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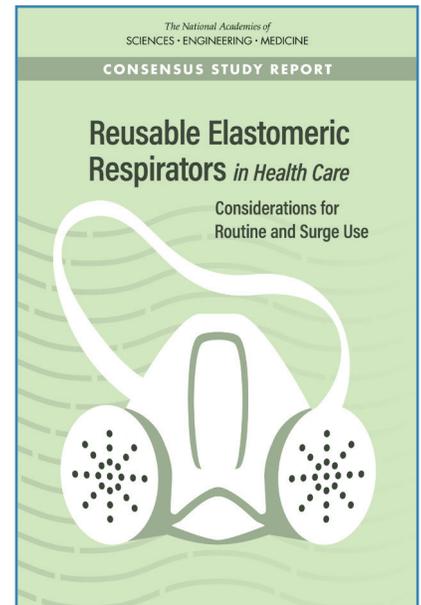
## Reusable Elastomeric Respirators in Health Care

### Considerations for Routine and Surge Use

Protecting the health and safety of health care workers is vital to the health of each of us. Preparing for and responding to a future influenza pandemic or to a sustained outbreak of an airborne transmissible disease requires a high-level commitment to respiratory protection for health care workers across a wide range of work settings. Keeping health care workers healthy despite occupational risks is an ethical commitment to the workers. Their good health also provides lifesaving continuity of care to patients and communities.

Reusable respirators (specifically, reusable half-facepiece elastomeric respirators) are the standard respiratory protection device used in many industries. Their durability and reusability make them desirable for stockpiling for emergencies, during which large volumes of respirators can be needed. Until now, options for using reusable half-facepiece elastomeric respirators in routine and surge use in health care have not been fully explored.

With support from the National Personal Protective Technology Laboratory and the National Center for Immunization and Respiratory Diseases at the Centers for Disease Control and Prevention, the National Academies of Sciences, Engineering, and Medicine conducted a study on the use of half-facepiece reusable elastomeric respirators in health care. This report explores the potential for using elastomeric respirators in the U.S. health care system. It focuses on economic, policy, and implementation challenges and opportunities.



## ABOUT RESPIRATORS

Respirators are one component of a range of administrative, engineering, and environmental hazard controls used in health care to protect workers from exposure to airborne transmissible diseases. In addition, respirators are used to protect workers from chemical, biological, or radiological hazards. They are also used during maintenance activities, such as mold remediation; laboratory analysis, including microbiology preparations; and the handling of hazardous waste or hazardous medication.

Most U.S. health facilities use disposable filtering facepiece respirators, often called N95s. These respirators are to be discarded after one use. The committee could identify only two institutions that use reusable elastomeric respirators either exclusively or primarily. However, given recent concerns about pandemics and emergent diseases and the challenges experienced with supply chain limitations, reusable respirators are an option to be explored.

Using half-facepiece reusable elastomeric respirators could be considered during two distinct circumstances: routine use and surge use. Routine use refers to day-to-day health care work. In surge use, health care systems need to manage a sudden or rapidly progressive influx of patients and prevent the spread of infections. During a public health emergency response, protecting health care workers from infectious disease transmission is essential, since these workers provide clinical care to those who fall ill, have a high risk of exposure, and must be assured of workplace safety.

## KEY CONSIDERATIONS

The selection of workplace respiratory protection must consider the type of exposure, the level of protection needed, how the respirator will be used, the materials with which it is constructed, fit characteristics, the ambient environmental conditions and, in the case of elastomeric respirators, cleaning and storage. User-focused considerations, such as comfort, risk perception, and acceptability also matter, as these influence use of the devices.

Key challenges in transitioning to elastomeric respirators would be their cleaning, disinfection, maintenance, and storage. Workers are currently accustomed to disposing of single-use respirators between patients, so the initial implementation of cleaning and disinfection protocols required for elastomeric respirators would be challenging and potentially time-

consuming; dedicated stations or centralized processing systems would need to be established.

From a cost perspective, the few studies that have examined the costs of stockpiling respirators for a surge event have found that elastomeric respirators have the lowest costs when considering costs to acquire and warehouse the devices. Data-driven policy development, staff education and training time, and staff time and supply costs for cleaning, disinfection, and maintenance remain large unknown costs. However, given the wide cost differences in the estimates, the stockpiling and use of elastomeric respirators could be a cost-effective option. Naturally, further analyses of total costs are necessary.

Other implementation factors for introducing reusable elastomeric respirators include

- *manufacturing* (production capacity and the ability to gear up to meet the demands for respirators in a global emergency situation);
- *storage* (a wide variety of products and devices compete for limited space in most health care facilities); and
- *emergency stockpiles* (identifying and publicizing the types of respirators available and having trained staff to lessen the burden of implementation during a crisis).

The committee explored a wide range of issues regarding reusable elastomeric respirators and carefully examined the challenges and benefits of these respirators, including their efficacy and the feasibility of their implementation. (For more detail, please see the table on the next page.)

Based on their analysis, the committee offers a number of evidence-based conclusions.

## THE COMMITTEE'S CONCLUSIONS AND RECOMMENDATIONS

The committee concludes that research studies in controlled laboratory settings have demonstrated the efficacy of reusable elastomeric respirators. The devices could be a viable option for respiratory protection programs for routine use in health care when policy and practices, logistics, and implementation challenges are addressed, including education, training, cleaning, disinfection, maintenance, and storage challenges. Routine use would lead to better preparedness in the event of the need for broader use during an emergency or pandemic situation.

**TABLE** Routine and Surge Use of Reusable Elastomeric Respirators

	<b>Definition</b>	<b>Examples</b>	<b>Advantages</b>	<b>Challenges</b>
<b>ROUTINE USE</b>	Day-to-day use of a respirator as needed to protect from airborne contaminants	Pulmonary units	Institutional and employee familiarity with product before a pandemic or other emergency	Cleaning and disinfection protocols
	Clinical condition requires respiratory protection	Areas with large volumes of patients on airborne isolation precautions	Potentially improved fit	Storage issues between uses
				Cannot be used in a sterile, surgical field
<b>SURGE USE</b>	Facility capacity (beds, staff, supplies) is exceeded	Seasonal influenza that persists beyond traditional timeframe	Avert shortage of disposable filtered facepiece respirators	Cleaning and disinfection protocols
	Respiratory illness incidence extends beyond epidemic curve	Pandemic influenza	Health care workers' perception that institution is investing in their safety and well-being	Storage issues between uses
	Atypical illness that requires airborne isolation	Viral hemorrhagic fever or other airborne outbreak		

The reusable elastomeric devices could also be a viable option for use as needed in surge situations, when logistic and implementation challenges are addressed, including challenges related to cleaning, disinfection, and storage, as well as just-in-time fit testing and training for staff unfamiliar or untested for these respirators. A smooth transition to surge use would be expedited and enhanced if reusable elastomeric respirators were a part of the health care facilities' day-to-day respiratory protection programs.

Addressing the respiratory health needs of health care workers will require the design of innovative reusable respirators and the implementation of robust respiratory protection programs. Urgent action is needed to resolve a number of gaps in knowledge and leadership on reusable respiratory protection to protect the health and safety of health care workers, particularly in an influenza pandemic or an epidemic of an airborne transmissible disease.

The committee sees potential long-term value in the use of elastomeric respirators both during routine use and during public health emergencies, and it has developed a set of recommendations to promote their use, to protect workers, and to improve the care of

patients. These recommendations are intended to spur the conduct of research, stimulate effective respiratory protection programs, training, and education; and ensure rapid and seamless implementation.

To read the full text of the committee's recommendations, please visit [nationalacademies.org/ElastomericRespirators](http://nationalacademies.org/ElastomericRespirators).

## CONCLUSION

Although this report is focused on one type of respiratory protective device, the paramount issues are much broader and center on ensuring the safety and health of health care workers and the continuity of high-quality patient care. Health care has long been acknowledged as a profession with potential dangerous and life-threatening risks. Thus, there is an ethical imperative to improve and ensure health care worker safety and health.

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## Committee on the Use of Elastomeric Respirators in Health Care

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**Linda Hawes Clever  
(Co-Chair)**

California Pacific Medical Center

**M. E. Bonnie Rogers  
(Co-Chair)**

University of North Carolina

**Gloria Addo-Ayensu**

Fairfax County Department of Health

**Gio Baracco**

University of Miami Miller School of Medicine, and Miami VA Healthcare System

**Jim Chang**

University of Maryland Medical Center

**Christopher Friese**

University of Michigan School of Nursing

**Robert Harrison**

University of California, San Francisco School of Medicine

**Sundaresan Jayaraman**

Georgia Institute of Technology

**James S. Johnson**

JSJ and Associates

**Bruce Lippy**

The Center for Construction Research and Training

**Allison McGeer**

Mount Sinai Hospital and University of Toronto

**Ann-Christine Nyquist**

University of Colorado School of Medicine

**Mike Schmoltdt**

Argonne National Laboratory

**Skip Skivington**

Kaiser Permanente

**Patricia Stone**

Columbia University School of Nursing

**Tener Veenema**

Johns Hopkins University

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## Study Sponsor

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Centers for Disease Control and Prevention

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## Study Staff

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**Catharyn T. Liverman**

Study Director

**Olivia C. Yost**

Associate Program Officer

**Katie LaWall**

Senior Program Assistant (through July 2018)

**Judy Estep**

Program Associate (from July 2018)

**Daniel Bearss**

Senior Research Librarian

**Andrew M. Pope**

Director, Board on Health Sciences and Policy

To read the full report, please visit  
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