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SARS-CoV-2 exposures among healthcare workers in New York City

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Background	Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had a significant impact on hospitals, including the occupational health departments in charge of handling healthcare worker (HCW) staffing during high rates of exposure and infection of HCWs. HCWs who were exposed to a patient or community member infected with SARS-CoV-2 were required to isolate from work for a minimum of 14 days from the date of exposure.
Aims	This study was aimed to assess the relative risk of SARS-CoV-2 infection following different types of workplace and community exposures.
Methods	We analyzed the details of workplace and community exposures of HCWs to SARS-CoV-2 at Montefiore Medical Center in New York between 22 June 2020 and 22 November 2020.
Results	Of 562 HCW SARS-CoV-2 exposures analyzed, 218 were from the community and 345 were from the workplace. Twenty-nine per cent of community exposures resulted in infection, which was significantly greater than workplace exposure infection (2%). Household community exposures resulted in a larger frequency of infection than non-household community exposures. Of the seven infections after workplace exposures, five had qualifying exposures to a co-worker and two were exposed to an infected patient during a non-aerosolized procedure.
Conclusions	HCW exposure to SARS-CoV-2 continues to present staffing challenges to healthcare systems. Even with deviations from standard personal protective equipment protocol, workplace exposures resulted in low frequencies of infection. In our study, the primary source of HCW infection was exposure in the community. Our findings support investing in efforts to educate around continued masking and social distancing in the community in addition to interventions targeted at addressing vaccine hesitancy.
Key words	healthcare worker; hospital administration; occupational health; prevention and control; SARS-CoV-2.

Introduction

Avoiding transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) remains a priority for all healthcare settings. Infection prevention measures like proper personal protective equipment (PPE) adherence, hand hygiene and contact tracing to identify and mitigate high-risk exposures remain a central strategy to fight coronavirus disease 2019 (COVID-19). The New York State Department of Health (NYSDOH) and Centers for Disease Control and Prevention (CDC) have defined criteria for exposures in the workplace and in the community [1,2]. The goal of this study was to analyse the SARS-CoV-2 exposures of healthcare workers (HCWs) at a large, urban, academic medical centre to better understand the likelihood of subsequently testing positive for SARS-CoV-2.

Key learning points

What is already known about this subject:

- Increased duration and proximity to people with COVID-19 is known to be a risk for COVID-19.
- Healthcare workers' use of personal protective equipment and hand hygiene decrease the risk of COVID-19.
- Studies show an increased risk of infection for healthcare workers caring for COVID-19 patients and that proper personal protective equipment is effective in preventing transmission.
- It is less clear which specific exposures put healthcare workers at greatest risk now that advances were made in availability of personal protective equipment, testing and contact tracing.

What this study adds:

- COVID-19 exposures at the healthcare workplace led to a much lower frequency of SARS-CoV-2 transmission than expected.
- Community exposures to COVID-19 led to a much higher frequency of SARS-CoV-2 positivity than exposures from the healthcare workplace.

What impact this may have on practice or policy:

- Healthcare facilities should focus efforts on mitigating community risk for their healthcare workers, including programs to overcome vaccine hesitancy and education around community spread.
- Workplace exposures continue to happen even with increased availability of PPE and enhanced knowledge around transmission.
- Continued efforts to promote vaccination, universal masking and social distancing during times where SARS-CoV-2 is prevalent remain necessary.

Methods

This retrospective cohort study analysed all community and workplace SARS-CoV-2 exposures reported to Occupational Health and Safety (OHS) at Montefiore Medical Center in New York between 22 June 2020 and 22 November 2020. Before June 2020, HCWs were not quarantined after all exposures due to critical staffing issues. After November 2020, the exposure quarantine duration was shortened, there was increased community interaction during holidays, and vaccination began.

Exposures reported to OHS by HCWs and additional results of workplace contact tracing investigations by Infection Prevention and Control (IPC) were included in the analysis. The details of all exposures were documented in an OHS REDCap database hosted at Albert Einstein College of Medicine [3]. All HCWs were offered diagnostic testing and were required to quarantine at home for a minimum of 14 days following the exposure regardless of symptoms. This study considered only diagnostic testing completed within 14 days of exposure.

The NYSDOH generally aligns with the CDC on exposure definitions, but the definitions changed a few times and the NYSDOH was ultimately more conservative during our study period [1,2,4]. Exposures were defined as being within 6 feet of an infected individual for greater than 10 min over a 24-h period [2]. Community exposures use these criteria regardless of masking status. Workplace exposures were stratified into four workplace categories: (i) exposures from aerosol-generating procedures (AGPs), (ii) exposures from patients without an AGP (non-AGP), (iii) exposures between HCWs who share a workspace and (iv) exposures between HCWs over a break or mealtime. Patient AGP exposures were defined as the HCW not wearing a gown, gloves, eye protection and/or N95 respirator for any amount of time during patient care. The remaining exposure types were when the HCW or index case was not wearing a mask. If the index case was not masked, but the HCW had both a mask and eye protection, the HCW was not considered exposed [1].

Fischer's exact tests were used to compare percentages of infection between exposure categories. All analyses were performed using Stata (version 11.2, StataCorp, College Station, TX, USA). This study was approved by the affiliated Institutional Review Board.

Results

A total of 562 HCWs met study criteria: 218 (39%) had community exposures and 344 (61%) had workplace exposures.

Sixty-four (29%) of the community exposures tested positive for SARS-CoV-2 in the 14 days after exposure. Of the community exposures, 129 (59%) were from household members. When exposed to a household member, 42 (33%) tested positive versus 22 (25%) of 89 community exposures to non-household members (Table 1).

Seven (2%) workplace exposures tested positive for SARS-CoV-2 within 14 days following exposure. Of the workplace exposures, 59 (17%) were 'patient AGP', of which none had positive tests, and 106 (31%) were 'patient non-AGP', of which 2 (2%) had positive tests.

Table 1. Frequency of testing positive for SARS-CoV-2 infection by exposure type

	Total	Positive, *n* (%)
Total	562	71 (13)
Community	218	64 (29)
Household[a]	129	42 (33)
Non-household	89	22 (25)
Workplace	344	7 (2)
Patient	164	2 (1)
AGP	59	0 (0)
Non-AGP	105	2 (2)
HCW–HCW	180	5 (3)
Shared workspace	59	4 (7)
Meals or break	121	1 (1)

[a]Thirty-five of the 42 (83%) who tested positive after a household exposure either initially tested negative, did not work during the exposure window, or had documentation of symptoms that developed after identification of the index case.

Fifty-nine (17%) were 'shared workspace,' of which four (7%) had positive PCR tests. One hundred twenty-one (35%) were 'meals or break', of which one (1%) had a positive PCR test (Table 1).

SARS-CoV-2 positivity following workplace exposures when the specific PPE is not used is presented in Table 2. The two HCWs who tested positive after 'patient non-AGP' exposures were not wearing eye protection while interacting with unmasked patients. Five HCWs tested positive after 'HCW–HCW' exposures. Four of these cases involved both co-workers being unmasked. In the fifth case, the HCW was masked but the index case was not.

Using Fischer's exact test, we identified that HCWs with community exposures had a significantly higher risk of having a positive SARS-CoV-2 test in the 14 days following their exposure than HCWs with workplace exposures ($P < 0.001$).

Table 2. Frequency of COVID-19 infection by workplace exposure type and PPE deviation

	Total	Positive, *n* (%)
Patient	165	2 (1)
AGP	59	0 (0)
Missing N95[a]	19	0 (0)
Missing eye protection	19	0 (0)
Missing gown	49	0 (0)
Missing gloves	3	0 (0)
Non-AGP	106	2 (2)
Missing HCW mask	0	0 (0)
Missing patient mask or HCW eye protection	106	2 (2)
HCW–HCW	180	5 (3)
Shared workspace	59	4 (7)
Both mask-less	40	3 (8)
HCW masked, index case mask-less	16	1 (6)
HCW mask-less, index case masked	3	0 (0)
Meals or break	121	1 (1)
Both mask-less	116	1 (1)
HCW masked, index case mask-less	4	0 (0)
HCW mask-less, index case masked	1	0 (0)

[a]All 19 HCWs who had patient AGP exposures due to missing an N95 respirator wore surgical masks during the exposure.

Discussion

This study found a very low frequency of transmission of SARS-CoV-2 after qualifying workplace exposures. But similar to other studies [5–8], we found that community exposures, particularly those in the household, resulted in a high frequency of SARS-CoV-2 transmission. Our findings also align with Lentz *et al.*, who showed that routine contact had a higher risk of nosocomial transmission to HCWs than AGPs [8].

Of the 345 workplace exposures, only 7 resulted in positive SARS-CoV-2 tests. Five were after exposure to a co-worker and two were after patient exposures. Both of these types of exposures have previously been identified as potential sources of spread in hospitals [9,10], but these frequencies are still low. The pace of healthcare delivery may not allow for prolonged co-worker interactions and shorter exposure times could partially account for the lower transmission seen versus community exposures. Although total numbers are low, longer duration could explain why exposures from shared offices had a higher frequency of SARS-CoV-2 transmission than exposures from meals and breaks. Our study suggests that even when PPE strategies break down, workplace exposures in healthcare are lower risk than anticipated regardless of whether the index case is a patient or co-worker and the PPE deviations.

A limitation of our study was the reliance on HCWs to self-report community exposures. Workplace exposures are typically revealed during contact tracing but are still subject to recall bias. Additionally, our study took place prior to the emergence of new variant strains of SARS-CoV-2 and prior to vaccination availability.

Our analysis showed that exposure in the community, not the workplace, accounted for the vast majority of positive SARS-CoV-2 cases after HCW exposures. Workplace exposures were associated with very low SARS-CoV-2 positivity. Healthcare facilities should consider focusing on methods to decrease HCW risk for COVID-19 and associated exposures outside the workplace, including community education programs and continued programs to reduce vaccine hesitancy.

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Competing interests

None declared.

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