A Rapid Nucleic Acid Amplification Test–Based, Conditional Release-to-Work Policy for Health Care Personnel With Symptoms Consistent With COVID-19

Mark A. Jacobson, MD, Colin Hart, MPH, Will Huen, MD, MS, MPH, Griselda Suarez Guardado, LVN, Allyson Villanueva, RN, MS, CNS, Jeffrey Whitman, MD, and Paul D. Blanc, MD, MSPH

Objective: Most health care personnel (HCP) reporting symptoms consistent with COVID-19 illness are assessed by high-accuracy SARS-CoV-2 assays performed in clinical laboratories, but the results of such assays typically are not available until the following day. **Methods:** This is an observational study over 16 weeks of a rapid nucleic acid amplification test (NAAT) performed at point of contact. The benchmark for comparison was a simultaneously obtained specimen assayed by a routine NAAT assay performed in a clinical laboratory. **Results:** There were 577 paired rapid and routine NAAT results. Rapid test positive predictive value was 90.0% (95% confidence interval = 88.8%–91.2%), and negative predictive value was 95.2% (95% confidence interval = 93.5%–96.9%). The rapid test avoided an estimated 160 to 184 lost work shifts over 4 months. **Conclusions:** A rapid NAAT test–based strategy proved effective in safely clearing symptomatic employees without infection for earlier return to work.

Keywords: COVID-19, symptomatic, diagnosis, health care personnel, workforce

LEARNING OUTCOMES

- Upon completion of this educational activity, learners should be able to: summarize the role that COVID-19 testing has in determining whether health care personnel (HCP), who notify an occupational health service about symptoms compatible with COVID-19 infection, can be released to work on-site; and contrast the relative benefits and risks that relying on rapid, point-of-contact COVID-19 test versus a routine COVID-19 test performed in a clinical laboratory have in making a release-to-work decision in terms of maintaining a safe work environment and an adequate HCP workforce to safely take care of patients.

Most health care personnel (HCP) who report new symptoms consistent with COVID-19 illness typically are assessed by high accuracy SARS-CoV-2 amplification assays performed in clinical laboratories. Although most of these persons under investigation ultimately prove to test negative for SARS-CoV-2,[1] the results of such assays are usually not available until the day after a specimen is obtained. To protect patients and coworkers, most health care centers in the US bar symptomatic employees from working on-site until a highly accurate test establishes or excludes the presence of SARS-CoV-2 infection. A rapid, point-of-contact SARS-CoV-2 nucleic acid amplification test (NAAT) with similar accuracy to benchmark diagnostic tests performed in a clinical laboratory test could reduce the unnecessary isolation and related distress and allow personnel to return to work more quickly, mitigating social and labor force disruption.

In October 2021, the Zuckerberg San Francisco General (ZSFG) Hospital occupational health service (OHS) began assessing the test performance of a commercially available, Food and Drug Administration (FDA) emergency use authorized rapid SARS-CoV-2 NAAT test with point-of-contact results available in 20 minutes. This rapid NAAT had been independently validated with results published in a peer-reviewed journal.[2] That study reported agreement between the rapid NAAT and a reference routine SARS-CoV-2 NAAT test performed in a clinical laboratory to be 95.7% (22 of 23) and negative percent agreement to be 98.4% (239 of 243), after excluding 25 (8.6%) either invalid or "canceled" results. As a quality improvement project, we evaluated the performance of a simultaneous rapid and routine NAAT testing strategy to determine whether symptomatic employees could be correctly identified as not infected and safely released, presumptively, for immediate return to work on the basis of a negative rapid test result, rather than waiting until the following day or longer for the result of a simultaneously obtained specimen for definitive routine NAAT testing performed in the hospital clinical laboratory.

METHODS

Trained OHS staff engaged in employee testing at an outdoor field testing trailer on the ZSFG Hospital campus obtained 2 nasal swabs from health care personnel who presented with mild to moderate symptoms consistent with potential COVID-19 illness. The swab obtained for rapid NAAT (CUE Health, San Diego, CA) was assayed at the trailer field testing site by OHS staff. Following the manufacturer's instructions, OHS staff inserted the swab with an employee specimen into the NAAT rapid test reader, obtaining a result within 20 minutes, with the result communicated immediately to the employee. The second swab was submitted to the ZSFG Clinical Microbiology Laboratory where a routine NAAT assay was performed by clinical laboratory technicians using a Panther System, Aptima SARS-CoV-2 Assay (Hologic, Inc, Marlborough, MA), which has been reported to have equivalent precision and accuracy to FDA-approved SARS-CoV-2 reverse transcriptase-polymerase chain reaction (RT-PCR) assays.[3] Results of the routine NAAT were generally available after a lag of at least one work shift.

An initial run-in period to evaluate the real-world performance of the rapid NAAT test took place between October 27, 2021, and January 9, 2022, during which time 419 paired rapid and routine NAAT tests were performed on employee specimens. Initially, 2 duplicate nasal swabs for rapid NAAT testing and 1 for routine NAAT

From the Division of Occupational Medicine, University of California San Francisco School of Medicine, San Francisco, California (Dr Jacobson, Dr Blanc); Division of HIV, Infectious Diseases, and Global Medicine, University of California San Francisco School of Medicine, San Francisco, California (Dr Jacobson); Department of Public Health, San Francisco, California (Mr Hart, Ms Suarez Guardado, Ms Villanueva); Department of Medicine, University of California San Francisco School of Medicine, San Francisco, California (Dr Huen); Department of Laboratory Medicine, University of California San Francisco School of Medicine, San Francisco, California (Dr Whitman).

Funding Sources: None.

Conflict of Interest: None declared.

Ethical considerations: The results of the quality improvement project summarized in this report were deemed by the University of California San Francisco IRB to not be considered human subjects research under the 2018 Revised Common Rule (45 CFR46.102(l)(2)): public health surveillance activities, including the collection and testing of information or biospecimens, conducted, supported, requested, ordered, required, or authorized by a public health authority.

Address correspondence to: Mark A. Jacobson, MD, 995 Potrero, 4th Flr, San Francisco, CA 94110 (mark.jacobson@ucsf.edu).

DOI: 10.1097/JOM.0000000000002733

testing were obtained from each employee. After finding only one pair of discordant duplicate rapid NAAT results during the first 30 days of this run-in phase, only a single swab for rapid NAAT testing and the single swab for routine NAAT testing were obtained during the subsequent 6 weeks of further run-in testing. Overall, 10 of the NAAT tests (2.4%) were read as invalid and 21 (5.0%) were canceled by the reading device during this run-in period. The bulk of these canceled or invalid tests occurred during the first month. Canceled or invalid tests became far less frequent as the testing staff gained experience in operating and positioning the rapid NAAT reading device and environmental conditions in which the test was performed in the trailer were optimized. After excluding canceled and invalid results, there were 388 paired rapid and routine NAAT results available for analysis, of which 372 (95.9%) were concordant, 6 (1.6%) were rapid NAAT positive/routine NAAT negative, and 10 (2.7%) were rapid NAAT negative/routine NAAT positive.

In early January 2022, when the Omicron variant of SARS-CoV-2 emerged as the regionally predominant circulating viral strain and the number of employees newly testing positive for COVID-19 began to steeply increase, ZSFG Hospital and its OHS-affiliated San Francisco Department of Public Health facilities were facing an impending critical workforce shortage. Based on the data from the run-in phase of testing summarized previously, the ZSFG OHS initiated a policy on January 10, 2022, of conditionally releasing for immediate return to work any afebrile employee presenting with otherwise mild-moderate COVID-19–like symptoms if a negative rapid NAAT test result was obtained. Continuation of the conditional release for return to work was contingent on the pending results of a simultaneously obtained nasal swab that underwent confirmatory, clinical laboratory testing by routine NAAT in the ZSFG Clinical Microbiology Laboratory. Operationally, if employees were informed that their routine NAAT result was positive, either by outreach from OHS staff or from accessing their electronic occupational health record, they were to immediately leave work or, if off site, not return to work until guided to do so by OHS staff. The result of the routine NAAT test generally became available in the occupational health record and was communicated to OHS staff within 24 hours. Employees who were contingently cleared were also directed to follow-up with the COVID-19 employee hotline should they develop new or worsening symptoms consistent with COVID-19, even if initial testing had been negative. This policy of rapid NAAT testing for contingent release to return to work remained in place until April 29, 2022, when supplies of the proprietary swabs and cartridges needed for OHS staff to perform the rapid NAAT test were exhausted.

For quality improvement purposes, we analyzed the performance characteristics of the rapid NAAT assay results obtained under this protocol compared with those of the routine NAAT. We calculated sensitivity, specificity, and positive and negative predictive values, including 95% confidence intervals, using standard statistical methods.[4] We also analyzed in detail the electronic occupational health record of each employee who had an immediate negative rapid test and a subsequent positive routine NAAT test result. Finally, we estimated the workdays saved through contingent release to return to work by assuming on average 1.33 work shift absences were avoided per employee correctly returned contingently.

RESULTS

SARS-CoV-2 NAAT Performance Characteristics During Rapid NAAT–Based Conditional Release-to-Work Policy Implementation

Between January 10 and April 28, 2022, 582 paired nasal swabs were obtained from employees by OHS staff for both rapid and routine SARS-CoV-2 NAAT testing. One of these rapid NAAT tests resulted as invalid, and 4 were canceled by the reading device (0.9% test failure).

TABLE 1. Rapid and Routine NAAT Positive and Negative Results

	Routine NAAT Positive	Routine NAAT Negative
Rapid NAAT positive	85	9
Rapid NAAT negative	23	460

Excluding these 5, 577 rapid NAAT results paired with a simultaneously obtained routine NAAT result remained for analysis. Using the routine test result as the benchmark, rapid NAAT true and false-positive and false-negative results are summarized in Table 1. Rapid NAAT sensitivity in the context of implementing this conditional release-to-work policy was 78.7% (95% confidence interval [CI] = 75.4%–82.0%); specificity was 98.1% (95% CI = 97.0%–99.2%); positive predictive value was 90.0% (95% CI = 88.8%–91.2%); and negative predictive value was 95.2% (95% CI = 93.5%–96.9%).

Outcomes of Rapid NAAT–Based Conditional Release-to-Work Policy Implementation

We next examined the occupational health records of the 23 employees who had false-negative rapid NAAT results and were therefore conditionally released to return to work. Of these, the record review revealed that 3 had actually been asymptomatic. Of the remaining 20 who had reported symptoms to OHS staff, 14 (70%), for a variety of reasons, had not actually returned to work by the time they were informed of their positive routine NAAT result and thus were directed by OHS staff to continue to be off work and isolate based on that routine test result, which became available before their next scheduled shift. Only 6 of the symptomatic employees with a false-negative rapid NAAT result actually did return to work before knowing that their routine NAAT result was positive. Two of these worked more than one shift, for a collective total of 8 shifts worked while presumably contagious to others. All 6 reported consistently wearing a face mask at work during the interval between testing negative by rapid NAAT and receiving their positive routine NAAT result. Contact investigation revealed no instances of work-related transmission from these individuals.

From a workforce maintenance perspective, 460 employees who had a rapid NAAT result that was a true negative were eligible to be immediately released to work one or potentially more than one work shifts before receiving their confirmatory negative routine NAAT result. If we assume (based on the 70% rate of not returning among the false negatives) that only 30% of the true negatives did return to work immediately and (based on the 8 shifts among the 6 false negatives) that 1.33 shifts were garnered by each of these individuals before they actually became aware of their true negative status and their supervisor would have rescheduled them under the previous policy of requiring a negative routine NAAT to return to work, then this protocol avoided the loss of 184 shifts during the 16 weeks that it was operational.

DISCUSSION

During a 16-week implementation period of a rapid NAAT–based, conditional release-to-work policy for HCP reporting mild to moderate symptoms consistent with COVID-19 illness, which included 577 evaluable, paired rapid and routine NAAT results, only 20 false negatives occurred. Of these, only 6 resulted in a symptomatic employee actually returning to work while potentially contagious, and none of these incidents led to an identified nosocomial transmission. From an institutional employee safety and infection control perspective, the greatest risk of implementing such a conditional release-to-work policy, which is based on a rapid test not conducted by trained laboratory technicians, is the possibility that a symptomatic employee with a false-negative rapid test result might return to the workplace

while contagious, leading to potential exposure for other coworkers and patients. No appreciable adverse consequences of this risk occurred, suggesting that our hospital-based OHS policy of rapid NAAT testing to permit conditional, immediate release to work for symptomatic employees, pending the result of a confirmatory routine NAAT performed in a licensed clinical laboratory by certified technicians, was effective and safe.

One limitation of this analysis is that we do not know the exact proportion of the 460 employees with a true-negative rapid NAAT result who actually did not have symptoms at the time of presenting for symptomatic testing because we were unable to review their narrative clinical notes. However, if we were to assume that the proportion incorrectly categorized as symptomatic among the true negatives was the same as for those with false-negative results (13%), whose narrative clinical notes we did review as part of this quality improvement project, then there may have been only 400 symptomatic true negatives. Thus, based on this assumption, we might have excluded 60 others had their clinical records been reviewed. In such a scenario, our estimate of the number of lost work shifts avoided would be reduced from 184 to 160.

Another potential limitation to consider is that we used a routine NAAT assay (SARS-CoV-2 Aptima), instead of an RT-PCR assay, as the benchmark for determining true and false rapid NAAT results. However, the FDA has developed a reference panel of SARS-CoV-2 RNA specimens from live virus for diagnostic developers to precisely compare the performance of NAAT and RT-PCR SARS-CoV-2 assays performed in clinical laboratories, and the agency reported that the SARS-CoV-2 Aptima assay, when performed by trained technicians, had equivalent or better precision and accuracy than the SARS-CoV-2 RT-PCR assays that were tested.[3]

This immediate conditional release-to-work policy helped ZSFG Hospital maintain adequate health care personnel staffing during the peak of the Omicron COVID-19 surge in the region. For context, just during the month of January 2022, 680 employees who tested positive for COVID-19 were taken off work for a mandatory isolation period of 5 to 20 days. Our previous policy had mandated that all employees who endorsed the new onset of symptoms consistent with COVID-19 be off work until demonstrating a negative SARS-CoV-2 routine NAAT or RT-PCR result. As result of implementing this rapid NAAT–based, conditional release-to-work policy, a conservatively estimated 160 lost work shifts were avoided over 16 weeks. Were we to assume that the immediate return to work rate was higher than 30% in the face of a negative results (eg, if the true negatives felt in better health than the false negatives and thus manifested a higher immediate return rate of 60%), then the lost work estimated work savings could have been even greater. In California, the average state or county employee would work 72 eight-hour shifts over 16 weeks based on the typical 40-hour work week and subtracting official holidays. Thus, even the conservatively estimated 160 unnecessary missed shifts would translate in our health care system into more than 2 full-time employees' effort over a 16-week period. This type of conditional release policy based on a rapid SARS-CoV-2 test has the potential to reduce workforce shortage to an even greater proportional extent during periods when SARS-CoV-2 transmission rates are lower than we observed, but while non–SARS-CoV-2 viral upper respiratory infections are increased—a scenario that could occur in future winter months should current relaxation of community masking mandates continue and if COVID-19 incidence does not again reach the levels of the initial and subsequent Omicron variant surges. Additional potential benefits of implementing this type of rapid NAAT–based conditional release policy that are harder to quantify include reducing employee anxiety and self-quarantining outside of work and, for managers, a reduction of stressors related to staffing gaps.

There are other SARS-CoV-2 rapid tests that could be examined in this manner for screening employees with symptoms consistent with COVID-19. The most widely available are rapid antigen tests (RATs), which are designed to only detect amounts of virus in nasal secretions that correlate with contagiousness (ie, higher levels than that detectable by nucleic acid amplification techniques, such as RT-PCR, rapid NAAT, or routine NAAT). While RAT assays thus have an inherent lower sensitivity than a rapid NAAT assay, they are considerably less expensive, simpler to perform, and less subject to assay failure than we and others have observed with the CUE NAAT.[2] Before the Omicron era, when less infectious SARS-CoV-2 variants predominated, several RAT assays were independently validated to have diagnostic performance characteristics similar to what we observed with the CUE Health rapid NAAT assay in the first phase of the Omicron era while the BA.1 and BA.2 strains predominated.[5,6]

After a temporary hiatus in rapid NAAT test availability, we were able to obtain a resupply of the special swabs and cartridges required to perform this point-of-contact NAAT and reimplemented our rapid-NAAT–based, immediate-conditional release-to-work policy in mid-June 2022, just as the BA.4 and BA.5 Omicron subvariants began to predominate. We continue to vigilantly monitor the screening performance characteristics of the rapid CUE NAAT and the outcomes of false-negative results because results obtained while BA.1 and BA.2 predominated may not generalize to the current era in which even more infectious Omicron subvariants predominate. We encourage health care facilities to consider implementing such a rapid test–based, conditional release-to-work policy, with careful monitoring of its performance, safety, and impact on work loss.

ACKNOWLEDGMENTS

The authors thank the ZSFG OHS and Clinical Microbiology staff for the efforts. Without their attention and commitment to this quality improvement project, the data described previously could not have been obtained.

REFERENCES

1. Angel Y, Spitzer A, Henig O, et al. Association between vaccination with BNT162b2 and incidence of symptomatic and asymptomatic SARS-CoV-2 infections among health care workers. *JAMA*. 2021;325:2457–2465.
2. Donato LJ, Trivedi VA, Stransky AM, et al. Evaluation of the CUE health point-of-contact COVID-19 (SARS-CoV-2 nucleic acid amplification) test at a community drive through collection center. *Diagn Microbiol Infect Dis*. 2021;100:115307.
3. FDA. SARS-CoV-2 reference panel comparative data. Posted 12/7/2020. Available at: https://www.fda.gov/medical-devices/coronavirus-covid-19-and-medical-devices/sars-cov-2-reference-panel-comparative-data. Accessed August 6, 2022.
4. van Zaane B, Vergouwe Y, Donders AR, Moons KG. Comparison of approaches to estimate confidence intervals of post-test probabilities of diagnostic test results in a nested case-control study. *BMC Med Res Methodol*. 2012;12:166.
5. Prince-Guerra JL, Almendares O, Nolen LD, et al. Evaluation of Abbott BinaxNOW rapid antigen test for SARS-CoV-2 infection at two community-based testing sites—Pima County, Arizona, November 3–17, 2020. *MMWR Morb Mortal Wkly Rep*. 2021; 70:100–105.
6. Bekliz M, Adea K, Essaidi-Laziosi M, et al. SARS-CoV-2 antigen-detecting rapid tests for the delta variant. *Lancet Microbe*. 2022;3:e90.

