American Journal of Infection Control 000 (2022) 1–6

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Healthcare personnel early return-to-work program after higher-risk SARS-CoV-2 exposure: A learning health system quality improvement project

Amy Ruscetti PT, DPT [a], Maddie Chrisman PT, DPT [a], Suzanne Wagester MSN, RN [a], Patricia Smith MBA [b], Colleen O'Hare MS, PA [c], Abbie Mallon MHA [c], Ashley Chung MPH [a], Calvin T. Lutz MA [b], Tamra E. Minnier MS, RN, FACHE [a], Rachel L. Zapf PhD [a], Paula L. Kip PhD, RN [a], Graham M. Snyder MD, MS [d,e,*]

[a] *Wolff Center, University of Pittsburgh Medical Center, Pittsburgh, PA*
[b] *Workpartners, University of Pittsburgh Medical Center, Pittsburgh, PA*
[c] *Laboratory Service Center, University of Pittsburgh Medical Center, Pittsburgh, PA*
[d] *Division of Infectious Diseases, University of Pittsburgh School of Medicine, Pittsburgh, PA*
[e] *Department of Infection Control and Hospital Epidemiology, UPMC Presbyterian, Pittsburgh, PA*

Key words:
Workforce shortages
Health care capacity
Quarantine period
SARS-CoV-2 nucleic acid amplification testing

Background: Incidence of health care personnel (HCP) with a higher-risk SARS-CoV-2 exposure and subsequent 14-day quarantine period adds substantial burden on the workforce. Implementation of an early return-to-work (RTW) program may reduce quarantine periods for asymptomatic HCP and reduce workforce shortages during the COVID-19 pandemic.

Methods: This observational quality improvement study included asymptomatic HCP of a multi-facility health care system with higher-risk workplace or non-household community SARS-CoV-2 exposure ≤4 days. The program allowed HCP to return to work 8 days after exposure if they remained asymptomatic through day 7 with day 5-7 SARS-CoV-2 nucleic acid amplification test result negative.

Results: Between January 4 and June 25, 2021, 384 HCP were enrolled, 333 (86.7%) remained asymptomatic and of these, 323 (97%) tested negative and were early RTW eligible. Mean days in quarantine was 8.16 (SD 2.40). Median day of early RTW was 8 (range 6-9, IQR 8-8). Mean days saved from missed work was 1.84 (SD 0.52). A total of 297 (92%) HCP did RTW ≤10 days from exposure and days saved from missed work was 546.48.

Conclusions: Implementing an HCP early RTW program is a clinical approach for COVID-19 workplace safety that can increase staffing availability, while maintaining a low risk of SARS-CoV-2 transmission.

During the COVID-19 global pandemic, *maintaining appropriate staffing in healthcare facilities is essential to providing a safe work environment for health care professionals (HCP) and for safe patient care*.[1] As fluctuations in the number of COVID-19 cases occur, strategies to mitigate the ripple effect on staffing shortages are imperative. HCP may be at higher-risk of SARS-CoV-2 exposure in the workplace. A post-exposure quarantine period of the full potential 14-day incubation period adds substantial burden on the health care workforce, particularly if risk of developing symptomatic disease is low after day 7 of exposure.[2] The Centers for Disease Control and Prevention (CDC) defined higher-risk SARS-CoV-2 exposure as prolonged close contact (within 6 feet for a cumulative total of 15 minutes over 24 hours) to someone with SARS-CoV-2 infection and generally involves exposure of HCP's eyes, nose, or mouth to material potentially containing SARS-CoV-2.[1] At the time of this project, CDC guidelines recommended self-isolation at home for 14 days while monitoring for symptoms.[3] These guidelines suggest alternate approaches when workforce shortages exist.

Previous modeling and limited real-world studies suggest that testing upon exit from quarantine may be a strategy that safely reduces quarantine duration.[1,3-5] Specifically, day 6-7 after exposure is the ideal timeframe when the date of exposure is known[3]. Based

* Address correspondence to Graham M. Snyder, MD, MS, University of Pittsburgh Medical Center, 3601 Fifth Ave, Suite 150, Pittsburgh, PA 15213.
E-mail address: snydergm3@upmc.edu (G.M. Snyder).

Conflicts of interest: None of the authors received any payments or influence from a third-party source for the work presented.

https://doi.org/10.1016/j.ajic.2022.01.027

on CDC modeling, completing asymptomatic testing on an individual significantly decreased the post-quarantine transmission risk, especially if completed after day 5.[6] At the time of this project, no studies regarding reduced quarantine duration in health care settings had been reported.

Prior to the start of this project, we had developed a robust contact tracing application to establish coordination between Infection Prevention and Control, Employee Health, and frontline staff managers. Based on internal data confirming an extremely low rate of development of symptoms after 10 days from date of exposure, our institution policy for HCP who had a higher-risk workplace or non-household community SARS-CoV-2 exposure was changed from a 14-day quarantine period to a 10-day quarantine period, returning to work on day 11 after exposure if they remained asymptomatic through day 10, without asymptomatic testing.[6] Moreover, this learning health system approach was used for the conceptual framing of an early return-to-work (RTW) program with a 7-day quarantine period. This approach synergizes knowledge generation with daily practice to seek continuous improvement in care.[7] We hypothesized that testing asymptomatic HCP on day 5-7 from the exposure date would reduce the 10-day quarantine period and avoid increased likelihood of transmission events. Thus, the primary aim of the project was to implement an evidence-based, early RTW program to reduce the quarantine period for asymptomatic HCP following higher-risk SARS-CoV-2 exposure. As the COVID-19 pandemic progresses, it is vital to prepare strategies for potential staffing shortages to manage health care capacity. Therefore, the secondary aim was to evaluate the early RTW program as a capacity strategy for workforce shortages during the COVID-19 pandemic.

METHODS

Design

A multidisciplinary collaboration including the departments of Infection Prevention and Control; Quality, Safety, and Innovation; Human Resources; Employee Health; and Laboratory Services synthesized current evidence, CDC guidelines, and institution policies to design the early RTW program. The project underwent formal review and was granted ethical approval (Project 3201) as a quality improvement project by our Quality Improvement Review Committee. Methods and results are reported in accordance with Strengthening the Reporting of Observational Studies in Epidemiology statement and Standards for Quality Improvement Reporting Excellence guideline (Supplementary Table S1).[8,9]

Setting

This quality improvement project was completed during January 4, 2021 through June 25, 2021 at a 40-hospital integrated academic health care system providing care principally within central and western Pennsylvania (USA). The study period encompassed both elevated community activity and a low-prevalence period with a system-wide patient test-positivity rate ranging from approximately 25% to 2.5%, and nearly 50,000 positive tests performed in the health system during the study period. During the project and throughout the COVID-19 pandemic, a consistent approach to infection prevention was maintained, providing institution-wide education and resources for all HCP. Infection prevention practices were informed by public health recommendations including personal protective equipment, patient and visitor policies, employee travel recommendations, and routine contact tracing for all potential health care-related exposures. Some of our institutional policies differed from CDC guidance for acute care facilities. For example, our definition of exposure was slightly varied as having prolonged direct close contact (less than 6 feet for 15 minutes or greater) 48 hours before symptom onset of a person who is COVID-19 positive or who is later identified as a COVID-19 positive person (tested and resulted later). General institution wide resources included telehealth evaluation applications and testing symptomatic employees. Periodic testing for asymptomatic employees with or without reported SARS-CoV-2 exposure was not an institutional requirement. Evaluation of respiratory illness and testing for COVID-19 was offered at no cost to employees. Human Resources policies discouraged presenteeism by allowing for paid time off for both possible and confirmed COVID-19 illness and quarantine following exposure.

Throughout the pandemic, contact tracing for COVID-19 diagnoses and positive SARS-CoV-2 tests were conducted by Infection Prevention and Control and Employee Health teams in conjunction with frontline managers. Access to data was password protected and limited to the project team. Data documented within a secure intranet system was de-identified for analysis.

Participants

All employees who reported or were identified as having a higher-risk workplace or non-household community SARS-CoV-2 exposure were invited to participate in the early RTW program if they were determined to be ≤4 days since date of last exposure. Employees were excluded if the higher-risk exposure was in their household or their primary location of employment was within a long-term care community or outside the state of Pennsylvania (due to differences in regulations). Vaccination of HCP began at the beginning of this program and vaccination levels were nearly 70% at the end of the study period. Fully vaccinated individuals were not required to quarantine after a high-risk exposure and so are not included in this analysis.[10]

Intervention

Consistent with a learning health system approach, procedures for the early RTW program were embedded in Employee Health's routine clinical care for higher-risk SARS-CoV-2 exposures across the system. The project team implemented processes for asymptomatic HCP identification, selfswabbing, and SARS-CoV-2 nucleic acid amplification testing (NAAT) of asymptomatic HCP involved in a higher-risk workplace or nonhousehold community exposure.[11] The quarantine strategy for the early RTW program is presented in Figure 1. In the event the HCP experienced a higher-risk workplace or nonhousehold community exposure, they were directed to report the event through Employee Health. A nurse documented the event, assessed symptoms, provided guidance on quarantine, and provided an overview of the testing process. Following verbal consent, eligible HCP who were asymptomatic and the exposure time was determined to be ≤4 days were enrolled in the early RTW program, which included the following actions described in Table 1.

The comparison group included HCP who had a higher-risk workplace or non-household community SARS-CoV-2 exposure and were not eligible to RTW early. This group was guided by the existing institution policy of a 10-day quarantine period (previously 14 days) and RTW on day 11 after exposure if they remained asymptomatic through day 10, without asymptomatic testing.

Outcomes

The primary aim of the project was to implement an evidence-based, early RTW program to reduce the 10-day quarantine period for asymptomatic HCP following SARS-CoV-2 exposure. The primary outcome included average number of days in quarantine and average

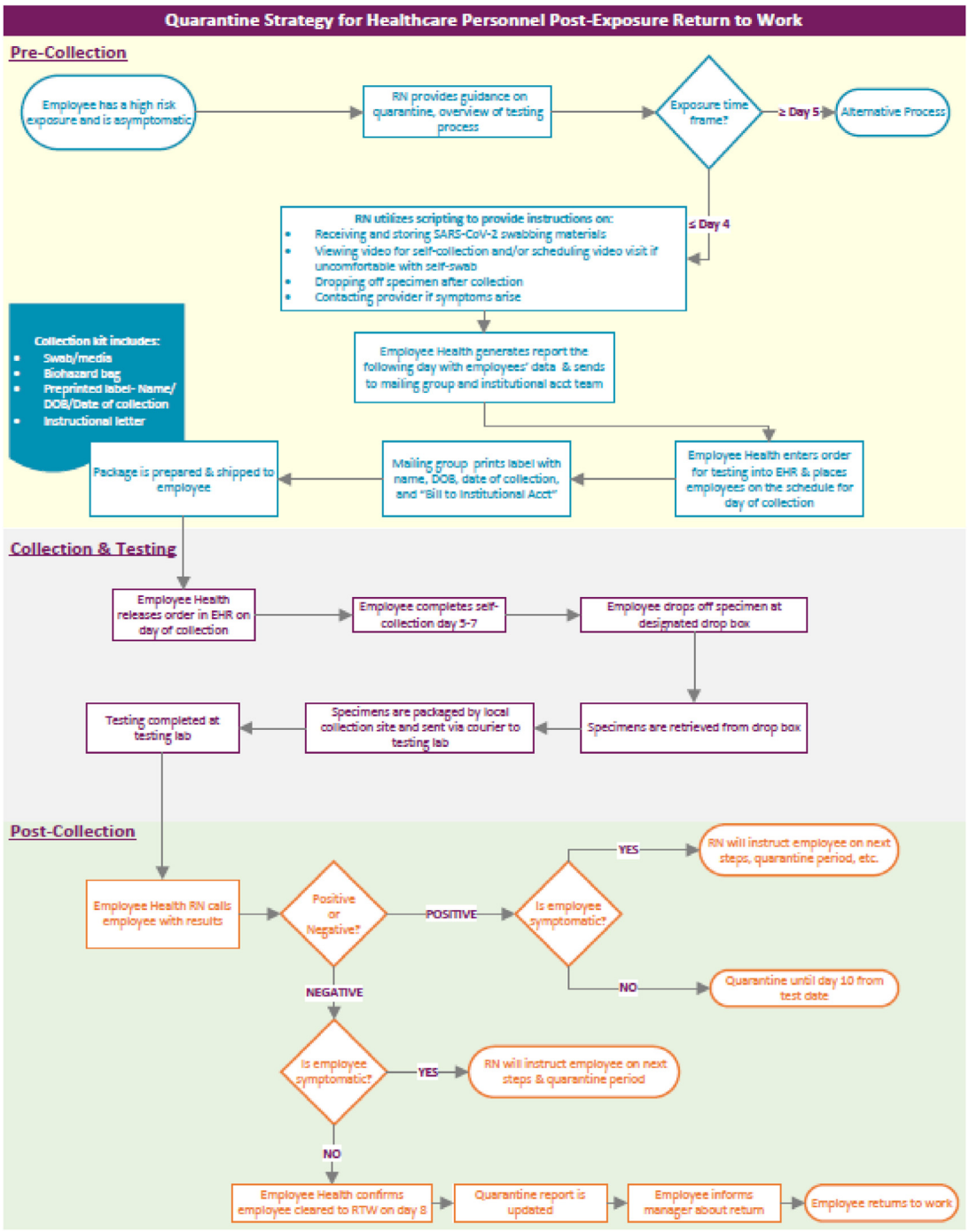

Fig 1. Health care personnel early return-to-work program flowchart. Abbreviations: HCP, health care personnel; RN, registered nurse; EH, employee health; DOB, date of birth; RTW, return-to-work.

day during quarantine the HCP was eligible to RTW. The secondary aim was to evaluate the early RTW program as a capacity strategy for workforce shortages during the COVID-19 pandemic. Therefore, the secondary outcome was the number of HCP eligible for early RTW and number of days saved from missed work due to quarantine.

Statistical analysis methods

Data collected during the project were analyzed using descriptive statistics (means, percentages, and standard deviations). Due to the strict employee health policy mandates, there was no anticipated loss to follow-up. The average number of days in quarantine was calculated by dividing the total number of days in quarantine (minimum = 7 days, maximum = 10 days per person) among all HCP eligible for early RTW; the average day of quarantine was calculated as the sum of the last day of actual quarantine by the number of HCP eligible for early RTW; the total number of HCP eligible for early RTW was calculated as the sum of HCP who tested negative and remained asymptomatic through 7 days; and the number of days saved from missed work in quarantine was calculated as the sum of maximum

Table 1
Operational steps in the early return-to-work program

Employee Health nurse initiates an order for the program in the electronic health record.
Employee Health sends daily list of employees with an order for the program to the Mailing Group.
Mailing Group prints a label with pertinent employee information and sends a package that contains a self-collection specimen kit.[12,13] A video on proper collection of the nasal swab was provided to the employee, and Employee Health team members were available for assistance as needed.
Employee performs self-collection day 5-7 and drops off specimen in a drop box at a predetermined convenient location among 24 sites.
Specimen retrieved from drop box, transported to select *regional laboratory hubs* that had available capacity to complete SARS-CoV-2 NAAT.
Employee Health nurse calls employee with test results. HCP who tested negative and remained asymptomatic through day 7 were eligible to RTW on day 8 after exposure.

days in quarantine (10 days) subtracted by actual days in quarantine (minimum = 7 days, maximum=10 days per person).

RESULTS

Participants

Presented in Figure 2, between January 4 and June 25, 2021, 492 HCP were screened eligible, of whom 108 (22%) were not enrolled (declined, n = 9; did not submit required specimen, n = 99) and 384 (78%) were enrolled and completed follow-up. Among the 384 HCP successfully enrolled and studied through completion, 51 (13.3%) developed symptoms prior to RTW and 333 (86.7%) remained asymptomatic through day 7 from exposure.

Primary outcome

During the 6-month project period, among the 333 HCP who remained asymptomatic, there were 323 (97%) HCP eligible for early RTW (remained asymptomatic and negative SARS-CoV-2 NAAT). Mean days in quarantine prior to early RTW eligibility was 8.16 (standard deviation [SD] 2.40). The median for day of early RTW was 8 (range 6-9, IQR 8-8). Additionally, there were 8 (2.4%) who remained asymptomatic and tested positive, and 2 (0.6%) asymptomatic with test results pending at the end of the 10-day quarantine period (final disposition = 2 negative). Importantly, these HCP were prevented from early RTW, thus potentially avoiding further transmission events (repeat SARS-CoV-2 NAAT was not performed).

Of the 51 HCP who developed symptoms during the 10-day quarantine period following SARS-CoV-2 exposure, there were 19 (37.3%) who tested negative, 27 (52.9%) tested positive, and 5 (9.8%) with test results pending at the end of the 10-day quarantine period (final disposition = 4 negative, 1 test was cancelled). The median for day of symptom onset during quarantine was 4 (range 0-9, IQR 3-5). There were 38 (74.5%) HCP who developed symptoms prior to testing for SARS-CoV-2 and 3 (5.9%) developed symptoms with date of onset unknown.

Notably, there were 10 (19.6%) HCP who developed symptoms after testing for SARS-CoV-2 and necessitate further examination as potential program failures. Of these, 7 (70%) HCP collected their specimens outside of the directed day 5-7 window with 6 (60%) tested negative days 2-4 and developed symptoms days 2-4, and 1 (10%) tested positive on day 9 and developed symptoms on day 9. The remaining 3 (30%) HCP collected their specimen within the directed day 5-7 window with 1 (10%) tested negative on day 6 and developed symptoms on day 7, and 2 (20%) tested positive on day 6 and developed symptoms on day 6. Mean days between asymptomatic negative test and symptom onset was 0.33 (SD 0.57) and between asymptomatic positive test and symptom onset was 0. All asymptomatic HCP in the program who later became symptomatic or tested positive were successfully prevented from early RTW and therefore potentially avoided risk of infection transmission (repeat SARS-CoV-2 NAAT was not performed).

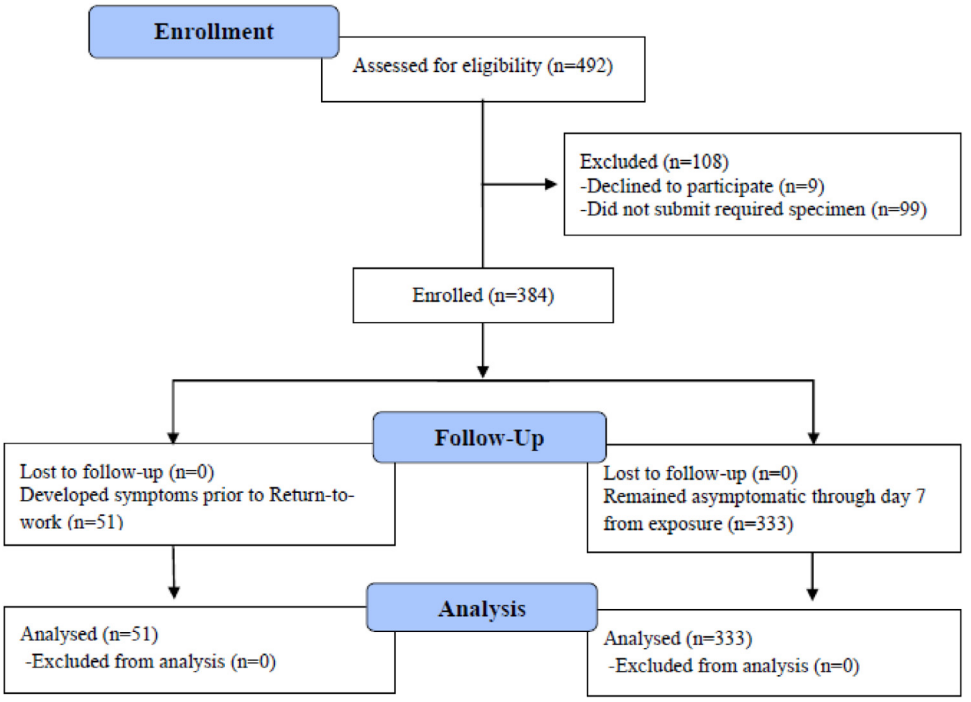

Fig 2. CONSORT diagram.

Secondary outcome

As reported earlier, there were 323 (97%) asymptomatic HCP who met eligibility criteria (SARS-CoV-2 NAAT negative and remained asymptomatic through 7 days) to RTW early. The mean number of days saved from missed work in quarantine consequential to early RTW was 1.84 (SD 0.52). The potential total number of days saved was 594.32. However, of the 323 HCP who were eligible to RTW early, 297 (92%) did RTW earlier than day 11 postexposure. The 26 (8%) eligible HCP who did not RTW early was due to logistical delays in providing test results on or after day 10 of higher-risk exposure. Thus, over the initial 6-month period of the program, actual days saved from missed work secondary to the early RTW program was 546.48. Potential downstream benefits from the program may include reduced burden on the workforce and prevented infections, which are difficult to estimate.

DISCUSSION

In this quality improvement project characterizing the impact of a 7-day early RTW program for HCP who remain asymptomatic and have a negative selfcollected SARS-CoV-2 NAAT during day 5-7, we found that 97% of those who remained asymptomatic had a negative test result, and among these 92% successfully RTW 1.84 days early and over a 6-month period a total of 546 days were safely recovered. None of the 384 HCP in this program were symptomatic after returning to work. These data support the approach that HCP can safely RTW earlier than the conservative recommended quarantine periods of 10-14 days.

The COVID-19 pandemic will likely persist for years, and the Omicron variant has shown that emerging variants may lead to high community prevalence. Therefore, health care capacity strategies to mitigate staffing shortages will remain vital. The 10-day quarantine guideline was established to be conservative with respect to transmission of SARS-CoV-2 to persons known to have been exposed to the virus.[1] Such efficiencies in staffing and early RTW among HCP are especially needed during waves of COVID-19 cases when the strain is enormous on the workforce and health care systems at large. We were able to flex the 7-day quarantine period in the program back to a 10-day quarantine period when staffing constraints eased and resume the 7-day early RTW program when the pandemic surged again. As a learning health system, we used these findings to inform new methods for Employee Health specimen collection, including a program for symptomatic self-testing with results typically available within one day. Adaptability is critical in pandemic response, as is real-time evaluation of interventions like the early RTW program. Outcomes from this program were reviewed no less than weekly to ensure a safe work environment for HCP and safe patient care.

One of the challenges the SARS-CoV-2 virus presents is a typically short (3-5 days) but potentially long (up to 14 days) incubation period, and the potential of transmissibility in a pre-symptomatic period.[14] Thus, the present intervention was implemented to presumably identify a shorter quarantine period that would not result in any increased incidence of COVID-19, while at the same time, allow HCP to safely RTW earlier than day 11 from date of exposure. This real-world program is needed to identify potential success and failure of asymptomatic screening strategies and to enable real-time optimization of workforce capacity during the COVID-19 pandemic.

A limiting factor in the success of the program relates to employees' ability to participate and laboratory resources to accommodate the program. Although the rate of program declination was low (9/492, 2%), 20% (99/492) could not provide a specimen in a timely fashion, for a variety of reasons including illness and transportation. This prompted our organization to develop a process following this project for specimen self-collection and drop-off at several dozen locations to reduce barriers to testing. The clinical laboratory performed sample stability studies (accounting for room temperature of collected specimen, collection media, courier time) to ensure a reliably recovery rate (data not shown), which may not be feasible for all organizations.

Several design elements of this quality improvement intervention result in limitations in the analysis or interpretation of the findings. We did not repeat asymptomatic testing at day 14, so we may have missed asymptomatic acquisition after returning to work. We did not routinely perform asymptomatic screening for HCP in acute care facilities and did not perform baseline asymptomatic screening at the time of exposure, so we cannot exclude the possibility that some SARS-CoV-2 NAAT positive results were unrelated to the exposure (eg, asymptomatic or subclinical recent infection within the last 90 days). The exact natures of the exposures were not quantified, but the conversion rate has been consistent throughout the pandemic (unvaccinated HCP subsequently became symptomatic and tested positive for SARS-CoV-2 in 6.0% of all higher-risk exposures during this project period, and 3.4% of higher-risk exposures in the approximate 2.5 month period preceding this [data not shown]). We did not present subsequent transmission data, but we do extensive contact tracing throughout the pandemic and to the best of our knowledge, there were no secondary transmission events from these HCP after they were identified as exposed. As vaccinated HCP were not included in this analysis, the findings may not be generalizable to institutions requiring quarantine of vaccinated HCP.

CONCLUSION

There is a clear and measurable impact to invest in a comprehensive, clinical approach for COVID-19 workplace safety. To optimize employee health, patient safety, and health care capacity, extraordinary efforts are needed to address contingency and crisis planning to mitigate staffing shortages before the next wave of COVID-19 cases. Implementing an HCP early RTW program is one strategy to increase staffing availability and therefore reduce burden of staffing shortages on the health care workforce, while maintaining a low risk of SARS-CoV-2 transmission.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.ajic.2022.01.027.

References

1. Centers for Disease Control and Prevention. Strategies to mitigate healthcare personnel staffing shortages. 2021. Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/hcp/mitigating-staff-shortages.html.
2. Byrne AW, McEvoy D, Collins AB, et al. Inferred duration of infectious period of SARS-CoV-2: rapid scoping review and analysis of available evidence for asymptomatic and symptomatic COVID-19 cases. *BMJ Open*. 2020;10:e039856.
3. Centers for Disease Control and Prevention. COVID-19: interim infection prevention and control recommendations for healthcare personnel during the Coronavirus disease 2019 (COVID-19) pandemic. Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html.
4. Wells CR, Townsend JP, Pandey A, et al. Optimal COVID-19 quarantine and testing strategies. *Nat Commun*. 2021;12:356.
5. Quilty BJ, Clifford S, Hellewell J, et al. Quarantine and testing strategies in contact tracing for SARS-CoV-2: a modelling study. *Lancet Public Health*. 2021; 6:E175-E183.
6. Centers for Disease Control and Prevention. Options to reduce quarantine for contacts of persons with SARS-CoV-2 infection using symptom monitoring and diagnostic testing (Updated 12/2/2020). Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-options-to-reduce-quarantine.html.

7. Institute of Medicine. Roundtable on evidence-based medicine: the learning healthcare system workshop summary. 2007. Accessed October 22, 2021. https://pubmed.ncbi.nlm.nih.gov/21452449/.
8. von Elm, Altman DG, Egger M, et al. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ*. 2007;335:806.
9. Ogrinc G, Davies L, Goodman D, et al. SQUIRE 2.0 (Standards for QUality improvement reporting excellence): revised publication guidelines from a detailed consensus process. *BMJ Qual Saf*. 2016;25:986–992.
10. Centers for Disease Control and Prevention. When you've been fully vaccinated: how to protect yourself and others. Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated.html.
11. Centers for Disease Control and Prevention. Overview of testing for SARS-CoV-2 (COVID-19). Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html.
12. Zhou Y, O'Leary TJ. Relative sensitivity of anterior nares and nasopharyngeal swabs for initial detection of SARS-CoV-2 in ambulatory patients: rapid review and meta-analysis. *PLoS ONE*. 2021;16: e0254559.
13. Centers for Disease Control and Prevention. Interim guidelines for collecting and handling of clinical specimens for COVID-19 testing. Accessed October 22, 2021. https://www.cdc.gov/coronavirus/2019-ncov/lab/guidelines-clinical-specimens.html#anchor_1635197152863.
14. Wei WE, Li Z, Chiew CJ, Yong SE, Toh MP, Lee VI. Presymptomatic transmission of SARS-CoV-2 – Singapore, January 23-March 16, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69:411–415.