or sitting within six feet of the patient in a waiting area or room) or having unprotected direct contact with infectious secretions or excretions of the patient (e.g., being coughed on, touching used tissues with a bare hand). High-risk exposure is defined as HCW who had prolonged close contact with COVID-19 patients who were not wearing a facemask while the HCW's nose and mouth were exposed to material potentially infected with the virus causing COVID-19 or being present in the room for procedures that generate aerosols or during which respiratory secretions are likely to be poorly controlled (e.g., cardiopulmonary resuscitation, intubation, extubation, bronchoscopy, nebulizer therapy, sputum induction) on patients with COVID-19 when the HCP's eyes, nose or mouth were not protected. Medium-risk exposure is defined as HCW who had prolonged close contact with patients with COVID-19 who were not wearing a facemask while the HCW nose and mouth were exposed to material potentially infectious with the virus causing COVID-19. Low-risk exposure includes brief interactions with patients with COVID-19 or prolonged close contact with patients who were wearing a facemask for source control while the HCP was wearing a facemask or a respirator with eye protection, where the addition of a facemask or respirator would further lower the risk of exposure. Individuals outside of healthcare settings with close contact (<6 feet) for $\geq$15 min to a person with COVID-19 who had symptoms (in the period from two days before symptom onset of a clinically compatible illness) or a person who has tested positive for COVID-19 (laboratory-confirmed), but were asymptomatic in the two days before the date of specimen collection until they met criteria for discontinuing home isolation, has community exposure. High-risk domestic travel areas were identified as California and Washington State, while the international high-risk areas were China, South Korea, Iran, Italy, and Spain.

Statistical analysis

Descriptive statistics were used to summarize the baseline characteristics of the cohort and key study outcome variables. Categorical variables were compared by the Chi–squared test and Student *t*-test for continuous variables. Missing data were imputed with the mean for continuous variables. Binomial logistic regression was used to calculate odds ratios and 95% CI for evaluating the association with seroprevalence of socio-demographic variables. Significant symptoms and exposure-related variables observed to be associated with seropositivity in a bivariate analysis (cut-off of $p < 0.15$) were independently assessed by multivariable logistic regression for its association with seropositivity, adjusting for all significant variables as covariates. A p-value of <0.05 was considered significant. All statistical tests were performed using SPSS version 17 (IBM, USA).

Results

Among the 659 participants screened for the study, 500 consented and underwent PCR and antibody testing, and 478 participants completed the survey. The participants who completed the survey were included in the evaluation and analysis of characteristics predisposing to seroprevalence. Overall study participants were female (69%), under the age of 40 (48%), Hispanic (28%), Asian and Caucasian (24%) racial/ethnic distribution, with 33% being physicians followed by nurses (30%). Hypertension, asthma/COPD, and diabetes were common comorbidities. Childhood BCG vaccination was reported by 43% of participants. Most participants lived in NYC boroughs and used either public transport or walked to work.

In our study group, 53% were asymptomatic. Symptomatic participants reported sore throat/sinusitis (67%), myalgia (57%), and fever (36%), with 39% having symptoms for up to two weeks. Most HCWs (85%) had a prior test for SARS-CoV-2 PCR, with 19% of

Table 1
Association of variables with seropositivity.

Characteristics	Total (N = 478)	IgG+ (N = 130)	IgG- (N = 348)	p	OR (95% CI)
Age					
From 20 to 39	230 (48%)	58 (25%)	172 (75%)	–	Ref
From 40 to 59	196 (41%)	60 (30%)	136 (70%)	0.210	0.76 (0.5–1.16)
>60	52 (11%)	12 (23%)	40 (77%)	0.740	1.12 (0.55–2.28)
Gender					
Female	329 (69%)	87 (26%)	242 (73%)	0.600	0.9 (0.67,1.24)
Male	149 (31%)	43 (29%)	106 (31%)		
Ethnicity					
Hispanic	132 (28%)	41 (31%)	91 (69%)	0.005	2.42 (1.3–4.5)
Black	87 (18%)	28 (32%)	59 (68%)	0.006	2.55 (1.3–5.02)
Asian	114 (24%)	30 (26%)	84 (74%)	0.050	1.9 (1.00–3.69)
Other race	30 (6%)	13 (43%)	17 (57%)	0.002	4.1 (1.7–9.9)
Caucasian	115 (24%)	18 (15%)	97 (85%)	–	Ref
Living conditions					
Alone	116 (24%)	30 (25%)	86 (75%)	0.800	0.93 (0.66–1.32)
With others	362 (76%)	100 (28%)	262 (72%)		
Housing					
Apartment/Condo	269 (56%)	83 (31%)	186 (69%)	0.040	1.37 (1.008,1.86)
Single family home	209 (44%)	47 (23%)	162 (78%)		
Means of travel to work					
Private transport	252 (53%)	60 (24%)	192 (76%)	–	Ref
Public transport[b]	204 (43%)	59 (29%)	145 (71%)	0.200	1.3 (0.85–1.98)
Walk to work	22 (4%)	11 (50%)	11 (50%)	0.010	3.2 (1.3–7.75)
Comorbidities					
Hypertension	81 (17%)	25 (31)	56 (69%)	0.400	1.06 (0.9,1.2)
Diabetes	31 (7%)	10 (32%)	21 (68%)	0.300	1.08 (0.8–1.3)
Heart failure	2 (0.5%)	1 (50%)	1 (50%)	0.400	1.4 (0.36–5.83)
Copd/Asthma	46 (10%)	18 (39%)	28 (61%)	0.080	1.21 (0.95–1.54)
Chronic kidney disease	3 (0.6%)	1 (33%)	2 (67%)	0.600	1.09 (0.49–2.43)
Cancer	3 (0.6%)	1 (33%)	2 (67%)	0.600	1.09 (0.49–2.43)
Rheumatological diseases	10 (2%)	4 (40%)	6 (60%)	0.270	1.21 (0.73–2.02)
History of BCG vaccine[c]	204 (43%)	63 (31%)	141 (69%)	0.120	1.09 (0.97–1.22)
History of symptoms of COVID					
Fever	80 (17%)	62 (78%)	18 (23%)	<0.001	3.68 (2.44–5.54)
Myalgias	128 (27%)	70 (55%)	58 (45%)	<0.001	5.84 (3.74,9.11)
Cough/Sorethroat/Sinusitis	150 (31%)	72 (48%)	78 (52%)	<0.001	4.3 (2.8,6.59)
Ageusia	61 (13%)	53 (87%)	8 (13%)	<0.001	29.25 (13.36–64.04)
Anosmia	65 (14%)	55 (85%)	10 (15%)	<0.001	24.79 (12.08–50.86)
Diarrhea	78 (16%)	35 (45%)	43 (55%)	<0.001	2.61 (1.58–4.32)
Nausea/Vomiting	41 (9%)	25 (61%)	16 (39%)	<0.001	4.94 (2.54,9.6)
Asymptomatic	253 (53%)	32 (13%)	221 (87%)	<0.001	0.19 (0.12–0.3)
Approximate duration of symptoms in days (IQR)[a]	7 (3–14)	14 (5–21)	5 (3–7)	<0.001	
<5 days	94 (20%)	26 (28%)	68 (72%)	–	Ref
6–14 days	77 (16%)	37 (48%)	40 (52%)	0.006	2.4 (1.2–4.5)
>14 days	47 (10%)	37 (79%)	10 (21%)	<0.001	9.6 (4.2–22.2)
Type of PPE used[d]					
N95 only	76 (16%)	19 (25%)	57 (75%)	0.300	0.87 (0.5,1.54)
Surgical mask only	109 (23%)	39 (36%)	70 (64%)	0.020	1.7 (1.08,2.69)
N95 and surgical mask	361 (75%)	90 (25%)	271 (75%)	0.050	0.64 (0.41,1)
Face shield and goggles	329 (69%)	77 (23%)	252 (77%)	0.004	0.55 (0.36,0.84)
None	2 (0.4%)	1 (50%)	1 (50%)	0.470	2.69 (0.17,43.2)
Nature of work					
Physician	157 (33%)	39 (25%)	118 (75%)	–	Ref
Nurse	142 (30%)	40 (28%)	102 (72%)	0.510	1.18 (0.7–1.9)
Ancillary service	72 (15%)	20 (28%)	52 (72%)	0.600	1.1 (0.62–2.1)
Others	107 (22%)	31 (29%)	76 (71%)	0.450	1.2 (0.71–2.1)
Health care worker exposure[e]					
High and moderate	65 (14%)	25 (38%)	40 (62%)	0.710	1.84 (1.06,3.18)
Low	413 (86%)	105 (25 %)	309 (75%)		
Community exposure[f]	119 (25%)	44 (37%)	75 (63%)	0.005	1.86 (1.19–2.9)
Location of residence					
Manhattan	79 (17%)	22 (28%)	57 (72%)	–	Ref
Bronx	154 (32%)	41 (27%)	113 (73%)	0.840	0.94 (0.51–1.7)
Brooklyn	20 (4%)	7 (35%)	13 (65%)	0.530	1.39 (0.49–3.95)
Queens	39 (8%)	12 (31%)	27 (69%)	0.740	1.15 (0.49–2.66)

Table 1 (*Continued*)

Characteristics	Total (N = 478)	IgG+ (N = 130)	IgG- (N = 348)	p	OR (95% CI)
Long island	19 (4%)	6 (32%)	13 (68%)	0.740	1.19 (0.40–3.5)
Upstate NY	11 (2%)	2 (18%)	9 (82%)	0.500	0.57 (0.11–2.87)
New Jersey	47 (10%)	9 (19%)	38 (81%)	0.270	0.61 (0.25–1.47)
Westchester county NY	24 (5%)	7 (29%)	17 (71%)	0.900	1.06 (0.38–2.92)
Rest of the country	85 (18%)	24 (28%)	61 (72%)	0.900	1.01 (0.51–2.01)
Travel history[g]					
Domestic (High risk)	26 (5%)	3 (12%)	23 (88%)	0.040	0.18 (0.03–0.96)
International (High risk)	19 (4%)	5 (26%)	14 (74%)	0.340	1.9 (0.38–9.44)

[a] IQR-Interquartile Range.
[b] Public Transport includes: Subway, Taxi or Bus.
[c] BCG Vaccine received in childhood.
[d] PPE: Personal Protective Equipment.
[e] High-Risk HCW defined as: HCP who had prolonged close contact with patients with COVID-19 not wearing a facemask while the HCP nose and mouth were exposed to material potentially infectious with the virus causing COVID-19 OR Being present in the room for procedures that generate aerosols or during which respiratory secretions are poorly controlled when the HCP's eyes, nose, or mouth were not protected. Moderate Risk HCW was defined as: HCP who had prolonged close contact with patients with COVID-19 who were not wearing a facemask while the HCP nose and mouth were exposed to material potentially infectious with the virus causing COVID-19. Low-Risk HCW was defined as: Brief interactions with patients with COVID-19 or prolonged close contact with patients who were wearing a facemask for source control while the HCP was wearing a facemask or respirator.
[f] Community Exposure defined as: Individual had close contact (<6 feet) for ≥15 min to a person with COVID-19 who had symptoms or a Person who has tested positive for COVID-19 but were asymptomatic.
[g] High-Risk Domestic locations include: California and Washington state. High-Risk International locations include: China, South Korea, Iran, Italy, and Spain.

those being positive. Among the HCWs involved in direct patient care, 14% had high/moderate risk exposure. Community exposure due to household contact with COVID-19 was present in 18% of the participants.

Risk factors and seropositivity

In the overall cohort, the prevalence of SARS-CoV-2 IgG antibodies was 27% (137/500). Of the participants that completed the survey, 130 were positive for IgG antibodies. Ninety-eight (75%) of the 130 participants with positive antibodies had COVID-19-like symptoms in the preceding ten weeks. Among the symptomatic participants, 44% (98/225) were seropositive compared to 13% (32/253) without symptoms.

Table 1 shows the distribution of covariates with respect to SARS-CoV-2 IgG positivity. Race was significantly associated with seropositivity with an unadjusted odds ratio of 2.42 (95% CI 1.3–4.5; p = 0.005) for Hispanics and 2.55 (95% CI 1.3–5.02; p = 0.006) for Blacks when compared to Caucasians. The unadjusted odds ratio for seropositivity was significantly higher for anosmia (29.25; CI 13.36–64.04; p < 0.001) and ageusia (24.79; CI 12.08–50.86; p < 0.001) (Figure 1). On multivariate analysis (Table 2), HCWs who reported symptoms of fever, ageusia, and anosmia were 7.4, 3.3, and 5.5 times, respectively, likely to be seropositive compared to those without the aforesaid symptoms. Participants with symptoms above 14 days were 4.3 times more likely to be seropositive than those with symptoms less than five days. High and moderate risk of exposure was twice as likely to be associated with seropositivity than low risk.

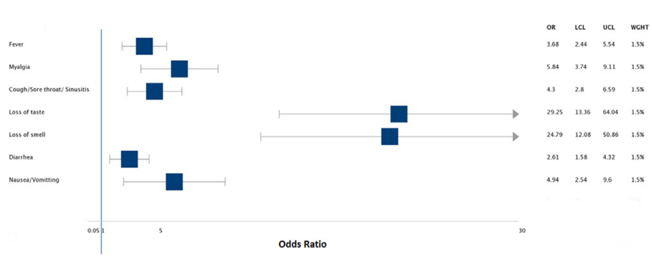

Figure 1. Association between symptomatology and seroconversion.

Correlation of point seroprevalence with SARS-CoV-2 PCR results and prior PCR status

Based on the viral PCR and antibody testing results, three subgroups of the cohort were identified (Figure 2). Of the 130 participants who were antibody positive, 105 had a negative SARS-CoV-2 PCR during the study. In this subgroup, 60 subjects had prior PCR positivity, with 50 being symptomatic. Twenty-two of the 25 subjects who were both PCR and antibody-positive at the time of the study had prior PCR positivity, with 18 reporting symptoms of COVID like illness. Among 348 participants who tested negative for viral PCR and anti-SARS-CoV-2 antibody at the time of testing, 285 (82%) did not report any detectable viral RNA anytime in the past three months (study period) with predominantly low-risk healthcare exposure (255/347–73%). This subcohort was younger participants less than 40 years of age, without any significant comorbidities, and of these, 98 (35%) reported sore throat/ sinusitis (62/98) and myalgia (46/98). Seven participants with prior positive PCR, including four who were symptomatic, were seronegative at the time of this study. Both groups had low-risk healthcare exposure.

Discussion

We report the seroprevalence of SARS-CoV-2 in a cross-sectional sample of HCWs who worked on the frontlines in one of NYC's public hospitals. The 27% seroprevalence in our high-risk cohort is comparable to 24.4% observed in a cross-sectional study of 554 HCWs from a hospital in the UK (Shields, 2020). Recent data from a university hospital in the US support the considerably higher prevalence of COVID-19 infection among HCWs in comparison with non-HCWs (7.3% vs. 0.4%) (Barrett, 2020). In a similar vein, a previous study done during the influenza A (H1N1) pandemic that occurred in 2009, wherein a multicenter study to evaluate seroprevalence before and after vaccination, showed that first-responders that interacted with five or more infected patients mounted a significantly higher seropositivity (Aguilar-Madrid et al., 2015). The evaluation of SARS-CoV2 antibody levels among 40,329 HCW in an extensive hospital system in the greater NYC area showed a 13.7% seroprevalence.

In contrast, another large retrospective cross-sectional analysis of SARS-CoV-2 seroprevalence in a comparative group including patients with COVID-19 infections and a representative sample

Table 2
Adjusted Associations of seropositivity with participant characteristics using Multivariate Linear Regression.

Characteristics	Prevalence (%)	IgG seropositivity OR (95% CI)	p-value
Ethnicity			
Hispanic	31%	1.32 (0.6–2.89)	0.480
Black	32%	1.5 (0.62–3.58)	0.360
Asian	26%	0.90 (0.39–2.07)	0.820
Other races	43%	2.59 (0.86–7.73)	0.080
Caucasian	15%	Ref.	
Means of travel			
Public	29%	0.84 (0.47–1.52)	0.580
Walk to work	50%	2.29 (0.69–7.54)	0.170
Private	24%	Ref.	
Healthcare exposure high and moderate risk	38%	2.0 (0.99–4.25)	0.050
Community exposure	37%	1.27 (0.68–2.36)	0.440
Symptoms			
Fever	78%	7.43 (3.33–16.57)	<0.001
Cough/Sore throat/Sinusitis	48%	1.04 (0.5–2.18)	0.900
Myalgia	55%	1.40 (0.66–2.9)	0.370
Ageusia	87%	3.35 (1.03–10.8)	0.040
Anosmia	85%	5.57 (1.88–16.5)	0.002
Nausea	61%	1.64 (0.57–4.6)	0.350
Diarrhea	45%	0.50 (0.20–1.21)	0.120
Duration of symptoms			
>14 days	79%	4.3 (1.4–12.90	0.008
6 to 14 days	48%	1.19 (0.49–2.91)	0.690
<5 days	28%	Ref.	

IgG negative was considered as the reference category for seroconversion.

from the general population confirmed the presence of seropositive samples in late February, suggesting that SARS-CoV-2 infection was present in the NYC metropolitan area before March 1 (Moscola et al., 2020; Stadlbauer, 2020). The representative sample's seroprevalence was 19.3% in late April, suggesting low community seroprevalence (Stadlbauer, 2020). We believe the higher seroprevalence seen in our cohort could be a combination of healthcare and community exposure as our hospital was the “epicenter of the epicenter” during the pandemic, and most of the HCWs lived in and around NYC.

In our analysis, after adjustment for baseline characteristics, on multivariate regression analysis, we did not find any racial/ethnic predisposition to seropositivity among HCW. On the contrary, there has been published data favoring an association of SARS-CoV-2 seropositivity in non-Hispanic blacks and Hispanics when compared to whites in the general population (Biggs, 2020; Feehan, 2020; Killerby, 2020; Menachemi, 2020). The reasons for this disparity could be factors related to social determinants of health, increased comorbidities, and a higher likelihood of people from these communities to be essential workers, increasing their risk of exposure to the infection (Gould and Wilson, 2020).

We observed a difference in seropositivity among prior symptomatic and asymptomatic HCWs (44% vs. 13%), similar to a cross-sectional study of HCWs from the UK (35.8% vs. 17.1%) (Shields, 2020). The persistence of PCR positivity in 22 of the 25 seropositive participants seemed less likely to be infectious, though we do not have viral load estimation to corroborate. As has been shown in previous studies, ageusia and anosmia were positively associated (OR > 24) with seropositivity (Garcia-Bastiero et al., 2020). The lower seropositivity rates among asymptomatic participants suggest that developing the disease following the infection was an important factor influencing the presence of antibodies. Among the 43% (204/478) of participants who had received BCG vaccination in childhood, 63 (31%) developed antibodies to SARS-CoV-2 compared to 27% seropositivity in the entire cohort; the difference was, however, not significant.

Multiple studies on prevalence in the community and among HCW have shown a wide-range of seropositivity for SARS-CoV-2 antibodies in the NYC area ranging from 6.9% to 27%, which is well below the estimated 67% needed to achieve herd immunity to SARS-CoV-2 (Fontanet and Cauchemez, 2020). Hence implementation of protocols and workflows to reduce exposure and transmission among HCWs must be implemented to protect the frontline HCWs during a second surge. Screening and triage of everyone entering the healthcare facility for signs and symptoms of COVID-19, revaluation of admitted patients for signs and symptoms of COVID-19, implementation of universal source control measures including the use of facemasks among all patients/visitors to the hospital, use of facemasks by all HCWs at all times, continued physical distancing and implementation of universal use of personal protective equipment are some of the strategies recommended by CDC. Appropriate use of telemedicine for consultations, primary care visits, and communications with family members of hospitalized patients is a valuable resource during the pandemic (Cianetti et al., 2020).

The Abbott SARS-CoV-2 antibody assay detected the presence of IgG against SARS-CoV-2 nucleocapsid protein. A recent study comparing performance characteristics of various commercially available antibody tests in a high prevalence area has shown that currently available test systems missed a large proportion of antibodies as the sensitivities were insufficient for detecting everyone with neutralizing antibodies (Mueller, 2020).

Our study has several limitations. First, it is a single-center design with voluntary participation and subject characteristics collected via a self-reported online survey. Second, data about symptoms within the previous 8–10 weeks were collected, resulting in the possibility of self-report bias. Third, we were unable to perform a quantitative analysis of SARS-CoV-2 IgG and

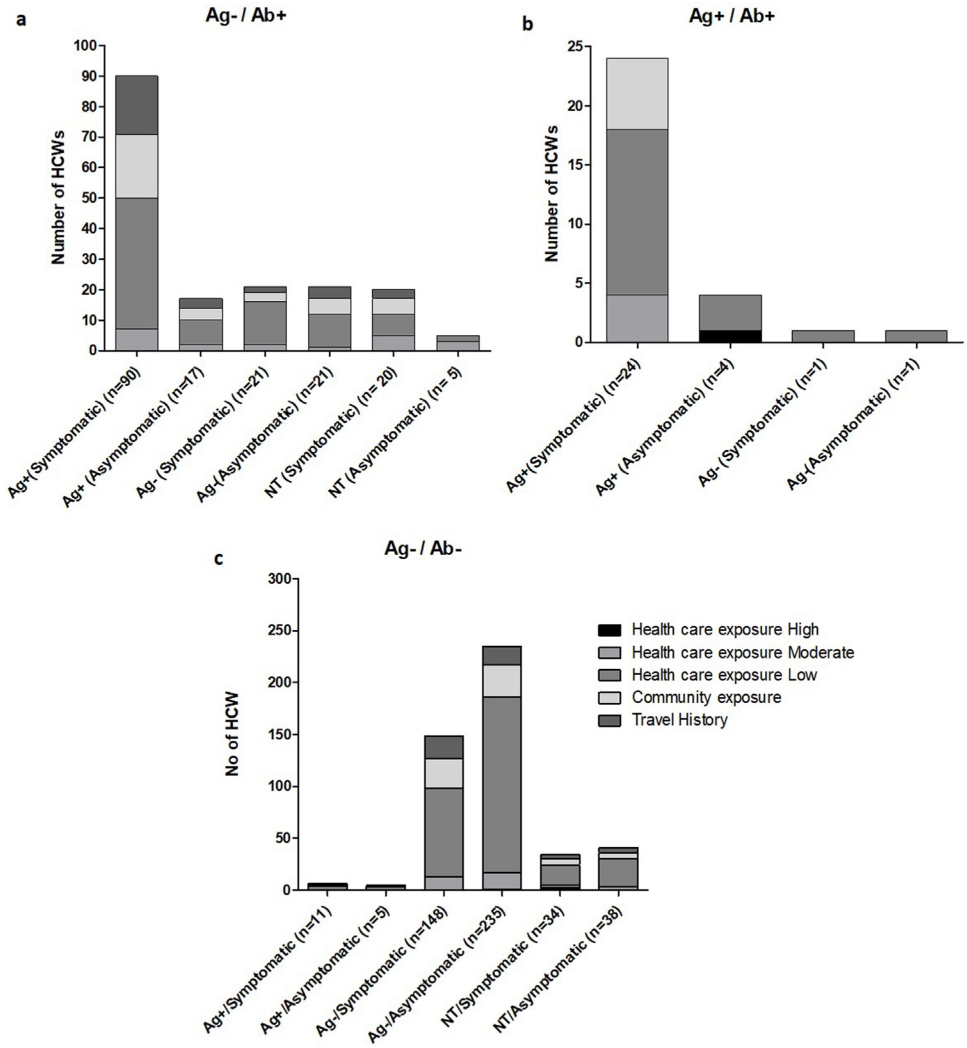

Figure 2. Antigen (PCR) and antibody (IgG) results compared to the history of prior PCR results and symptoms in HCWs. (a) Ag−/Ab+ groups, N = 144; (b) Ag+/Ab+ groups, N = 30; and (c) Ag−/Ab− groups, N = 426. HWC, healthcare workers.

neutralizing antibodies to complete the evaluation of seroprevalence at this time. Fourth, there remains a possibility that we could have missed seroconversion in a group of subjects based on the timing of the study since IgM tests were not performed, which could reflect more recent infections as compared to IgG. Fifth, we were able to receive only 478 surveys among our tested 500 participants, which could also contribute to bias. Finally, we did not determine dynamic antibody responses at this time, though we plan it for the future.

In conclusion, HCWs tested after the initial surge following the COVID-19 pandemic, have demonstrated a higher seroprevalence compared to the community in NYC. Symptomatic participants had a higher rate of seropositivity compared to those without symptoms. A combination of healthcare and community exposure likely contributed to the seroprevalence. While the present assessment might not be an accurate indicator of immunity to the SARS-CoV-2 virus due to barriers in the testing method, the timing of the testing, etc., further studies are warranted to better understand our adaptive immune response.

Conflict of interest

None declared.

Author contribution

UV, VD and VM conceptualized and visualized the study, in addition to working with the team on data curation, formal analysis, designing the methodology, writing the original draft and review & editing. NJ, SR, MJ, MA, and SM worked on data curation, validation, project administration, formal analysis, and writing - original draft. MAS and AMB were involved in executing the methodology of the study with project administration, use of resources, supervision and validation of data curation, formal analysis, and writing the original draft, with review & editing the manuscript. AP, NS and MK were involved in supervision, validation, methodology, project administration, and writing - review & editing the manuscript. All authors approved the final version of the submission with review and editing.

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analysis, and writing the original draft, with review & editing the manuscript. AP, NS and MK were involved in supervision, validation, methodology, project administration, and writing - review & editing the manuscript. All au-thors approved the final version of the submission with review and editing.

Ethical approval

The study protocol was approved by the Institutional Review Board Committee (IRB# 20-009) on 5/1/2020. All patients provided written, Informed Consent to participate in the study.

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