

# WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

## Preparedness through Daily Practice: The Myths of Respiratory Protection in Healthcare

### Summary

Evidence from surveillance studies indicates gaps in hospitals' respiratory protection programmatic operations and healthcare workers' (HCWs) marginal compliance with respiratory protection recommended practices. Improper use of respiratory protective devices (RPDs) may expose HCWs to infectious respiratory illnesses. In this document, NIOSH addresses common myths related to respiratory protection and provides information to reinforce respiratory protection program administrator responsibilities and HCW knowledge concerning the proper use of these devices so that they can be prepared for the next public health emergency and best protect themselves in daily practice.

### Description of Exposure

#### Background

The healthcare industry is among the fastest growing occupational sectors in the United States, with nearly 18 million workers [NIOSH 2012]. Because of the nature of their work, HCWs may be exposed to various infectious respiratory illnesses that are spread through

airborne and droplet routes, such as *Mycobacterium tuberculosis* and seasonal influenza, respectively. During a public health emergency, HCWs have an increased risk of exposure [HHS 2005]. They were among the most affected during the 2009 H1N1 pandemic. One study reported higher rates of influenza-related hospitalizations compared with workers in other industries [Luckhaupt et al. 2012]. Appropriate implementation of precautions against airborne and droplet transmission are critical to prevent the spread of aerosol transmissible diseases among HCWs who work directly with patients and others [Siegel et al. 2007]. However, only 20% of HCWs known to be infected by contagious patients reported using RPDs during all interactions with patients suspected of being infectious [Wise et al. 2011]. Addressing HCWs' marginal use of RPDs might be a way to reduce their risk. Any staff member may be exposed if he or she works in areas near patients who are suspected of having a disease that requires precautions against airborne transmission. To minimize the risk of exposure, healthcare facilities should implement engineering and administrative controls, including airborne infection isolation rooms and employee vaccination programs. In

some cases, the Centers for Disease Control and Prevention (CDC) recommends that HCWs wear RPDs, such as N95 filtering facepiece respirators (FFRs), also known as "N95s", or powered air purifying respirators (PAPRs) if they must share the same airspace with a potentially infectious patient [Siegel et al. 2007]. To read more on healthcare workplace pandemic influenza risk classification, please reference this [Occupational Safety and Health Administration \(OSHA\) fact sheet](#).

To be effectively protected from infectious respiratory diseases that require Airborne Precautions, HCWs must properly use RPDs when needed. From past research, NIOSH has determined that many HCWs do not follow recommended practices; and in some cases, they do not use RPDs when they should [Beckman et al. 2013; Wise et al. 2011].

### NIOSH Research—the Respirator Evaluation in Acute Care Hospitals (REACH II) Study

From 2011–2012, NIOSH worked with health departments and universities in six states located in five U.S. regions for the Respirator Evaluation

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in Acute Care Hospitals study (REACH II). The goal of REACH II was to determine whether HCWs were following recommended respiratory protection practices [Siegel et al. 2007; CDC 2013]. In addition, NIOSH questioned whether acute care hospitals were implementing their respiratory protection programs in workplaces where respirator use is required by the OSHA respiratory protection standard 29 CFR 1910.134. More than 1,500 workers (i.e., hospital managers, unit managers, and HCWs) in 98 hospitals participated in the study. NIOSH found that many hospitals did have a written respiratory protection program but that hospital managers and HCWs were following these programs differently. REACH II results confirm past research, finding that many HCWs are not following recommended infection control guidelines and appear to be confused about when, what type, and how to properly care for, use, remove and dispose of RPDs [Peterson et al, 2015; Siegel et al. 2007]. To ensure their health is protected, respiratory protection program administrators must be knowledgeable and inform HCWs about the required elements of a respiratory protection program and recommended infection precaution practices before the next public health emergency occurs (See [infographics of Key Requirements and Infection Control in Healthcare](#)).

## Pandemic Preparedness

Influenza pandemics vary widely in their severity and impact [Reed et al. 2013]. In addition, pandemics are unpredictable in terms of when and where they begin. Scientists have not established accurate methods for forecasting influenza pandemics, nor have they established methods for predicting the severity of a future pandemic [Chretien et al. 2014]. When a pandemic occurs, most people will likely have little to no immunity to the novel virus causing the pandemic, and a vaccine will likely not be immediately available. The next pandemic could cause an estimated 314,000–734,000 hospitalizations in the United States alone [OSHA 2009]. In the last decade, several different types of infectious disease outbreaks have occurred. Therefore as part of emergency preparedness efforts, hospitals and other medical facilities should include planning for HCWs to properly use RPDs as part of response efforts. During the REACH II research process [Peterson et al. 2015], NIOSH discovered several common myths that require attention.

### Myth: We are prepared for an influenza pandemic because there are stockpiles of N95s

Stockpiles of personal protective equipment (PPE), including RPDs, are maintained by some government bodies and

\* Code of Federal Regulations. See CFR in References.

healthcare facilities; however, a pandemic could easily consume these supplies. More than 75% of the N95s in the Federal Strategic National Stockpile were shipped out during the 2009 H1N1 pandemic [HHS 2012]. Despite the stockpiled supplies, some healthcare facilities reported shortages of RPDs and issues with the devices they received. In many cases, the RPDs received did not match the facility's current inventory in terms of sizes and models; requiring many HCWs to be fit tested for the new devices [HHS 2012]. In addition, the Department of Health and Human Services recommends that healthcare facilities have a 6–8 week supply of disposable N95s [HHS 2005]. Yet about 50% of hospitals report that they do not have an RPD stockpile [Rebmann et al. 2013]. Overall, a number of healthcare facilities are not fully equipped for the next influenza pandemic or infectious disease outbreak and should further plan and prepare.

### Myth: Respirators and surgical masks provide the same type and level of protection for the user

Respirators and surgical masks (i.e. facemasks) are intended for different functions and do not provide the same types or levels of protection. Surgical masks can be used as source control to protect patients from an HCW's respiratory secretions as well as to protect HCWs from large-droplet splashes or sprays of bodily fluids from patients. Surgical masks are typically disposable, loose-fitting, and do not form a tight seal to the face (See Figure 1). They are also not designed to capture a large percentage of small particles, which means that they cannot prevent the wearer from breathing in airborne particles that may be transmitted by coughs, sneezes, or certain medical procedures (i.e. aerosol generating procedures). Because of these factors, HCWs using surgical masks will not be protected against exposure to airborne transmissible diseases [NIOSH 2009].

Respirators are designed to protect HCWs by providing a tight seal against the skin and filtering out a wide size range of airborne particles. However, the NIOSH certification process does not include testing for splash and spray protections. If an HCW needs both respiratory and splash and spray protection, then a **surgical N95** respirator should be used [NIOSH 2013] (See Figure 2). Ideally, RPDs should be selected based on the type of infectious disease transmission precaution recommended by the CDC [Siegel et al. 2007]. In some cases, the task being performed on a patient with a suspected or confirmed infectious disease (i.e., aerosol-generating procedure or close contact) will affect the types of RPDs that are recommended (See Figure 3).

For more information about respiratory protection devices in healthcare settings, please see the [OSHA/NIOSH Hospital Respiratory Protection Program Toolkit](#).



**Figure 1.** Loose-fitting surgical mask



**Figure 2.** Tight-fitting N95 Filtering Facepiece Respirator (sealed against the skin)

## Myth: All N95 respirators fit and protect the same

Although all N95 FFRs are designed to filter at least 95% of a wide size-range of particles, this protection depends on selecting the right respirator for the wearer. To be properly protected, the wearer must select a respirator that fits well to his or her face and minimizes the amount of air leakage into the facepiece [NIOSH 2009]. Because the fit of a respirator depends on certain factors, including facial characteristics, employers must provide a variety of respirator models and sizes for workers to try during the fit testing process. In addition, users and their RPP administrator should consider their purpose for wearing a respirator: do they only need respiratory protection? Or do they also need to be shielded from possible splashes and sprays? These factors must be considered during a HCW's first fit test, which is done before an employee is authorized to wear a respirator [The Joint Commission 2014].

According to OSHA regulations, before an employee is allowed to wear a respirator, he or she must be fit tested. Fit testing must be repeated on a yearly basis, when a different respirator must be used, or when there has been a change to the wearer's facial structure such as in cases of extreme weight change or dental work. Results from REACH II indicate that many HCWs do not know the model and size respirator for which they have been fit tested, nor do they know how often fit testing should take place. If HCWs are unaware of this information, they may use a device for which they have not been fit tested, or not be fit tested frequently enough. During a pandemic, shortages of N95 FFRs are

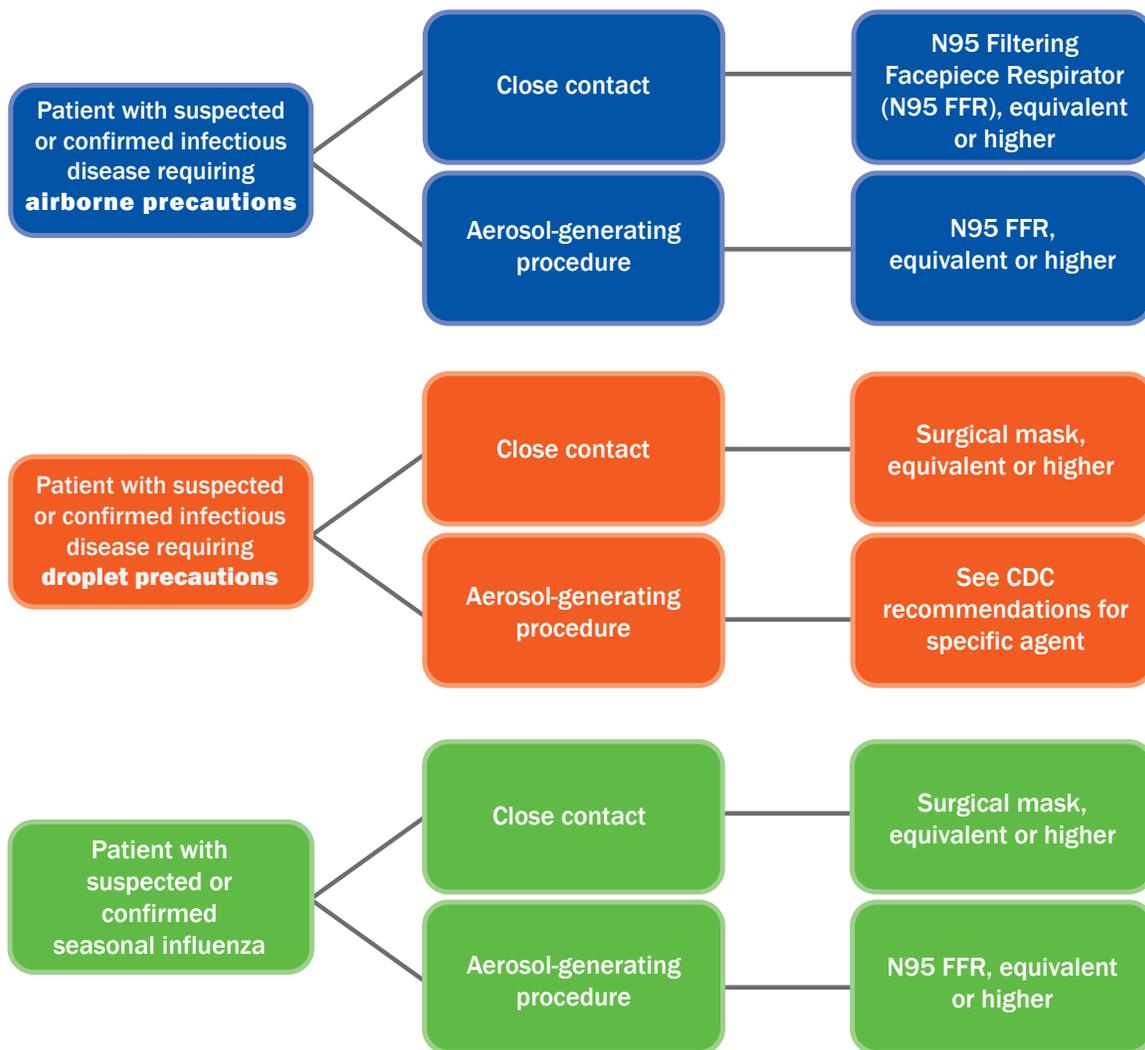
likely to occur, and workers may need to switch to a different model or size device. In this emergency situation, HCWs would need to be fit tested again with the new respirator (See [Infographic of Fit Test Requirements](#)).

## Myth: A good fit is good enough

Selecting a respirator that fits properly is important, but HCWs will not be protected if they do not use the respirator correctly. During the REACH II study, researchers observed more than 300 HCWs as they donned (put on) and doffed (took off) a respirator. In many of the hospitals, HCWs used improper practices, including wrong strap placement, not performing a user seal check, improper removal (not using straps), and improper disposal of the device. Every respirator has its own user instructions from the manufacturer, which typically include information about proper donning and doffing techniques for the device. HCWs should be trained on a yearly basis to use their respirator and have access to these instructions so that they are aware of the proper procedures for their respirator. (Please see [these general guidelines](#) for proper donning and doffing procedures.)

## Myth: Medical evaluations are only necessary before initial clearance for respirator use

Medical evaluations are necessary before initial clearance because respirators can affect a wearer's physiological and psychological status. The evaluation process ensures that a worker's health will not be negatively affected by wearing



**Figure 3.** Recommended type of RPD for airborne and droplet precautions and seasonal influenza.

an RPD. Before clearance, an employee fills out a medical questionnaire; and if any answer indicates a possible health issue, the employee will be referred for a follow-up examination.

OSHA also requires medical evaluations in other scenarios such as when the licensed medical provider deems it necessary; when a HCW reports medical symptoms that may interfere with their ability to safely use a respirator; when a supervisor feels that a worker needs to be re-evaluated; and when changes in the workplace may affect an employee's ability to wear a respirator [29 CFR 1910.134]. Findings from the REACH II study [Peterson et al. 2015] indicate that both managers and HCWs are aware that medical evaluations need to be conducted prior to use, but many are unaware of the other scenarios in which evaluations may be necessary. More information about medical evaluations can be found on the [NIOSH Medical Evaluation FAQs webpage](#).

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## References

- Beckman S, Materna B, Goldmacher S, Zipprich J, D'Alessandro M, Novak D, et al. [2013]. Evaluation of respiratory protection programs and practices in California hospitals during the 2009–2010 H1N1 influenza pandemic. *Am J Infect Control* 41(11):1024–1031.
- CDC [2013]. Prevention strategies for seasonal influenza in health-care settings. Atlanta, GA: U.S. Department of Health and Human

Services, Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases. <http://www.cdc.gov/flu/professionals/infectioncontrol/healthcaresettings.htm>

CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

Chretien J-P, George D, Shaman J, Chitale RA, McKenzie FE [2014]. Influenza forecasting in human populations: a scoping review. *PLoS ONE* 9(4):e94130. doi:10.1371/journal.pone.0094130

HHS [2005]. DHHS pandemic influenza plan. Washington, DC: U.S. Department of Health and Human Services. <http://www.flu.gov/planning-preparedness/federal/hhspandemicinfluenzaplan.pdf>

HHS [2012]. 2009 H1N1 influenza improvement plan. Washington, DC: U.S. Department of Health and Human Services. <http://www.phe.gov/Preparedness/mcm/h1n1-retrospective/Documents/2009-h1n1-improvementplan.pdf>

Luckhaupt SE, Sweeney MH, Funk R, Calvert GM, Nowell M, D'Mello T, et al. [2012]. Influenza-associated hospitalizations by industry, 2009–10 influenza season, United States. *Emerg Infect Dis* 18(4):556–562. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3309704/>

NIOSH [2009]. NIOSH science blog: N95 respirators and surgical masks. Washington, DC: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. <http://blogs.cdc.gov/niosh-science-blog/2009/10/14/n95/>

NIOSH [2012]. NIOSH program portfolio: healthcare and social assistance. Washington, DC: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. <http://www.cdc.gov/niosh/programs/hcsa/sector.html>

NIOSH [2013]. Respirator awareness: your health may depend on it. Personal protective equipment for healthcare workers. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2013-138. <http://www.cdc.gov/niosh/docs/2013-138/pdfs/2013-138.pdf>

OSHA [2009]. Pandemic influenza preparedness and response guidance for healthcare workers and healthcare employers. Washington, DC: U.S. Department of Labor, Occupational Safety and Health

Administration. <https://www.osha.gov/Publications/3328-05-2007-English.html>

OSHA, CDC, NIOSH [2015]. Hospital respiratory protection toolkit. <https://www.osha.gov/Publications/OSHA3767.pdf>

Peterson KK, Novak D, Stradtman L, Wilson D, Couzens L [2015]. Hospitals' respiratory protection programs and practices in six American states: A public health evaluation study. *Am J Infect Control* 43(1):63–71.

Rebmann T, Wang J, Swick Z, Reddick D, delRosario JL, Jr. [2013]. Business continuity and pandemic preparedness: US health care versus non-health care agencies. *Am J Infect Control* 41(4):e27–33.

Reed C, Biggerstaff M, Finelli L, Koonin LM, Beauvais D, Uzicanin A, et al. Novel framework for assessing epidemiologic effect of influenza epidemics and pandemics. *Emerg Infect Dis* 19(1)—January 2013. [http://wwwnc.cdc.gov/eid/article/19/1/12-0124\\_article](http://wwwnc.cdc.gov/eid/article/19/1/12-0124_article)

Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee [2007]. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>

The Joint Commission [2015]. Implementing hospital respiratory protection programs: strategies from the field. Oakbrook Terrace, IL: The Joint Commission. [http://www.jointcommission.org/health\\_services\\_research.aspx](http://www.jointcommission.org/health_services_research.aspx)

Wise ME, De Perio M, Halpin J, Jhung M, Magill S, Black SR, et al. [2011]. Transmission of pandemic (H1N1) 2009 influenza to healthcare personnel in the United States. *Clin Infect Dis* 52:(Suppl1) S198–204. [http://cid.oxfordjournals.org/content/52/suppl\\_1/S198.full](http://cid.oxfordjournals.org/content/52/suppl_1/S198.full)

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