**Article Type: Concise Communication**

**Seroprevalence of SARS-CoV-2 Antibodies Among Healthcare Workers With Differing Levels of COVID-19 Patient Exposure**

Abbreviated title: SARS-CoV-2 Antibodies in Healthcare Workers

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Word Count: 1,191

**ABSTRACT**

Healthcare employees were tested for antibodies against SARS-CoV-2. Among 734 employees, the prevalence of SARS-CoV-2 antibodies was 1.6%. Employees with heavy COVID-19 exposure had similar antibody prevalence as those with limited or no exposure. Guidelines for PPE use seem effective for preventing COVID-19 infection in healthcare workers.

## INTRODUCTION

There has been concern and disagreement about what personal protective equipment (PPE) is required to safely protect front line providers from the SARS-CoV-2 virus.[1,2] Recommendations have changed and angst has been fueled by a lack of respirators and other PPE in several countries.[1,3] Front line healthcare workers (HCWs) in COVID-19 units may have a higher rate of infection than those in the general population.[4] Our institution follows the World Health Organization (WHO) guidelines for PPE in the SARS-CoV-2 pandemic, including universal masking, with respirator (N-95 or equivalent) utilization only during approved aerosol generating procedures.[5] The seroconversion rate among front line providers could provide valuable information regarding the effectiveness of our PPE strategy.

The goal of this investigation was to compare the proportion of people with SARS-CoV-2 antibodies among a large group of healthcare employees with differing levels of exposure to patients with COVID-19. We also sought to compare the prevalence of confirmed COVID-19 infection in healthcare workers with that of the general population in the state, which at the time was approximately 2.8%[6]

## METHODS

This study was granted approval under exempt status by the local Institutional Review Board.

**Participants and Settings**

Indiana University Health is a large, integrated healthcare system with 17 hospitals and approximately 35,000 employees across the state of Indiana. We deployed 760 antibody tests to employees from 18 different locations, including 14 hospitals, 3 outpatient centers, and an administrative building where employees have no patient exposure. Hospitals were categorized as high risk if they had admitted a total of at least 30 confirmed cases of COVID-19, and low risk if they had admitted fewer than 30. Six of 14 hospitals were thus deemed high-risk.

Open invitations to volunteer for serology testing were sent via email to groups of employees at each setting. For healthcare settings with direct patient contact, the number of tests allocated to each setting was stratified by patient volume. Employees with active symptoms or previously confirmed COVID-19 were excluded. At clinical sites, all providers, nurses, and respiratory therapists were invited to participate. Since we were testing for IgG, asymptomatic employees who tested positive were not asked to quarantine

or take off work. After invitations were sent, volunteers responded by email and were accepted on a first come – first serve basis until the tests allocated to that setting were all accounted for. For hospital settings, invitations were only extended to groups of employees with high-risk patient exposure: intensive care unit (ICU), ED, or hospitalist physicians, advanced practice providers, nurses, and respiratory therapists. For high prevalence settings, serology testing was only offered to those working in the ED or on COVID units.

**Testing**

All antibody testing was performed on serum samples using the Emergency Use Authorization granted Abbott Architect i2000SR chemiluminescent microparticle immunoassay for the qualitative detection of SARS-CoV-2 IgG antibody. This test was approved by the Food and Drug Administration based on data showing 99.6% specificity and 100% sensitivity for patients with confirmed COVID-19 who had more than 14 days of symptoms. Serology testing was performed at one centralized laboratory between April 29, 2020, and May 8, 2020.

**Statistical Analysis**

Seroprevalence was stratified by high versus low risk work environment, and role (nurse, administration, physician/provider, or respiratory therapist). Comparative rates are reported as relative risk (RR) with 95% confidence intervals (CIs), calculated by Taylor series. The preplanned comparisons were high risk versus low risk setting, nurses (thought to be highest risk secondary to spending the most time with direct patient contact) versus all others, and administration (no patient contact) versus all others.

**RESULTS**

Of 760 individuals who volunteered for antibody testing, 734 (96.6%) completed the study. The average age was 43 years and 70.1% were female.

Twelve employees (1.6%) tested positive for SARS-CoV-2 IgG antibodies. Employees from high-risk settings comprised 52.5% of those tested and had a 1.3% positive rate (5/385), compared to 2.0% in low-risk employees (7/349). The difference in rates was not statistically significant (RR = 0.65; 95% CI = 0.21 to 2.0). Nurses had a similar rate of positive cases to other employees (2.2% vs. 1.2%; RR = 1.9, 95% CI = 0.60 to 5.8). Of 44 administrative staff with no patient contact, 2 were positive, for a rate of 4.5%, which was not statistically significantly different than patient facing employees (RR = 3.1, 95% CI = 0.71 to 13.9).

**DISCUSSION**

We found a low rate of antibodies to SARS-CoV-2 among a large group of healthcare employees, including those with exposure to a large number of COVID-19 patients. Further, HCWs did not appear to be at higher risk than employees with no patient contact or the general population. At the time our study was being carried out, the Indiana State Health Department performed serologic and PCR testing across the state. Among 4000 randomly selected volunteers, they found a prevalence of 2.8%,[6] similar to our population of largely high-risk HCWs. Workers with previously confirmed COVID-19 infection were excluded from our study. However, at the time that we began the study, only 1.3% of total employees had tested positive for COVID-19. Adding this to our seroprevalence yields a 2.9% infection rate, almost identical to that found in the general population in Indiana.

Perhaps the most interesting finding in our study was that HCWs with the most exposure to COVID-19 patients were not higher risk for developing antibodies than employees with little to no work-related COVID-19 exposure. Other studies have suggested front line HCWs are more likely to have antibodies or test positive for active COVID-19 than the general population.[4] This may be attributable to our institutional application of WHO guidelines for PPE use.[5] Respirators (N-95) were utilized only for aerosolizing procedures, (intubation, use of nebulizers, bronchoscopy) so as to conserve high level PPE. Early in the pandemic, the prevalence of SARS-CoV-2 was much lower in the state than in other areas with more dense populations that were earlier hit, such as Seattle, California, and New York. This gave our hospital system additional time to prepare, which also may have= contributed to a low infection rate among HCWs.

There are several limitations to this cross sectional study. Employees were included based on volunteering to participate. Volunteers may have had more reason to think they could be positive than those who did not volunteer. While the overall number of people tested was, to our knowledge, the largest group of HCWs in a single study to date, the number of administrative employees (those with no patient contact) was small (44), resulting in large confidence intervals around the relative risk for them compared to front line HCWs. At the time this study was carried out, our hospital system had seen roughly 1000 confirmed COVID-19 patients, representing a very different environment than that seen in very hard hit areas such as New York City. Our results may not extrapolate to settings with overwhelming numbers of community

COVID-19 infections.

In conclusion, we found a low prevalence of seroconversion to indicate previous SARS-CoV-2 infection among a large group of healthcare employees without a pre-existing diagnosis of COVID-19. Front line HCWs with heavy exposure to infected patients did not have higher rates of seroconversion than employees with little or no patient exposure.

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**Table: Results by employee title**

|  | Positive (n=12) | Negative (n=722) | Total (n=734) |
|---|---|---|---|
| **Age (mean, yrs)** | 44.5 | 42.7 | 42.8 |
| **Gender (%female)** | 75% | 70% | 70% |
| **Physician/APP** | 3 | 276 | 279 |
| **RN** | 7 | 310 | 317 |
| **RT** | 0 | 94 | 94 |
| **Admin** | 2 | 42 | 44 |
| **Total** | 12 | 722 | 734 |