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Original Article

Survey of coronavirus disease 2019 (COVID-19) infection control policies at leading US academic hospitals in the context of the initial pandemic surge of the severe acute respiratory coronavirus virus 2 (SARS-CoV-2) omicron variant

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Abstract

Objective: To assess coronavirus disease 2019 (COVID-19) infection policies at leading US medical centers in the context of the initial wave of the severe acute respiratory coronavirus virus 2 (SARS-CoV-2) omicron variant.

Design: Electronic survey study eliciting hospital policies on masking, personal protective equipment, cohorting, airborne-infection isolation rooms (AIIRs), portable HEPA filters, and patient and employee testing.

Setting and participants: "Hospital epidemiologists from U.S. News top 20 hospitals and 10 hospitals in the CDC Prevention Epicenters program." As it is currently written, it implies all 30 hospitals are from the CDC Prevention Epicenters program, but that only applies to 10 hospitals. Alternatively, we could just say "Hospital epidemiologists from 30 leading US hospitals."

Methods: Survey results were reported using descriptive statistics.

Results: Of 30 hospital epidemiologists surveyed, 23 (77%) completed the survey between February 15 and March 3, 2022. Among the responding hospitals, 18 (78%) used medical masks for universal masking and 5 (22%) used N95 respirators. 16 hospitals (70%) required universal eye protection. 22 hospitals (96%) used N95s for routine COVID-19 care and 1 (4%) reserved N95s for aerosol-generating procedures. 2 responding hospitals (9%) utilized dedicated COVID-19 wards; 8 (35%) used mixed COVID-19 and non–COVID-19 units; and 13 (57%) used both dedicated and mixed units. 4 hospitals (17%) used AIIRs for all COVID-19 patients, 10 (43%) prioritized AIIRs for aerosol-generating procedures, 3 (13%) used alternate risk-stratification criteria (not based on aerosol-generating procedures), and 6 (26%) did not routinely use AIIRs. 9 hospitals (39%) did not use portable HEPA filters, but 14 (61%) used them for various indications, most commonly as substitutes for AIIRs when unavailable or for specific high-risk areas or situations. 21 hospitals (91%) tested asymptomatic patients on admission, but post-admission testing strategies and preferred specimen sites varied substantially. 5 hospitals (22%) required regular testing of unvaccinated employees and 1 hospital (4%) reported mandatory weekly testing even for vaccinated employees during the SARS-CoV-2 omicron surge.

Conclusions: COVID-19 infection control practices in leading hospitals vary substantially. Clearer public health guidance and transparency around hospital policies may facilitate more consistent national standards.

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The coronavirus disease 2019 (COVID-19) pandemic has highlighted the critical importance of rigorous infection control practices in preventing viral transmission in healthcare settings.[1] Recommendations from the Centers for Disease Control and Prevention (CDC) have continued to evolve in response to real-world experiences on the effectiveness of infection control strategies, new data on the science of severe acute respiratory coronavirus virus 2 (SARS-CoV-2) transmission, and the rise of more transmissible variants.[2] However, the CDC guidance is not prescriptive and allows institutions considerable discretion for many key practices, including the specific type of face covering used for universal source control, how to prioritize airborne infection isolation rooms (AIIRs), the role of portable high-efficiency particulate air (HEPA) filters in mitigating transmission risk, and testing strategies for patients and healthcare workers.

Some hospitals considering potential modifications to their infection control programs in response to the evolving pandemic and new data on transmission may wish to compare practices at peer institutions. We surveyed hospital epidemiologists from leading US medical centers to understand COVID-19 infection control practices immediately following the COVID-19 wave caused by the SARS-CoV-2 omicron variant.

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Methods

We distributed an electronic survey in REDCap[3] to hospital epidemiologists at 20 hospitals included in the 2021–2022 *US News World & Report* rankings and 10 nonoverlapping hospitals in the CDC Prevention Epicenters program (hospitals listed in the Supplementary Table online). The survey assessed hospital policies on masking and personal protective equipment (PPE), cohorting COVID-19 patients, use of AIIRs and HEPA filters, patient testing, and employee testing. Survey questions are provided in the Appendix (online). Hospital epidemiologists were contacted directly by the study investigators using an e-mail template. Reminders were sent twice if no response was received. Participation was voluntary, and the survey invitation clearly stated that individual hospital practices would not be identifiable. The survey was open from February 15 to March 3, 2022, corresponding to the period when all regions of the United States were experiencing decreasing COVID-19 case counts following the initial pandemic surge caused by the SARS-CoV-2 omicron variant. Simple descriptive analyses were used to summarize survey results. The study was approved by the Mass General Brigham Institutional Review Board.

Results

Survey response rate and hospital geographic distribution

We received responses from 23 of the 30 surveyed hospitals (77% response rate); all respondents identified themselves as hospital epidemiologists. All 23 hospitals were large academic hospitals representing all US Census regions of the United States (8 Midwest, 6 South, 5 Northeast, and 4 West).

Universal masking and personal protective equipment

Among responding hospitals, 18 (78%) used medical masks for universal masking (ie, non–COVID-19 care), 5 (22%) used N95 respirators, and none used KN95s (Table 1). Of the 18 hospitals that used medical masks, 11 explicitly allowed healthcare workers discretion for using N95s. In 1 hospital, N95s were used for high-risk encounters, but the criteria for these were not specified. Of the 5 hospitals with a universal N95 strategy, 2 respondents explicitly noted that it was tied to current high community rates of COVID-19. In 16 hospitals (70%), universal eye protection for non–COVID-19 care was required. When caring for patients with suspected or confirmed COVID-19, 22 hospitals (96%) used N95s for all aspects of care, and 1 hospital (4%) used medical masks as the default and reserved N95s for aerosol-generating procedures.

COVID-19 care models, AIIRs, and portable HEPA filters

Among the responding hospitals, 2 (9%) cared for COVID-19 patients on dedicated COVID-19 units, 8 (35%) interspersed COVID-19 patients with non–COVID-19 patients on their wards (albeit in separate rooms), and 13 (57%) used both dedicated COVID-19 units and mixed units (11 of these 13 reported that most COVID-19 patients were managed on dedicated COVID-19 units) (Table 2).

4 hospitals (17%) used AIIRs for all COVID-19 patients, 10 (43%) prioritized AIIRs for aerosol-generating procedures, 3 (13%) used alternate risk-stratification criteria (eg, low PCR cycle threshold [Ct] values along with high oxygen requirement or nebulizer use), and 6 (26%) did not routinely use AIIRs. Hospitals used various mitigation strategies when hospital criteria for AIIR use were met but AIIRs were unavailable: 6 reported doing nothing (strictly first come–first serve); 6 moved patients to prioritize those at higher transmission risk; 6 worked with the engineering department to convert standard-pressure rooms to negative pressure; 8 added portable HEPA filters; 1 hospital had never run out of AIIRs because patients were cared for entirely on dedicated COVID-19 wards with abundant AIIRs; and 1 reported allowing unit-level discretion on allocating AIIRs. For hospitals that moved patients around based on transmission risk, factors considered included immunosuppression, nonventilated status and undergoing aerosol-generating procedures (AGPs), and non–critically ill patients within 5 days of symptom onset.

The use of portable HEPA filters varied greatly. 9 hospitals (39%) reported no use of portable HEPA filters at all. Of the 8 hospitals (35%) that used portable HEPA filters for COVID-19 patients when AIIRs were unavailable, 3 also reported using them in breakrooms, workrooms, shared patient rooms, and/or a specific high-risk area (eg, hallways occupied by behavioral health patients where masking was infrequent). Of the remaining 6 hospitals (26%), uses included portable HEPA filters in all COVID-19 rooms (n = 1), in COVID-19 rooms for patients undergoing AGPs or other high risk-procedures (n = 2), for broad use even in non–

Table 1. Summary of Survey Responses on Masking and Personal Protective Equipment

Infection Control Policy	Responses (N = 23), No. (%)	Comments
Universal masking policy for non–COVID-19 patients		2 hospitals that used universal N95s explicitly tied this policy to concomitant high community rates of COVID-19. The one hospital that used N95 for "high-risk encounters" did not specify what risk factors were used for stratification.
Medical mask	6 (26)	
Medical mask, with provider discretion for N95 respirators	11 (48)	
Medical mask but N95 respirators for high-risk encounters	1 (4)	
KN95 respirators	0 (0)	
N95 respirators	5 (22)	
Tools offered to improve medical mask fit (eg, mask fitters or braces)?		This question was only asked for the 17 hospitals that reported using medical masks for universal source control.
Yes	5 (29)	
No	12 (71)	
Respiratory PPE for suspected/confirmed COVID-19		
N95 respirators for all care	22 (96)	
Medical masks for routine care/N95s for AGPs	1 (4)	
Universal eye protection for non–COVID-19 care		Several hospitals explicitly noted that universal eye protection was tied to high community rates.
Yes	16 (70)	
No	7 (30)	

Note. PPE, personal protection equipment; AGP, aerosol-generating procedure.

Table 2. Summary of Survey Responses on COVID-19 Cohorting, AIIRs, and Portable HEPA Filters

Infection Control Policy	Responses (N=23), No. (%)	Comments
COVID-19 cohorting strategy		Of the 13 hospitals utilizing a mixed model, 11 reported that most COVID-19 patients were managed on dedicated COVID-19 wards.
Dedicated COVID-19 wards	2 (9)	
COVID-19 patients interspersed throughout hospital	8 (35)	
Mix of the above	13 (57)	
Use of AIIRs		For hospitals that use alternate risk stratification methods, these risk factors are described in the comments of the question below.
All SARS-CoV-2–positive patients	4 (17)	
SARS-CoV-2–positive patients undergoing AGPs	10 (43)	
SARS-CoV-2–positive patients, alternate risk stratification than AGP	3 (13)	
No routine use of negative pressure for COVID-19 patients	6 (26)	
Mitigation approach when AIIR unavailable		Several hospitals reported multiple mitigation strategies (hence, numbers add up to >23). For hospitals that incorporated transmission risk, factors included immunosuppression, nonventilated status and undergoing AGPs, noncritically ill patients within 5 days of symptom onset, low Ct values, and high oxygen requirement. One hospital explicitly allows unit-level discretion on AIIRs.
Nothing (strictly first come first serve)	6 (26)	
Move patients to prioritize highest transmission risk	6 (26)	
Convert standard pressure to negative pressure	6 (26)	
Add portable HEPA filters	8 (35)	
N/A (do not use AIIRs for COVID-19 patients)	6 (26)	
N/A (have not run out of AIIRs due to dedicated COVID-19 wards)	1 (4)	
Other	4 (17)	
Role of Portable HEPA filters		Several hospitals reported multiple uses of portable HEPA filters (hence, numbers add up to >23). For the "Other" category, 3 hospitals reported using portable HEPA filters for high-risk areas (including dental areas with frequent AGPs, hallways for behavioral health units, ED, and radiology areas with questionable effectiveness of negative pressure; 2 reported using them in COVID-19 patients needing AGPs, and 1 reported broad use even in non-COVID-19 rooms.
All SARS-CoV-2–positive patients	1 (4)	
SARS-CoV-2–positive patients if negative pressure unavailable	8 (35)	
Outside rooms of SARS-CoV-2–positive patients	0 (0)	
Nursing stations	0 (0)	
Workrooms	3 (13)	
Breakrooms	1 (4)	
Shared patient rooms	2 (9)	
No role	9 (39)	
Other	6 (26)	

Note. AIIR, airborne infection isolation room; HEPA, high-efficiency particulate air, aerosol-generating procedure; N/A, not applicable; ED, emergency department.

COVID-19 rooms (n = 1), in a dental procedural area (n = 1), and in emergency department and radiology areas where the effectiveness of built-in negative pressure was uncertain (n = 1).

Patient and employee testing

Overall, 21 hospitals (91%) used universal testing of patients (ie, both symptomatic and asymptomatic) on admission, whereas the other 2 hospitals tested only symptomatic, exposed, or other high-risk patients (Table 3). 7 hospitals (30%) had at least 1 post-admission test to detect virus that might have been incubating on admission and thus missed by the admission test. Testing occurred on day 3 (n = 2), day 4 (n = 1), day 5 (n = 2), or day 7 (n = 2). 6 hospitals additionally reported conducting repeated surveillance testing on non–COVID-19 patients every 4 days (n = 1), every 5 days (n = 2), or every 7 days (n = 3). In addition, 5 hospitals reported other tailored strategies: testing every 3 days through hospital day 14 for patients undergoing AGPs (n = 2), preprocedure testing after day 7 (n = 1); repeated testing for patients admitted to congregate units (n = 1); and twice weekly testing for patients receiving nebulizers (n = 1).

Among the respondents, 18 hospitals (78%) used nasopharyngeal swabs for symptomatic inpatients, 4 (17%) used anterior nasal swabs, and 1 used another site (not specified). For asymptomatic patients, 13 (57%) used nasopharyngeal swabs, 8 (35%) used anterior nasal swabs, and 2 (9%) used midturbinate swabs. No hospitals reported using saliva tests for symptomatic or asymptomatic patients.

Among all respondents, 12 hospitals (52%) used an algorithm to clear COVID-19 precautions for asymptomatic patients who

Table 3. Summary of Survey Responses on Patient and Employee Testing Policies

Infection Control Policy	Responses (N = 23), No. (%)	Comments
Strategy for patient testing on admission		
Universal testing, including asymptomatic patients	21 (91)	
Testing only of symptomatic/exposed/high risk patients	2 (9)	
Repeat postadmission testing to detect incubating virus?		Hospitals that conducted repeated after admission testing did so on day 3 (n=2), day 4 (n=1), day 5 (n=2), and day 7 (n=2).
Yes	7 (30)	
No	16 (70)	
Routine surveillance testing on non–COVID-19 patients?		"Other" strategies included testing every 3 days through hospital day 14 for patients undergoing AGPs (n=2), preprocedure testing after day 7 (n=1), testing every 4 days (n=1), repeat testing for patients admitted to congregate units (n=1), and twice weekly for patients receiving nebulizers (n=1).
Yes, every 3 d	0 (0)	
Yes, every 5 d	2 (9)	
Yes, every 7 d	3 (13)	
Yes, at intervals >7 d	0 (0)	
No	13 (57)	
Other	6 (26)	
Specimen site for symptomatic patients		No hospitals reported using midturbinate or saliva for symptomatic patients. The one "other" site was not specified.
Nasopharyngeal	18 (78)	
Anterior nasal	4 (17)	
Other	1 (4)	
Specimen site for asymptomatic patients		No hospitals reported using saliva or other specimen sites for asymptomatic patients.
Nasopharyngeal	13 (57)	
Anterior nasal	8 (35)	
Midturbinate	2 (9)	
Testing algorithm to clear asymptomatic SARS-CoV-2–positive patients with high Ct values?		The Ct value considered "high" varied among hospitals, most commonly 30 (n=6) followed by 33 (n=3) and 35 (n=3).
Yes, clear with single high Ct value	1 (4)	
Yes, clear if repeated PCR confirms high Ct value/negative, with positive serologies used to support prior infection	3 (13)	
Yes, clear if repeated PCR confirms high Ct value/negative; serologies not factored into algorithm	8 (35)	
No	11 (48)	
Primary strategy for clearing precautions from SARS-CoV-2–positive patients		
· Time-based criteria	8 (35)	
· Test-based criteria	2 (9)	
· Time-based for most, but test-based criteria for high-risk patients (ie, immunocompromised)	12 (52)	
Employee testing policy		The hospital with mandatory testing required weekly NAAT testing for vaccinated employees and twice weekly for unvaccinated employees during the omicron surge. "Other" strategies included testing unvaccinated employees weekly (n=1) or twice weekly (n=1) or at unspecified frequency (n=1). 1 hospital reported using selective testing for asymptomatic exposed employees based on vaccination status.
· Routine mandatory testing	1 (4)	
· Testing if symptoms or known COVID-19 exposure, or elective per employee discretion	13 (57)	
· Testing if symptoms or known COVID-19 exposure; no elective testing allowed	5 (22)	
· Other	4 (17)	

Note. Ct, cycle threshold; NAAT, nucleic acid amplification test; PCR, polymerase chain reaction.

tested positive for SARS-CoV-2 with high Ct values. Only 1 hospital used a single high Ct value; 3 hospitals required stably high Ct values on repeated PCR testing and factored in positive serologies to support evidence of prior infection (ie, residual viral RNA). 8 hospitals required stably high Ct values on PCR testing but did not factor serologies into their algorithm. The Ct value considered "high" for these purposes varied among hospitals, most commonly 30 (n = 6) followed by 33 (n = 3) and 35 (n = 3). When clearing precautions from patients with confirmed COVID-19, 8 hospitals (35%) primarily used time-based criteria, 2 (9%) used test-based criteria, and 12 used time-based criteria for most patients but used test-based criteria for high-risk patients such as those with immunocompromising conditions.

5 hospitals (22%) required regular testing of unvaccinated employees; 1 hospital (4%) reported mandatory weekly testing, even for vaccinated employees, during the COVID-19 surge related to the omicron variant. The other 18 hospitals did not have mandatory surveillance testing for employees but instead required testing for new symptoms or known COVID-19 exposures; 13 of these also allowed elective testing at the employee's discretion.

Discussion

We surveyed hospital epidemiologists from 23 leading US hospitals to understand COVID-19 infection control policies in the context of the initial wave of COVID-19 caused by the SARS-CoV-2 omicron variant in the United States. The 2 policies that were nearly uniform were the type of respiratory protection for COVID-19 patients (96% of survey hospitals used N95s for routine care) and universal testing of patients on admission (91% of survey hospitals). Consensus was moderately high regarding universal eye protection for non–COVID-19 patients (70% of survey hospitals), preference for nasopharyngeal swabs for symptomatic patients (78% of survey hospitals), and targeted rather than mandated surveillance testing of employees (78% of survey hospitals). Beyond this, however, we observed substantial variation in care models (dedicated COVID-19 units vs mixed units vs a combination of both), use of airborne infection isolation rooms, use of portable HEPA filters, postadmission testing strategies, specimen source sites for asymptomatic patients, use of algorithms to clear precautions from asymptomatic patients with high Ct values on their initial positive SARS-CoV-2 tests, what Ct values were considered to be high, and use of time versus test-based strategies to clear precautions from patients with confirmed COVID-19.

The routine use of N95s for all COVID-19 care rather than only for AGPs corresponds with shifts in the CDC and WHO guidance that reflect the growing evidence of aerosol-based transmission, even in the absence of AGPs.[4–6] Although most hospitals used medical masks for universal respiratory protection and source control when caring for patients without suspected or confirmed COVID-19, 5 hospitals reported using N95s for this purpose, and several explicitly tied this to high community rates. This finding may reflect the growing recognition that patients with early unsuspected infection can be highly contagious, even in the absence of symptoms, and that most clusters tend to occur in non–COVID-19 wards where transmissions can be rapidly sparked by patients or healthcare workers with unsuspected acute infections.[7,8] N95 respirators provide better respiratory protection for healthcare workers than medical masks and also provide better source control to reduce the risk of transmission to patients.[9–11] The advantages of universal N95s over medical masks, however, must be balanced against higher costs, less comfort, and logistical challenges related to fit testing.

The variability in cohorting strategies and use of AIIRs may reflect variability in the physical infrastructure and engineering capabilities of hospitals. Some hospitals, for example, can convert standard pressure rooms, wards, or even entire buildings to negative pressure, whereas others may only have a small, fixed number of AIIRs. Hospitals also varied in the criteria they used to place COVID-19 patients into AIIRs, ranging from all COVID-19 patients to just those requiring AGPs to not using AIIRs at all. Some hospitals used non-AGP risk-stratification schemes that incorporated low Ct values, severity of symptoms, duration from symptom onset, and immunocompromised status. These criteria may reflect emerging data that AGPs do not generate aerosols, though they can sometimes be proxies for factors that do increase transmission risk (eg, heavy breathing, coughing, and high viral loads).[13–17] Notably, few data are available on the clinical impact of AIIRs on preventing nosocomial spread of SARS-CoV-2 to other patients or healthcare workers.[19]

Interestingly, 9 hospitals reported not using portable HEPA filters at all as part of their infection control strategy; on the other end of the spectrum, 1 hospital used them for all patient rooms, even those without COVID-19. Many hospitals had a more targeted strategy, including using them when COVID-19 patients met their criteria for negative pressure but AIIRs were unavailable. Some hospitals also deployed portable HEPA filters outside the rooms of COVID-19 patients in selected high-risk areas, or in shared patient rooms. The latter indication makes sense insofar as transmission risk between roommates is very high when one has an occult infection,[20,21] and portable HEPA filters have been shown to help rapidly clear infectious aerosols and airborne virus from the rooms of COVID-19 patients.[22–26]

Almost all hospitals reported universal testing of patients on admission. This is an important infection control measure, given that a large fraction of infectious individuals are asymptomatic, presymptomatic, or paucisymptomatic.[27] The strategies for repeated testing after admission, however, varied greatly, with some hospitals conducting repeated surveillance testing as frequently as every 4 days, while others only did so for new symptoms or known exposures. Prior studies have suggested that surveillance testing can identify occult nosocomial infections, but the overall yield may be low depending on community transmission rates.[28]

Most hospitals used nasopharyngeal swabs for testing symptomatic patients, but many used anterior nasal swabs for asymptomatic screening. Although anterior nasal swabs may have slightly lower sensitivity than nasopharyngeal swabs, they have the advantage of greater patient comfort.[29] Interestingly, no hospitals used saliva testing, although this also appears to perform well and is noninvasive.[30]

More than half of the hospitals used algorithms to clear precautions from patients who incidentally tested positive with high Ct values. Some of these algorithms have been shown to safely facilitate rapid discontinuation of isolation in a large fraction of SARS-CoV-2–positive patients.[31,32] However, the precise algorithm and Ct value varied between hospitals (with 30 being the lowest threshold used). Some hospitals may be reluctant to consider Ct values for infection control decisions, however, given potential variability between assays and sample quality, given the lack of a uniform standard for inferring absence of infectiousness, and because some hospitals' assays or laboratories may not generate or report Ct values.[33]

Only 22% of hospitals in this survey required regular surveillance testing of employees. Conducting routine surveillance testing for large numbers of healthcare workers poses logistical challenges and is costly. False-positive results can exacerbate staff shortages, and the benefit on top of universal masking is unclear.[34] Nonetheless, pre-emptive testing when community incidence rates are high (as was the case with the initial pandemic surge due to the SARS-CoV-2 omicron variant) may be a reasonable additional strategy to minimize infections in the workplace.[35–37]

Our study had several limitations. First, the survey sample was drawn from 30 large academic hospitals, many with considerable resources relative to other hospitals, and with an incomplete response rate. Hence, these results cannot be considered generalizable to all US hospitals. However, our goal was to identify practices at leading institutions that many hospitals strive to emulate. Second, our study was conducted at a specific point in time, but COVID-19 infection control policies continue to evolve rapidly in response to new data and changes in local incidence rates. Third, our survey was designed only to describe the infection control policies being used across these hospitals and did not attempt to assess their effectiveness. Lastly, we attempted to focus on the most pressing questions regarding COVID-19 policies, but numerous other nuanced infection control issues likely vary across hospitals, such as the quarantine period and testing strategy for COVID-exposed inpatients, repeated testing practices prior to discharge to facilities, whether and how employee or patient vaccine and booster status affect testing strategies, and policies for visitations and visitor masking.

In conclusion, in this survey of 23 leading US hospitals, we documented some infection control policies that were common across institutions, but many more that were highly variable. This variability underscores the need for ongoing research into the effectiveness of different infection control policies. Clearer public health guidance and transparency around hospitals' policies may also facilitate more consistent national standards.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2022.155

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References

1. Rhee C, Baker MA, Klompas M. The COVID-19 infection control arms race. *Infect Control Hosp Epidemiol* 2020;41:1323–1325.
2. Interim infection prevention and control recommendations for healthcare personnel during the coronavirus disease 2019 (COVID-19) pandemic. Centers for Disease Control and Prevention website. https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html. Updated February 2, 2022. Accessed June 15, 2022.
3. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–381.
4. Scientific brief: SARS-COV-2 transmission. Centers for Disease Control and Prevention website. https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html. Updated May 7, 2021. Accessed February 24, 2022.
5. Klompas M, Milton DK, Rhee C, Baker MA, Leekha S. Current insights into respiratory virus transmission and potential implications for infection control programs: a narrative review. *Ann Intern Med* 2021;174:1710–1718.
6. Greenhalgh T, Jimenez JL, Prather KA, Tufekci Z, Fisman D, Schooley R. Ten scientific reasons in support of airborne transmission of SARS-CoV-2. *Lancet* 2021;397:1603–1605.
7. Braun KM, Moreno GK, Buys A, *et al.* Viral sequencing reveals US healthcare personnel rarely become infected with SARS-CoV-2 through patient contact. *Clin Infect Dis* 2021;73:e1329–e1336.
8. Jinadatha C, Jones LD, Choi H, *et al.* Transmission of SARS-CoV-2 in inpatient and outpatient settings in a Veterans' Affairs healthcare system. *Open Forum Infect Dis* 2021;8:ofab328.
9. Klompas M, Rhee C, Baker MA. Universal use of N95 respirators in healthcare settings when community coronavirus disease 2019 rates are high. *Clin Infect Dis* 2022;74:529–531.
10. Klompas M, Karan A. Preventing SARS-CoV-2 transmission in healthcare settings in the context of the omicron variant. *JAMA* 2022;327:619–620.
11. Baker MA, Rhee C, Tucker R, *et al.* Rapid control of hospital-based SARS-CoV-2 omicron clusters through daily testing and universal use of N95 respirators. *Clin Infect Dis* 2022. doi: 10.1093/cid/ciac113.
12. Byambasuren O, Beller E, Clark J, Collignon P, Glasziou P. The effect of eye protection on SARS-CoV-2 transmission: a systematic review. *Antimicrob Resist Infect Control* 2021;10:156.
13. Brown J, Gregson FKA, Shrimpton A, *et al.* A quantitative evaluation of aerosol generation during tracheal intubation and extubation. *Anaesthesia* 2021;76:174–181.
14. Wilson NM, Marks GB, Eckhardt A, *et al.* The effect of respiratory activity, noninvasive respiratory support and face masks on aerosol generation and its relevance to COVID-19. *Anaesthesia* 2021;76:1465–1474.
15. Gaeckle NT, Lee J, Park Y, Kreykes G, Evans MD, Hogan CJ Jr. Aerosol generation from the respiratory tract with various modes of oxygen delivery. *Am J Respir Crit Care Med* 2020;202:1115–1124.
16. Bem RA, van Mourik N, Klein-Blommert R, *et al.* Risk of aerosol formation during high-flow nasal cannula treatment in critically ill subjects. *Respir Care* 2021;66:891–896.
17. Thuresson S, Fraenkel CJ, Sasinovich S, *et al.* Airborne SARS-CoV-2 in hospitals— effects of aerosol-generating procedures, HEPA-filtration units, patient viral load, and physical distance. *Clin Infect Dis* 2022. doi: 10.1093/cid/ciac161.
18. Klompas M, Baker M, Rhee C. What is an aerosol-generating procedure? *JAMA Surg* 2021;156:113–114.
19. Klompas M, Ye S, Vaidya V, *et al.* Association between airborne infection isolation room utilization rates and healthcare worker COVID-19 infections in two academic hospitals. *Clin Infect Dis* 2021. doi: 10.1093/cid/ciab849.
20. Trannel AM, Kobayashi T, Dains A, *et al.* Coronavirus disease 2019 (COVID-19) incidence after exposures in shared patient rooms in a tertiary-care center in Iowa, July 2020–May 2021. *Infect Control Hosp Epidemiol* 2021. doi: 10.1017/ice.2021.313.
21. Karan A, Klompas M, Tucker R, *et al.* The risk of SARS-CoV-2 transmission from patients with undiagnosed COVID-19 to roommates in a large academic medical center. *Clin Infect Dis* 2022;74:1097–1100.
22. Conway Morris A, Sharrocks K, Bousfield R, *et al.* The removal of airborne SARS-CoV-2 and other microbial bioaerosols by air filtration on COVID-19 surge units. *Clin Infect Dis* 2021.
23. Garzona-Navas A, Sajgalik P, Csecs I, *et al.* Mitigation of aerosols generated during exercise testing with a portable high-efficiency particulate air filter with fume hood. *Chest* 2021;160:1388–1396.
24. Lindsley WG, Derk RC, Coyle JP, *et al.* Efficacy of portable air cleaners and masking for reducing indoor exposure to simulated exhaled SARS-CoV-2 aerosols—United States, 2021. *Morb Mortal Wkly Rep* 2021;70:972–976.
25. Rodriguez M, Palop ML, Sesena S, Rodriguez A. Are the portable air cleaners (PAC) really effective to terminate airborne SARS-CoV-2? *Sci Total Environ* 2021;785:147300.

26. Thuresson S, Fraenkel C, Sasinovich S, *et al.* Airborne SARS-CoV-2 in hospitals— effects of aerosol-generating procedures, HEPA-filtration units, patient viral load and physical distance. *Clin Infect Dis* 2022.
27. Johansson MA, Quandelacy TM, Kada S, *et al.* SARS-CoV-2 transmission from people without COVID-19 symptoms. *JAMA Netw Open* 2021;4: e2035057.
28. Smith L, Pau S, Fallon S, *et al.* Impact of weekly asymptomatic testing for severe acute respiratory coronavirus virus 2 (SARS-CoV-2) in inpatients at an academic hospital. *Infect Control Hosp Epidemiol* 2021:1–3.
29. 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;21:1233–1245.
30. Bastos ML, Perlman-Arrow S, Menzies D, Campbell JR. The sensitivity and costs of testing for SARS-CoV-2 infection with saliva versus nasopharyngeal swabs : a systematic review and meta-analysis. *Ann Intern Med* 2021;174:501–510.
31. Rhee C, Baker MA, Kanjilal S, *et al.* Prospective clinical assessments of hospitalized patients with positive SARS-CoV-2 PCR tests for necessity of isolation. *Open Forum Infect Dis* 2021;8:ofab194.
32. Kobayashi T, Trannel A, Holley SA, *et al.* Coronavirus disease 2019 serial testing among hospitalized patients in a Midwest tertiary medical center, July–September 2020. *Clin Infect Dis* 2021;73:e3116–e3119.
33. Rhoads D, Peaper DR, She RC, *et al.* College of American Pathologists (CAP) Microbiology Committee perspective: caution must be used in interpreting the cycle threshold (Ct) value. *Clin Infect Dis* 2021;72:e685–e686.
34. 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;42:592–597.
35. Klompas M, Baker MA, Rhee C, *et al.* A SARS-CoV-2 cluster in an acute-care hospital. *Ann Intern Med* 2021;174:794–802.
36. Paltansing S, Sikkema RS, de Man SJ, Koopmans MPG, Oude Munnink BB, de Man P. Transmission of SARS-CoV-2 among healthcare workers and patients in a teaching hospital in the Netherlands confirmed by whole-genome sequencing. *J Hosp Infect* 2021;110:178–183.
37. Klompas M, Baker MA, Griesbach D, *et al.* Transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from asymptomatic and presymptomatic individuals in healthcare settings despite medical masks and eye protection. *Clin Infect Dis* 2021;73:1693–1695.