

Protecting Health Care Workers from Transmissible Airborne Diseases: Challenges and Opportunities

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Health care workers face serious risks to their own health and safety during both routine and emergency work. Airborne transmissible diseases—pathogens that spread through the air or through droplets—are a silent, lurking threat to both health care workers and their patients. Nearly 16 million Americans work in health care settings, and these individuals are on the front lines for most public health emergencies, such as an influenza pandemic [1]. A 2019 study of health care workers in ambulatory settings estimated their incidence of laboratory-confirmed influenza as being between 7.2 and 8.2 percent, slightly higher than published community incidence [2,3]. Protecting these valuable workers has benefits to patients, health care institutions, society at large and, of course, the health care workers and their families. Employers and employees share joint responsibility to implement policies and procedures that ensure that health care workers receive and use appropriate protection throughout all phases of their daily work.

Despite ample evidence to support the need for personal protective equipment for all health care workers, a 2019 National Academies of Sciences, Engineering, and Medicine (the National Academies) report suggests that a sizable number of health care workers may be inadequately protected from airborne transmissible diseases [4]. This perspective will review findings from that report, which offered strategies to protect health care workers from contact with hazardous agents and proposed concerted cross-sector efforts that are required to accomplish this essential task.

Tackling the Invisible Threat of Airborne Transmissible Diseases

Infection control and occupational health professionals face complex challenges in protecting workers from events that can be unpredictable in magnitude and severity. Health care workers routinely face potential exposure to airborne transmissible diseases as they en-

counter patients with influenza and other respiratory infections. Conversely, dangerous outbreaks, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) occur infrequently and with less predictable temporal patterns, yet can have a much larger impact because of their severity. Health care facilities must prepare their staff to adopt preventive measures for both routine and urgent situations. The diverse nature of respiratory infections results in exposure opportunities that can vary in size from a handful of individuals to hundreds of thousands.

To address these challenges, the National Personal Protective Technology Laboratory and the National Center for Immunization and Respiratory Diseases at the Centers for Disease Control and Prevention asked the National Academies to conduct a consensus study report that would examine the utility of reusable elastomeric respirators in health care settings [4]. Currently, most health systems stock disposable surgical masks, N95 disposable filtering facepiece respirators, and powered air-purifying respirators (PAPRs). The latter two respirators are recommended to protect workers from serious airborne transmissible diseases, such as MERS or SARS. To date, few health care systems have used reusable elastomeric respirators. To inform its findings, the consensus study report committee, comprised of experts from diverse backgrounds that spanned engineering, occupational health, and infectious diseases, considered empirical evidence and experiences from across multiple sectors, including nuclear power and construction.

In contrast to widely used disposable N95 respirators, which can only be used once and then must be discarded, elastomeric respirators, specifically half-facepiece elastomeric respirators, can be stockpiled and reused after appropriate cleaning and disinfection. In contrast to PAPRs, half-facepiece elastomeric respirators weigh less and do not hamper communica-

tion. The consensus study report concluded that half-facepiece elastomeric respirators have demonstrated efficacy and could be considered in both routine and urgent high-volume situations. However, the committee also received reports that health care workers may not receive sufficient training in respirator fitting and use, which makes use of either type of respirator moot if they are not used as specified.

In studies that have examined barriers to personal protective equipment use, workers cite discomfort, excess weight, and communication difficulties when wearing existing respiratory protection [5]. In addition to these clinician-reported barriers, health systems have reported shortages of disposable N95 respirators in previous pandemics. The committee also recognized the challenges with training health care workers in respiratory protection, including adherence to protective recommendations, completion of annual fit testing, and proper respirator application through achieving an adequate seal between the face and respirator, as a major barrier to rigorous use of personal protective equipment.

Summary and Suggestions

The 2019 consensus study report findings show that health care workers routinely encounter threats to their health and safety by exposure to airborne agents. Improved equipment, clinical procedures, and organizational strategies are required to reduce exposure risks. Organizations must cultivate cultures that place worker health and safety at the highest priority. The authors of this paper propose the following strategies to protect health care workers from airborne transmissible diseases:

Strategy 1. Health care leaders, front-line clinicians, professional organizations, occupational health personnel, equipment manufacturers and policymakers should partner to support and promote broad and sustainable improvements in health care worker safety. Such engagement should occur regularly within a framework of soliciting priorities and preferences that advance worker health and safety. The consensus study report established a stakeholder framework to inform successful implementation of robust respiratory protection programs in health care settings. This framework outlined roles and responsibilities for manufacturers, health care facilities, health care workers, and policy and professional organizations. Collaboration across these sec-

tors will foster faster development and testing of novel products and processes.

Strategy 2. Health care leaders should include worker health and safety as a key component of their organizational priorities. Since clinical and leadership experiences indicate that appropriate adherence to and prioritization of health care worker safety starts at the top, leaders should broaden existing and important patient safety efforts to adopt data-driven, evidence-based strategies to ensure that their organizations are as safe as possible for both health care workers and patients. Safety metrics for health care workers should be reported as routinely as they are for patients. Monitoring and improving worker safety may confer benefits to clinician well-being and reductions in burnout. [6] The consensus study report reviewed promising evidence of effective and sustained respiratory protection programs from three hospitals in British Columbia and at the Texas Center for Infectious Disease. In these instances, health care leaders, engineers, and clinicians worked together to strengthen existing programs and promote respective accountability for performance. Such strategies may avert costly employee absenteeism and worker compensation claims from workplace exposure to hazardous agents.

Strategy 3. Health care organizations should anticipate and prepare for unexpected events that have the potential to harm workers [7]. The question for health care leaders is not if a respiratory pandemic will occur, but when. For decades, the nuclear power and aviation industries have embraced routine drills to prepare for unexpected events and formalize workers' responses during a crisis. Because the U.S. health care system will face mission-critical challenges to protecting health care workers when these events occur, the health care community must make practical plans for these emergencies now. In its 2019 report, the committee recommended that respiratory protection training occur at three time points: during health professions' preparatory and continuing education curricula; during routine respiratory mask fit testing in health care facilities; and during surges of respiratory infections (e.g., SARS, MERS). Training across multiple time points enables clinicians to retain necessary knowledge and skills, particularly in urgent, unpredictable situations.

Leaders may need to tailor strategies to their organizational context. For example, recent data from the

ambulatory setting suggest that surgical masks offer equivalent protection to N95 respirators for routine influenza transmission [2]. It is unclear whether inpatient studies would yield similar results, given the variation in patient populations and different care processes. Important considerations include what emergency equipment to stockpile, how to prepare workers in advance and when an event occurs, how to communicate the hazard plan, and how to evaluate effectiveness of the plan.

Strategy 4. Novel product design and testing to improve upon existing personal protective equipment are sorely needed. The consensus study report noted that innovative respiratory protection product design and testing has lagged compared to other sectors, such as nuclear power and construction. This is unfortunate, since health care workers would benefit from respiratory protection devices that resolve persistent concerns for discomfort and communication difficulties.

In concert with the broad stakeholder engagement proposed above, continued engagement should focus explicitly on better product design and testing. Manufacturers must accelerate the speed and breadth of innovation as they develop and test products to protect health care workers from dangerous exposures. Products designed for other markets, such as construction, do not meet the unique needs of health care.

The Biomedical Advanced Research and Development Authority (BARDA), authorized under the Pandemic and All-Hazards Preparedness Act of 2006, supports funding and technical assistance to develop new products for use during a public health emergency. To date, few manufacturers have participated in this program. The 2019 reauthorization of the act provided additional funds and regulatory flexibility to address urgent public health crises, such as pandemic control. Now is the time for manufacturers to partner with BARDA to meet the essential needs of health care workers, as a failure to innovate and invent threatens lives. In addition, innovation is needed in manufacturing and supply chain support to deliver products to areas of greatest need in emergent situations.

Conclusions

During both routine and urgent clinical care, health care workers are at risk of exposure to dangerous airborne pathogens. The current state of protective equipment and worker adherence is inadequate and

places too many workers at risk for adverse health events. These events threaten the ability of the health care workforce to meet patient care needs. There is an urgent need to develop innovative products and training and to promote evidence-based processes to protect workers from these threats. Through continued stakeholder engagement, increased leadership attention, careful organizational planning, and ample incentives to innovate, the U.S. health care system will be better equipped to deliver essential health care services by a well-protected, healthy health care workforce.

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