




Original Article

Experience with voluntary severe acute respiratory coronavirus virus 2 (SARS-CoV-2) testing of asymptomatic staff at the National Institutes of Health for one year

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Abstract

Voluntary asymptomatic severe acute respiratory coronavirus virus 2 (SARS-CoV-2) testing was provided by the NIH Clinical Center over 1 year. Among 105,927 tests, 0.2% were positive. Among eligible staff, 79% participated with variable frequency and 61% of positive individuals had symptoms at the time of testing. Saliva specimen collection was chosen as an option less frequently than midturbinate collection.

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The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has caused millions of deaths and untold strain on world economies.¹ Approximately 30% of infections may be asymptomatic or mild, and infectiousness peaks before symptomatology.^{2–5} Testing and contact tracing are cornerstones of a public health response, to identify and isolate infected persons early during infection. Some argue that this does not improve hospital safety,⁶ but other studies disagree.⁵ Clusters of infections associated with inadequate workplace infection control have been described.⁷

We report the experience from a voluntary asymptomatic testing program employing a pooled testing approach in the National Institutes of Health Clinical Center, a clinical research hospital. The staff participation trends, resources required, efforts to increase participation, and the finding of symptomatic staff choosing the asymptomatic collection center are discussed.

Methods

Data from May 21, 2020, to May 1, 2021, were analyzed. Hospital entry required verbal prescreening for coronavirus disease 2019 (COVID-19) symptoms. Universal use of surgical masks and physical distancing were required while in the hospital.

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The workflow from specimen collection to resulting was previously described.⁸ Staff could choose nasopharyngeal (NP), midturbinate (MT) or saliva specimen collection. Testing was performed using the Panther Fusion SARS-CoV-2 Assay (Hologic, Marlborough, MA) or the COBAS SARS-CoV-2 Test (Roche, Basel, Switzerland) after pooling 1:10 (NP or MT) and 1:5 (saliva).

All individuals testing positive were interviewed to determine symptom onset and to identify exposed contacts. Of the 209 specimens with positive results, 49 were excluded due to non-Bethesda campus work locations, non-NIH employee status, or repeated sampling, resulting in a final cohort of 160 staff members with positive SARS-CoV-2 PCR results.

Results

Asymptomatic employee testing for SARS-CoV-2 included 12,660 individuals (~79% of eligible on-site staff), yielding 105,927 specimens. Initially, NP swabs were used, but this procedure changed to MT specimen collection on June 14, 2020 (Fig. 1). After 4 months with NP and MT collection alone, saliva collection was introduced on September 13, 2020. Utilization trends increased with sample source diversification, and our trends mirrored both national- and state-level trends in case load.

Among 12,660 distinct individuals submitting specimens, 25% were tested only once, 13% and 9% returned for 1 or 2 repeated collections, and 41% had <5 collections. A small subset of users tested nearly weekly, and 709 individuals (6%) were tested >30 times over 49 weeks.

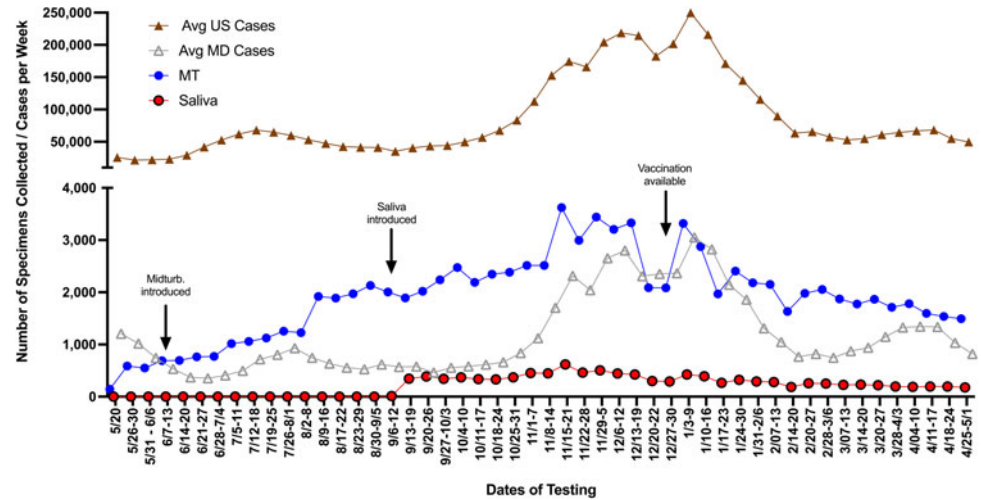


Fig. 1. Chronological analysis of specimen type and case load during the year-long asymptomatic testing for SARS-CoV-2 at the NIH Clinical Center. Total number nasopharyngeal per midturbinate (blue circles) and saliva (red circles) of specimens collected over time. The average weekly national (brown triangles) and state-level (Maryland, open gray triangles) case loads during the study period. Arrows indicate the introduction of new specimen sources as depicted, as well as the date of first vaccinations offered at the NIH Clinical Center.

We compared staff preference for different specimen choices. With the introduction of saliva, 25% of those initially testing chose saliva. Of those who initially chose MT, only 4% switched to saliva. Of those who initially choosing saliva, only 39% chose saliva again and 37% in both categories never retested after initial testing. Approximately 300–600 first-time users tested each week, and saliva collection comprised ~15%–30% of all weekly first-time specimens collected, never rising above 35%. These results show significantly lower utilization of saliva as a specimen source compared to MT ($P < .0001$, Mann-Whitney U test).

Contact tracing revealed that staff presented frequently with symptoms to the asymptomatic testing center. Among 160 individuals, 61% reported having been symptomatic during specimen collection, 38% had no symptoms, and 1% had uncertain onset (Table 1). At time of positive result, 74% of personnel had symptoms, 24% reported no symptoms, and 1% reported uncertain onset.

We estimated the resource burden of the asymptomatic testing line. For the information technology team, 8 weeks of testing and implementation were needed to make the online portal, and management required an average 80–110 hours per month. Specimen-center collection required 4–10 HCP, 3–4 staff for check-in, 3–4 staff to guide foot traffic, and 2 messengers for laboratory specimen drop off. The remaining resources covered the symptomatic carline as well as the asymptomatic line. For laboratory testing, 10 rotating senior-manager-level staff, 1–4 technologists for specimen receipt, 1–4 staff for pooling, and 2–4 staff for instrument operation were required. Moreover, 14 validations were carried out during the year due to shortages of instruments and consumables. The laboratory cost of testing for labor and supplies was ~\$3–5 per test, but this may be an underestimate because it does not include the cost of equipment purchased or labor costs and supply costs during validation. Contact tracing required 10–40 occupational medicine staff, 6 epidemiology staff, and volunteers to notify and interview individuals, to conduct risk assessment of workplace contacts, and to provide guidance for workplace exposures. During surges, those who conducted contract tracing worked 10–14 hours per day for 7 days per week.

Discussion

Presymptomatic or asymptomatic dissemination of SARS-CoV-2 has been documented, and studies have reported varied conclusions

on the utility of asymptomatic surveillance. A review evaluating risks for in-hospital transmission following exposures to unsuspected asymptotically or presymptomatically infected patients or staff found transmission rates from 0 to 4.6% (average, 1.2%). This review reported results from ongoing voluntary asymptomatic studies, with infection rates between 0.2% and 0.4%.⁶ Of individuals testing positive at our facility, only 38% identified as being asymptomatic at the time of specimen collection. Importantly, seroprevalence and symptomatic PCR testing of HCP revealed increased seropositivity against SARS-CoV-2, as well as increased PCR positivity in HCP compared to other professions.⁹ Reports of spread within a hospital highlight the potential value of asymptomatic testing.⁷

Our program has continued, initially offering asymptomatic testing to clinical staff and then to all on-site staff. Only 0.2% of samples tested were positive, consistent with several reports of low positivity with asymptomatic testing in medical settings with strict COVID-19 precautions in place. With the asymptomatic testing program in this study, 160 staff were identified as infected. Nearly all of these infections were linked to community-related rather than healthcare-related exposures. However, multiple instances of nonadherence to masking and eye protection policies were identified, frequently in breakrooms, conference rooms, and nursing stations. Upon interview, 61% of individuals were not asymptomatic but had symptoms consistent with COVID-19. Often, staff discounted these symptoms or ascribed them to other underlying conditions. Discovery of infected individuals prompted contact investigations that were both labor and resource intensive, underscoring the problem of presenteeism during this pandemic.

Implementation of testing was complicated by supply-chain logistics and validation requirements. Following initial NP testing, the less-intrusive MT sampling was offered, followed by a saliva-based option, which only a subset of individuals selected. Although offering saliva testing did not substantially increase participation, it is a practical alternative in appropriate settings due to the ease of self-collection and comparable sensitivity.¹⁰ The initiation of COVID-19 vaccination was associated with a decrease in staff participation in testing (Fig. 1). Participation at the end of 1 year was ~50% of peak participation during the winter before vaccinations began.

One of the limitations of our program is that testing was voluntary. Additionally, we lacked occupational data and a breakdown of direct patient care or COVID-19 patient exposure

Table 1. Number and Percentage of Positive Results at Time of Sampling and Resulting From Asymptomatic SARS-CoV-2 Testing

Variable	No.	%
Specimen type distribution		
MT/NP ^a	130	81
Saliva	30	19
Symptomatic on collection		
Yes	97	61
No	61	38
Uncertain	2	1
Symptomatic at time of result		
Yes	118	74
No	39	24
Uncertain	3	1

Note. MT, mid-turbinate; NP, nasopharyngeal.

^a125 MT and 5 NP specimens.

among participants. Despite our efforts, we cannot know the extent of prevented infections in patients or HCP in our hospital.

In conclusion, asymptomatic testing identified 160 SARS-CoV-2-infected staff members who were isolated according to the protocol; more than half had COVID-19-like symptoms at the time of sampling. The human and financial resources necessary to maintain this program were substantial; however, assessing the cost-benefit status of the program is difficult. The lower utilization of saliva as a specimen was surprising, but staff were reassured by the availability of the program at a time of uncertainty and recognized the HCP advocacy associated with the program.

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Conflicts of interest. All authors declare no conflicts of interest relevant to this article.

References

- Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *Lancet Infect Dis* 2020;20:533–534.
- He X, Lau EHY, Wu P, *et al.* Temporal dynamics in viral shedding and transmissibility of COVID-19. *Nat Med* 2020;26:672–675.
- Alene M, Yismaw L, Assemie MA, *et al.* Magnitude of asymptomatic COVID-19 cases throughout the course of infection: a systematic review and meta-analysis. *PLoS One* 2021;16:e0249090.
- McEllistrem MC, Clancy CJ, Buehrle DJ, *et al.* SARS-CoV-2 is associated with high viral loads in asymptomatic and recently symptomatic healthcare workers. *PLoS One* 2021;16:e0248347.
- Oran DP, Topol EJ. The proportion of SARS-CoV-2 infections that are asymptomatic : a systematic review. *Ann Intern Med* 2021;174:655–662.
- Shenoy ES, Weber DJ. Routine surveillance of asymptomatic healthcare personnel for severe acute respiratory coronavirus virus 2 (SARS-CoV-2): not a prevention strategy. *Infect Control Hosp Epidemiol* 2021. doi: [10.1017/ice.2020.1428](https://doi.org/10.1017/ice.2020.1428).
- Klompas M, Baker MA, Rhee C, *et al.* A SARS-CoV-2 cluster in an acute-care hospital. *Ann Intern Med* 2021. doi: [10.7326/M20-7567](https://doi.org/10.7326/M20-7567).
- McKeeby JW, Siwy CM, Revoir J, *et al.* Unveiling the silent threat among us: leveraging health information technology in the search for asymptomatic COVID-19 healthcare workers. *J Am Med Inform Assoc* 2021;28:377–383.
- Hanrath AT, Schim van der Loeff I, Lendrem DW, *et al.* SARS-CoV-2 testing of 11,884 healthcare workers at an acute NHS hospital trust in England: a retrospective analysis. *Front Med (Lausanne)* 2021;8. doi: [10.3389/fmed.2021.636160](https://doi.org/10.3389/fmed.2021.636160).
- Tsang NNY, So HC, Ng KY, Cowling BJ, Leung GM, Ip DKM. Diagnostic performance of different sampling approaches for SARS-CoV-2 RT-PCR testing: a systematic review and meta-analysis. *Lancet Infect Dis* 2021. doi: [10.1016/S1473-3099\(21\)00146-8](https://doi.org/10.1016/S1473-3099(21)00146-8).