

VIEWPOINT

Hospital-Acquired SARS-CoV-2 Infection

Lessons for Public Health

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From the outset of the coronavirus disease 2019 (COVID-19) pandemic, it was clear that hospitals were an important setting for viral transmission. A review of 2 early case series in China estimated that 44% of 179 severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections were hospital acquired.¹ An illustrative example of the devastating potential for health care transmission of SARS-CoV-2 came from St Augustine's Hospital in Durban, South Africa, a facility with 469 beds, including 18 wards, 6 intensive care units, and 735 clinical staff.² Through a detailed epidemiologic study supplemented by phylogenetic analyses, investigators documented how a single unsuspected case of SARS-CoV-2 led to 6 major clusters involving 5 hospital wards and an outside nursing home and dialysis unit, with infection ultimately confirmed among 80 staff members and 39 patients, 15 of whom died.²

Patients and health care workers around the world became concerned about the risk of providing routine care for patients with COVID-19, especially given the uncertainties about routes of transmission of SARS-CoV-2. Many settings intentionally limited or decreased elective visits and procedures during surging

continued to increase, consistent with the overall community incidence.³

Another study of health care workers at 12 hospitals with more than 75 000 employees found that the SARS-CoV-2 test positivity rate among health care workers decreased linearly from 14.65% to 11.46% during a 3-week period after implementation of universal masking.⁴ A detailed contact tracing study of 226 patients exposed to health care workers with confirmed COVID-19 during the surge in Boston found only 1 possible transmission, and this was in the context of a 30-minute encounter during which both patient and health care worker were unmasked.⁵ In a complementary analysis of the same hospital system, researchers found no convincing cases of in-hospital transmission among more than 9000 admitted patients after implementation of universal masking for staff and patients.⁶

Together, these findings suggest that overall hospital transmission of SARS-CoV-2 in the setting of universal masking is likely rare, even during periods of high community prevalence. This has at least 2 important implications. First, it is imperative for the public to understand that hospitals with well-implemented universal masking policies are overwhelmingly safe, and public health messaging should emphasize that avoidance or delay of needed and urgent health care is not necessary. Second, despite the politicization of masking, this is an important and compelling proof of concept for the broader use of universal masking in crowded indoor settings, even with good ventilation. High-quality studies in other contexts can inform the extent to which

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cases to reduce health care load and potential exposure. In addition, there have been substantial reductions in presentations for urgent or emergency illnesses, including myocardial infarction, tuberculosis, stroke, and hyperglycemic episodes. The consequences of these reductions are likely to contribute to excess mortality associated with the COVID-19 pandemic, considering that these conditions result in hundreds of thousands of deaths each year in the US.

Simultaneously, mounting evidence supports the effectiveness of a relatively simple intervention in reducing hospital transmission of SARS-CoV-2: universal use of surgical masks by health care workers and patients. This intervention appears to be effective, despite a relative inability to completely physically distance within the hospital. A study of 21 000 health care workers found that nosocomial-acquired SARS-CoV-2 infections decreased significantly after implementation of a universal masking policy, whereas community-acquired cases

efficacy differs with cloth masks or face coverings more typically used outside of hospital settings relative to surgical masks (and in some cases, especially during aerosol-generating procedures, use of N95 respirators) in hospitals. Masking will become even more important as the COVID-19 crisis continues into the upcoming influenza season in the northern hemisphere.

However, the World Health Organization recently suggested that health care workers account for up to 1 in 7 cases of COVID-19 worldwide. An analysis of more than 2 million community members and nearly 100 000 frontline health care workers in the US and the UK found an increased risk of having a positive SARS-CoV-2 test result among health care workers compared with community members, with rates of 2747 and 242 cases per 100 000 people, respectively, and a hazard ratio for a positive test result of 3.40 after adjusting for a wide variety of measurable factors.⁷ If hospital transmission with universal masking is so rare, what is the explanation for

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ongoing reports that health care workers account for a large proportion of cases worldwide?

The available data that suggest increased risk among health care workers must be interpreted with caution for several important reasons. First, many of these cases occurred either before the institution of universal masking protocols or in settings in which access or adherence to masks has been limited. Second, studies that have suggested higher risk of infection in health care workers have largely not been able to differentiate between community and hospital acquisition of infection. Health care workers may differ from the general public in their social exposure patterns outside the hospital. Third, health care workers are more likely to be tested than community members, and, even in studies that attempt to adjust for this differential in testing, estimates of risk of infection among health care workers relative to the community are almost certainly biased upward.

With these caveats in mind, detailed investigations of hospital outbreaks in the context of universal masking may be highly informative in identifying residual systemic weaknesses that allow transmission clusters to occur despite masking policies. These investigations, during which exhaustive contact tracing is routinely performed, could provide lessons that also could be applied to indoor settings outside the hospital, in which the specific nature of exposures is not as frequently available.

In the few outbreaks that have been reported in hospital settings during universal masking, several recurrent features have emerged. Duke Health in North Carolina found that "unmasked exposure to another [health care worker] rather than exposure to known infected patients resulted in the most [SARS-CoV-2] cases among staff after implementation [of universal masking]."⁸ Transmission leading to a cluster of at least 55 infections at Baystate Medical Center in Massachusetts in July 2020 was traced back to "staff who convened in a breakroom and removed their masks."⁹ In an outbreak at Brigham and Women's Hospital in Boston in September 2020 that was associated with infections in 42 health care workers and 15 patients, hospital epidemiologists identified a number of important contributing factors, including that "many patients were not masked during clinical care" and "[that there was a] lack of physical distancing among staff while unmasked while eating."¹⁰ This pat-

tern is unsurprising, especially given what is now known about the timing of infectiousness peaking at approximately symptom onset or just before; most patients with SARS-CoV-2 who require hospitalization are admitted at least 5 to 7 days after symptom onset, by which point they are probably minimally or noninfectious.

What is clear is that these hospital-based outbreaks have not revealed a failure of universal masking, but rather challenges in systems such as inadequate support to maintain masking adherence and basic human nature, in which individuals tire of masking. In particular, breakdowns have occurred in small workrooms and during mealtime in facilities that were not designed to allow adequate physical distancing during a respiratory pandemic. Although many in health care have focused on preventing transmission from patients with known SARS-CoV-2, these examples emphasize that residual transmission with universal masking appears to primarily occur after breaches in now-routine preventive measures. Lessons from the experiences of the millions of dedicated health care workers continuing to work during the COVID-19 crisis should be heeded by hospital systems and society in general to improve transmission prevention in all settings.

Hospital systems (and other indoor facilities) should focus on a number of provisions in addition to distributing a sufficient supply of masks to all staff and patients. Adequate, well-ventilated, and ideally dedicated space must be provided for breaks from daily work activities and mealtimes for health care workers, with processes in place to ensure that these are staggered to minimize contact and conversation during these higher-risk periods. Shared patient rooms should be avoided when possible, especially when local prevalence of infection is high, because of the possibility that patients might be admitted during the SARS-CoV-2 incubation period and because they must remove their masks to eat. The marginal benefit of universal eye protection should be evaluated, particularly during clinical encounters. Regular, flexible, and convenient testing with short turnaround times and adequate and statutory sick leave should be made available to all health care workers, with systems in place to ensure progression of training for medical trainees. Through these measures, transmission could be further minimized (and perhaps even eliminated), and emerging evidence could continue to direct policies designed to maintain safety in the hospital setting.

ARTICLE INFORMATION

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