

Universal Use of N95 Respirators in Healthcare Settings When Community Coronavirus Disease 2019 Rates Are High

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The Centers for Disease Control and Prevention recommends N95 respirators for all providers who see patients with possible or confirmed coronavirus disease 2019 (COVID-19). We suggest that N95 respirators may be just as important for the care of patients without suspected COVID-19 when community incidence rates are high. This is because severe acute respiratory syndrome coronavirus 2 is most contagious before symptom onset. Ironically, by the time patients are sick enough to be admitted to the hospital with COVID-19, they tend to be less contagious. The greatest threat of transmission in healthcare facilities may therefore be patients and healthcare workers with early occult infection. N95 respirators' superior fit and filtration provide superior exposure protection for healthcare providers seeing patients with early undiagnosed infection and superior source control to protect patients from healthcare workers with early undiagnosed infection. The probability of occult infection in patients and healthcare workers is greatest when community incidence rates are high. Universal use of N95 respirators may help decrease nosocomial transmission at such times.

Keywords. SARS-CoV-2 transmission; N95 respirators; hospital infection control.

The Centers for Disease Control and Prevention (CDC) recently upgraded their infection control guidance for healthcare workers caring for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) to require rather than prefer N95 or higher respirators instead of medical masks [1]. We applaud this change given the now abundant data that show that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is carried by aerosols that can be borne on air currents and that can pass through the gaps between medical masks and providers' faces [2]. Ironically, however, the need for better respiratory protection may be more acute for healthcare workers caring for patients without suspected or confirmed COVID-19 when community incidence rates are high.

First, patients with SARS-CoV-2 infections are generally most contagious just before and immediately following symptom onset [3]. This corresponds to measures of viral dynamics: viral loads are highest just before symptom onset and rapidly decline thereafter [4, 5]. This helps explain why asymptomatic and presymptomatic people account for the majority of SARS-CoV-2 transmissions and why secondary transmissions rarely occur after 5 days following symptom onset [3, 6]. By the time most patients develop symptoms and progress to the point of requiring medical attention, their viral loads have typically

fallen and they tend to be less contagious [7, 8]. Indeed, COVID-19 tends to be a biphasic illness for the subset of patients who progress to severe disease. The first phase is the viral replicative phase; the second phase is the inflammatory phase. Viral loads tend to be high during the first phase but low or absent during the inflammatory phase. Ironically, patients with some of the most severe manifestations of COVID-19 have low viral loads and are minimally contagious [7, 8].

By contrast, patients admitted to the hospital for non-COVID-19 reasons who test negative on admission but who are incubating SARS-CoV-2 (or acquire it in the hospital) pose a much greater threat to staff as their viral load and contagiousness will reach a peak after admission [8]. We and others have documented multiple instances in which asymptomatic and presymptomatic patients in ambulatory and inpatient settings have infected healthcare workers despite the fact that the workers were wearing masks and eye protection [9–12]. It follows that healthcare workers providing care to patients without known COVID-19 may be at greater risk for infection when the community incidence of COVID-19 is high compared with workers caring for patients who have already been diagnosed with COVID-19. This is borne out by studies demonstrating that healthcare workers interacting with undifferentiated patients are at higher risk for infection than healthcare workers in intensive care units [13, 14]. If N95 respirators are appropriate to protect healthcare workers seeing patients with confirmed COVID-19, then it follows that they are also appropriate to protect healthcare workers seeing asymptomatic patients in outpatient and inpatient settings when the incidence of COVID-19 is high.

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Second, patients with known or suspected COVID-19 tend to be managed according to strict safety protocols. Many hospitals preferentially place these patients in dedicated COVID-19 wards, often in negative pressure rooms with enhanced ventilation to minimize the amount of virus in the air, and specify strict protocols for donning and doffing personal protective equipment to minimize self-contamination. Providers seeing patients with known or suspected COVID-19 tend to be fastidious about their personal protective equipment, use eye protection in addition to respirators, and are more apt to remind their patients to wear masks for source control. By contrast, providers caring for patients on non-COVID-19 wards tend to assume they are uninfected (particularly if they tested negative on admission) and therefore tend to be less particular about ensuring that their masks fit well, using eye protection, and asking patients to wear masks [9]. This puts them at risk of infection if they have a patient with acute but occult COVID-19. Routine use of fit-tested N95 or similar respirators when community COVID rates are high could help mitigate this risk.

Third, respirators provide better source control than medical masks and therefore help protect patients from being infected by staff members [15–17]. Patients with active COVID-19 are at minimal risk of superinfection or reinfection if they receive care from a healthcare worker with occult SARS-CoV-2 infection. By contrast, infected healthcare workers pose a substantial risk to uninfected patients on non-COVID wards. There are now a plethora of reports documenting COVID-19 transmissions in healthcare settings, almost all in non-COVID wards [6, 9, 11, 12, 18]. Many have been traced to staff members who introduced SARS-CoV-2 into the facility or who served as vectors to carry the virus from patient to patient [9, 19, 20]. N95 respirators can not only help protect staff from being infected by patients with occult COVID-19 but may also help prevent occult positive staff members from infecting patients.

Vaccinating healthcare workers and patients is ultimately the most powerful way to reduce the risk of transmission between healthcare workers and patients. However, vaccination rates remain low in many countries and sometimes within specific communities in otherwise well-vaccinated countries. These countries and communities remain vulnerable to healthcare-associated transmission of SARS-CoV-2 [20]. Even vaccinated healthcare workers are still at risk of both getting infected and transmitting infections to patients during periods of high community incidence. Both breakthrough infections and silent carriage have been well documented [21, 22]. This is a particular concern when working with immunocompromised patients who are at increased risk for vaccine failure, prolonged carriage, and poor outcomes [23–25]. Our ability to rely on vaccines may also be reduced if highly transmissible vaccine-escape variants become more frequent or if substantial numbers of healthcare workers and patients continue to decline vaccination.

To be sure, there are downsides to N95 respirators. There is danger of overreliance on personal protective equipment

to protect staff and patients instead of redundant, multilayer, administrative and architectural controls. N95 respirators require fit-testing, can be uncomfortable to wear for long periods, may impair communication, and are more expensive than face masks. Unless and until we prioritize the use of respirators for more indications, however, we are unlikely to solve these problems. National and international coordination and higher demand could help increase production, lower costs, and catalyze innovators to design more comfortable models.

We fear that healthcare workers have developed a false sense of security about medical masks, borne of their experience that patient-to-staff infections are rare. It is important to recognize that the low number of patient-to-staff infections is because most patients do not have COVID-19; preprocedure and admission testing filters out most that do, and even patients who do test positive may no longer be contagious because polymerase chain reaction tests tend to remain positive long after patients are no longer contagious; and some healthcare worker infections go unrecognized because so much of COVID is asymptomatic or paucisymptomatic. These factors breed a false sense of security about the protective power of masks [9–12]. The CDC and others have given guidance on improving mask fit by wearing a cloth mask over a medical mask or adding mask braces or fitters, but it does not make sense to rely on these less effective alternatives in healthcare settings when standard-of-care respirators are available [26].

Many countries continue to struggle with very high rates of COVID-19. This is likely to continue due to both the relentless rise of viral variants associated with higher rates of transmission as well as sluggish vaccine distribution in middle- and lower-income countries. It is too soon to let down our guard. N95 respirators should be the standard of care for all patient encounters in communities with high rates of COVID transmission to better protect both healthcare workers and patients.

Note

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