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Respiratory Protection Against Influenza

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THE 2009 INFLUENZA A(H1N1) PANDEMIC HAS REVIVED debate about the role of respiratory protection in preventing the transmission of influenza to health care personnel (HCP). The Centers for Disease Control and Prevention (CDC) guidelines for preventing transmission of seasonal influenza are intended to limit exposure to large respiratory droplets and recommend the use of a medical (surgical) mask during the care of a patient with influenza as part of a comprehensive infection control strategy.^{1,2} However, data suggest that under certain conditions, influenza viruses can be transmitted via smaller particles that evade filtration by such masks.³ Unlike medical masks, N95 particulate respirators protect wearers from small particles when appropriately designed and worn.⁴ Recommendations to prevent influenza transmission take on special importance during pandemics, when there is little, if any, native immunity and vaccine is not available immediately.⁵

During the current pandemic, public health organizations and professional societies have reviewed information on influenza transmission and severity of the pandemic H1N1 virus and developed differing recommendations for respiratory protection. Some groups, including the World Health Organization and Society for Healthcare Epidemiology of America, recommend the use of medical masks for most patient care activities, and others, most notably the CDC, recommend N95 respirators. Deliberations have been influenced by animal studies indicating that 2009 influenza A(H1N1) virus was transmitted via inhaled particles and replicated in the lower respiratory tract.^{3,6} In September 2009, the Institute of Medicine (IOM) supported the use of N95 respirators during the care of patients infected with H1N1 influenza, although this group was instructed not to consider the available supply or comfort of N95 respirators in their decision.⁷

The debate on the type of mask has been hampered by a lack of clinical trials examining the efficacy of medical masks and N95 respirators and by limited understanding of the relative contributions of different transmission modes of influenza. In this issue of JAMA, Loeb et al⁸ report the results of a multicenter randomized trial comparing N95 respirators with surgical masks in preventing the transmission of influenza

in acute health care settings. This clinical trial involved 446 nurses working in emergency departments, medical units, or pediatric units in 8 Canadian tertiary care hospitals. During September 2008 through January 2009, each nurse was randomly assigned to wear either a medical mask or a fit-tested N95 respirator when caring for patients with febrile respiratory illness. Randomization of individual HCP permitted analysis at the individual level—a key strength of the study design. Participants were evaluated for clinical and laboratory-confirmed respiratory illness using influenza serology and a multiplex polymerase chain reaction (PCR) to detect a variety of viral respiratory pathogens. Influenza infection, diagnosed by a positive PCR or a 4-fold or greater rise in titers, was the primary outcome. The study was sufficiently powered to show noninferiority of the surgical masks given a 20% event rate. The 2 randomized study groups were well balanced with similar risk factors for influenza infection, including vaccination and febrile respiratory illness among household members, and participants were evenly distributed across study hospital wards. Only 30% of nurses in each study group had been vaccinated against influenza.

During the trial, influenza infection occurred in 23.6% of nurses wearing medical masks and 22.9% of nurses wearing N95 respirators ($P = .86$ for the comparison of the absolute risk difference). Although the study was not powered to detect other differences, rates of noninfluenza respiratory viral infections, physician visits for respiratory illness, and work-related absenteeism were virtually identical between groups.

Some strengths and limitations of this study offer important lessons. Ensuring similar exposures to influenza among HCP is critical in studies of respiratory protection. Loeb et al⁸ addressed this challenge by randomizing individual HCP so any given ward had HCP wearing a mixture of masks and respirators. Loeb and colleagues also assessed nonoccupational exposures by questioning HCP about ill household contacts. Because approximately 40% of influenza infections are asymptomatic, the investigators also assessed influenza infection by serology and PCR, which improved sensitivity and power.⁹ However, the authors did not directly assess exposure risks by collecting data on the number of nurse contacts with pa-

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tients exhibiting febrile respiratory illness. Further, although limited observations on adherence with mask and respirator use were performed—and adherence was 87.5% for N95 respirators and 100% for masks—the study did not evaluate hand hygiene adherence, triage procedures, and the implementation of respiratory hygiene/cough etiquette strategies. As demonstrated during the severe acute respiratory syndrome (SARS) outbreaks, these other factors are also important determinants of exposure risk.¹⁰

What are the implications of these findings? A single study will not end the debate over influenza respiratory protection for HCP. Unfortunately, this intense discussion over respiratory protection has distracted attention from the critical importance of implementing other strategies known to prevent the transmission of influenza in health care settings. Indeed, the use of personal protective equipment such as masks and respirators should be considered the “last line of defense” in a hierarchy of infection control measures.

Chief among these is the annual vaccination of HCP against influenza, which has been shown to protect both patients and HCP, decrease patient mortality, and minimize worker absenteeism.^{11,12} Although this recommendation is relevant every flu season, it is especially important during pandemics, as the population has increased susceptibility to infection. However, HCP adherence with annual flu vaccination remains poor at around 45%.¹³ Also important is the implementation of a multifaceted approach designed to reduce the risks of HCP exposures to patients infected with influenza. These include “administrative controls,” including plans to exclude ill visitors, rapidly and effectively triage patients with febrile respiratory illness into effective isolation, develop engineering measures to increase spatial separation and provide physical barriers, and implement respiratory hygiene/cough etiquette programs. Recent data demonstrate the important role that masking of an incubating or ill patient could have on transmission of virus and underscore the importance of this simple strategy, not just in waiting rooms, but even after patients have been admitted to facilities.¹⁴

Health care personnel adherence with hand hygiene is also far from ideal. Hand hygiene is effective in reducing clinical respiratory illness in both health care and community settings.^{1,15} In addition, HCP commonly work despite having febrile respiratory illness, thereby putting both patients and other HCP at risk.¹² The importance of HCP-to-HCP influenza transmission is underappreciated: 14% of HCP likely acquired the 2009 influenza A(H1N1) virus from another HCP (written communication, Alex Kallen, MD [CDC]; September 2009). Hence, a change in culture is needed; HCP must stay home when they are ill and employers must not penalize them when they do so.

Loeb and colleagues have undertaken an important study, despite significant logistic challenges.⁸ That this study is, to our knowledge, the first and only published randomized trial assessing respiratory protection for preventing influenza transmission is a sad commentary on the state of research in this

area. Uncovering the truth and identifying the most appropriate way to protect HCP will require that other investigators build on this study, replicating methodological strengths and addressing limitations. Ultimately, accumulating a body of evidence on this topic will provide much-needed answers. The recent IOM report calls on both federal agencies and private institutions to “fund and undertake additional research” on respiratory protection for HCP.⁷ However, while the debate over the role of respiratory protection in preventing influenza transmission will continue, neither the ongoing discussion nor the need for more research should excuse anyone from failing to implement other measures that are known to protect patients and HCP from influenza.

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