

## Regarding Respiratory Protection for Infection Control Measures for 2009 H1N1 Influenza among Healthcare Personnel

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CDC has released updated interim guidance on infection control measures to help prevent transmission of 2009 H1N1 influenza in healthcare facilities. As a supplement to that guidance document, these questions and answers provide additional information intended to assist healthcare facilities in optimizing implementation of recommended respiratory protection practices in the context of shortages of respiratory protection equipment. The information contained in this document applies uniquely to the special circumstances of the current 2009 H1N1 pandemic during the fall and winter of 2009-2010, and will be updated as new information becomes available during the course of this influenza season

What steps can healthcare facilities take to minimize risk of exposure to 2009 H1N1 influenza and conserve supplies of disposable N95 respirators?

Healthcare facilities should take a multi-layered approach when designing a strategy to reduce exposure of healthcare personnel and patients to influenza and prevent influenza transmission within healthcare settings. The approach to conserving supplies of N95 respirators can be organized into these broad categories:

- Minimize the number of individuals who need to use respiratory protection through the use of engineering and administrative controls;
- Use alternatives to disposable N95 respirators where feasible;
- Extend the use, and consider reuse of disposable N95 respirators; and
- Prioritize the use of N95 respirators for those personnel at highest risk of exposure.

What can healthcare facilities do to minimize the need for disposable N95 respirators?

In order to reduce the need for respiratory protection, healthcare facilities should consider implementation of measures to eliminate or reduce exposure to 2009 H1N1 influenza. Such measures can be organized according to infection control principles and a “hierarchy of controls”, which prioritizes protective measures based on their likelihood of reducing the risk of exposure. Top priorities in this hierarchy are those measures which can effectively eliminate the source of potential exposure such as measures that prevent visits by ill individuals to healthcare facilities where those can be postponed. Where exposures cannot be eliminated, engineering controls should be considered as the primary means for reducing exposure. Engineering

controls physically separate, shield or protect healthcare personnel from the sources of exposure. Examples include the use of partitions and barriers to separate potentially ill patients from well providers or use of closed suctioning systems for airways suction that prevent generation of aerosols. Engineering controls are particularly effective because they can be implemented without placing responsibility on individual employees for implementation. Administrative controls are work practices and policies which are designed to reduce or eliminate hazards, though their effectiveness is dependent on management implementation and personnel adherence. Examples of this include the placing of facemasks on ill individuals for source-control, vaccination of healthcare personnel, and the use of appropriate triage and isolation procedures. Although administrative controls are given lower priority in the classic hierarchy of controls, vaccination of healthcare personnel is particularly effective in that it protects against infections resulting from work, household, and community exposures. The use of personal protective equipment (PPE) is for protection from exposures that cannot otherwise be eliminated or controlled. PPE must be used and maintained properly to be effective. The prioritization of protective measures for healthcare personnel according to the hierarchy of controls is a concept that needs to be tailored to the needs, capabilities, and circumstances of each healthcare facility.

Further detailed recommendations for minimizing risk of 2009 H1N1 influenza in healthcare facilities can be found in [Table 1 of the Interim Guidance on Infection Control Measures for 2009 H1N1 Influenza in Healthcare Settings, Including Protection of Healthcare Personnel.](#)

### **What options are available to facilities if disposable N95 respirator supplies are insufficient for routine use according to current interim guidance?**

Facilities should eliminate potential exposures, and use engineering and administrative controls to minimize risk of exposure to the 2009 H1N1 virus. [This will also reduce the number of personnel using respiratory protection.](#)

Healthcare facilities can consider steps to extend the existing supply of disposable N95 respirators by either training personnel to wear them during serial patient encounters (“extended use,” i.e. without removing or re-donning between encounters) or to re-use them (“re-use,” i.e. removing and re-donning between patient encounters). Although these practices have the potential benefit of providing respiratory protection with limited supplies of respirators, there is the risk of respirator contamination and contact transmission. Either extended use or reuse of disposable N95 respirators could entail a risk of contact transmission by touching a contaminated surface of the respirator and subsequently touching the mucous membranes of the face or a hypothetical risk of re-aerosolization of virus from a used respirator. The precise balance between risk of contact transmission and benefit of extended use or re-use associated with this strategy is unknown, although the risk will be minimized if HCWs perform hand hygiene every time before and after touching the respirator. In general, if either of those options is chosen, wearing an N95 respirator over multiple encounters (while minimizing touching, removing, or re-donning between encounters) would be favored over re-use, as this strategy is expected to involve less touching of the respirator and therefore less risk

of contact transmission. (See questions on extended use and re-use). Disposable N95 respirators worn during aerosol-generating procedures should be discarded after the procedure.

Another option to consider is use of respirators other than disposable N95 respirators.

When a shortage of respirators exists despite reasonable efforts to obtain or extend a supply for anticipated needs, facilities should consider shifting to *prioritized respirator use mode*. In this mode, respirator use is prioritized to protect healthcare personnel at greatest risk of 2009 H1N1 influenza exposure or who care for patients with other diseases such as tuberculosis that require respiratory protection. Prioritization should be adapted to local conditions. In making decisions about prioritization, facilities should consider needs for performing aerosol-generating procedures and for managing patients with diseases other than influenza that require respiratory protection. To assure that respirators are likely to be available for the most important uses, facilities should maintain a reserve sufficient to meet the estimated needs for performing aerosol-generating procedures and for managing patients with diseases other than influenza that require respiratory protection until supplies are expected to be replenished.

At a minimum, any individuals attending aerosol-generating procedures should use respiratory protection at least as protective as fit-tested N95 respirators. When a shortage of respirators exists, respirator use can be temporarily discontinued for employees providing routine patient care who are not *at high risk of complicated infection*. Prioritization should consider intensity and duration of exposure, individual worker health risk factors for complications of infection, and vaccination status. An example of prioritization for personnel not attending aerosol-generating procedures is shown in Table 2 in “Interim Guidance on Infection Control Measures for 2009 H1N1 Influenza in Healthcare Settings, Including Protection of Healthcare Personnel”.

When respirator use for personnel who are not at high risk of complicated infection is temporarily discontinued during prioritized respirator use mode, *those personnel should be provided* with facemasks. Although facemasks do not filter particles from the air and allow air leakage around the edges, they are an effective barrier to splashes, droplet sprays, and autoinoculation of influenza virus from the hands to the nose and mouth. Thus, they should be chosen over no protection. Detailed information on prioritized respirator use can be found in Interim Guidance on Infection Control Measures for 2009 H1N1 Influenza in Healthcare Settings, Including Protection of Healthcare Personnel.

Routine chemoprophylaxis is not indicated for personnel wearing facemasks during the care of patients with suspected or confirmed 2009 H1N1 influenza.

## What other respirators can be used to reduce dependence on disposable N95 respirators?

Other classes of disposable respirators (e.g., N99s, N100s), which are similar in design and shape to N95s, can be considered. Alternatives to disposable respirators, such as powered air purifying respirators (PAPRs), or elastomeric half-mask and full facepiece respirators, can also be considered, especially in settings such as procedure rooms (e.g. bronchoscopy suites) where

higher-risk activities such as aerosol-generating procedures are intermittently performed, and in facilities that have prior experience with these respirators (see questions below on PAPRs and elastomerics, provide link). More information on respirators is available at: <http://www.cdc.gov/niosh/npptl/topics/respirators/>.

## Is extended use over multiple patient encounters an appropriate strategy for extending supplies of respiratory protection?

Extended use refers to wearing disposable N95 respirators for serial patient encounters, where the respirator has not been removed and re-donned between encounters. This practice may result in a risk of contact transmission by touching a contaminated surface of the respirator and subsequently touching the mucous membranes of the face. The precise balance between risk of contact transmission and benefit of extended use associated with this strategy is unknown, although the risk will be minimized if HCWs perform hand hygiene every time before and after touching the respirator. Extended use would be favored over re-use, because it is expected to involve less touching of the respirator and face. (See questions on extended use and re-use) Consultation with the facility's infection control experts should be sought in making decisions regarding the most appropriate and feasible personal protective equipment to protect workers from influenza if required by respirator shortages. If extended use practices are implemented as a means to extend respirator supplies, measures should be taken to reduce contact transmission, including:

- Discarding disposable N95 respirators following use during aerosol generating procedures.
- Discarding disposable N95 respirators if contaminated with blood, respiratory secretions, or other bodily fluids from patients.
- Considering use of a face shield over the disposable N95 respirator to prevent surface contamination.
- Performing hand hygiene before and after touching the respirator.

Extended use may be most practical in selected practice settings where serial contact with multiple suspected or confirmed 2009 H1N1 patients might fit naturally into the workflow (e.g. such as triaging multiple patients in admissions and on dedicated wards for 2009 H1N1 patients). Additional training of personnel will be needed if this alternative is considered for implementation.

## Can respirators be re-used to help extend the existing supply?


Re-use of disposable N95 respirators, where the respirator is removed and re-donned between patient encounters, can result in a risk of contact transmission by touching a contaminated surface of the respirator and subsequently touching the mucous membranes of the face. The precise balance between risk of contact transmission and benefit of re-use associated with this strategy is unknown, although the risk will be minimized if HCWs perform hand hygiene every time before and after touching the respirator. However, in general, extended use (i.e. wearing over multiple encounters while minimizing touching, removing, or re-donning between encounters) would be favored over re-use because it is expected to involve less touching of the

respirator and face. (See questions on extended use). Consultation with the facility's infection control experts should be sought in making decisions regarding the most appropriate and feasible personal protective equipment to protect workers from influenza if required by respirator shortages. If re-use is chosen as a strategy to increase availability of respiratory protection, the following should be considered to minimize risk of transmission:

- Discard disposable N95 respirators following aerosol-generating procedures.
- Discard disposable N95 respirators contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.
- Disposable respirators must only be used and re-used by a single wearer.
- Do not re-use a disposable respirator that is obviously contaminated, damaged or hard to breathe through.
- Consider use of a face shield over a disposable N95 respirator to prevent surface contamination.
- Store the respirator in a clean, breathable container such as a paper bag between uses.
- Avoid touching the inside of the respirator.
- Wearer should perform hand hygiene with soap and water or an alcohol-based hand sanitizer before and after touching a used respirator.

Consultation with the facility's infection control experts and training of healthcare personnel will be needed if this alternative is being considered for implementation.

## What should be recommended for facilities that can only obtain models of disposable N95 respirators for which their personnel have not been fit-tested?

In settings where sufficient supplies of disposable N95 respirators are available, they must be used in accordance with a comprehensive respiratory protection program, which includes fit testing, training, and medical clearance (see OSHA standard 29 CFR 1910.134 or [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=12716&p\\_table=standards](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards) ) . Healthcare personnel conducting the highest exposure risk activities (i.e., aerosol-generating procedures) should only wear fit-tested N-95 respirators. Using disposable N95 respirators that have not been fit tested does not provide the same assurance of respiratory protection as ones that are fit-tested because some individuals may have poor fit. Normally, a requirement for use of any NIOSH approved respirator, including disposable N95 respirators, is that the respirator be selected, fitted, used, and maintained in accordance with OSHA and other applicable regulations. However, in the context of supply limitations during the current pandemic, non-fit-tested disposable N95 respirators can be considered for personnel at lower risk of exposure or lower risk of complications from influenza until fit testing can be completed. This use will provide protection from droplets and splatter, as would facemasks, but also will provide some additional protection against small particle aerosols. Personnel using the replacement, non-fit-tested disposable N95 respirators should receive training on use of the model being used. Facilities should fit-test workers with the new model of disposable N95 respirator as soon as possible, beginning with those staff who are assigned to duties that

involve higher-risk exposure. (refer to Table 2 in main guidance for relative risks of different activities)

## In what settings could powered air-purifying respirators (PAPRs) be considered as an alternative to disposable N95 respirators?

One alternative for respiratory protection of healthcare personnel in settings when disposable N95 respirators are unavailable or in short supply is the powered air-purifying respirator (PAPR). Some healthcare facilities and personnel have accumulated experience with these devices, most commonly in settings such as procedure rooms (e.g. bronchoscopy suites) and in certain laboratory settings. PAPRs have the advantages of being more protective than N-95 respirators and the hooded designs can be worn with facial hair and do not require fit testing. PAPRs can also be cleaned and disinfected for reuse as indicated by manufacturers' instructions. Cleaning and disinfection procedures must be compatible with clinical use.

PAPRs can interfere with important patient care activities such as using a stethoscope to listen to patients' heart or lungs. Thus, PAPRs are not a practical option for use in many patient care settings. However, their use in even limited situations, such as aerosol-generating procedures, would increase the supply of disposable N95 respirators for other uses.

## In what settings could elastomeric respirators be considered an alternative to disposable N95 respirators?

Elastomeric half-mask and full facepiece respirators with N95 or higher particulate filters can be considered as options for respiratory protection of healthcare personnel in certain settings where N95 respirators are not available. While there is little accumulated experience with their use in patient care settings, they do offer some advantages over disposable N95 respirators, including greater durability and their ability to be cleaned and re-used by the same user or by multiple users. In addition, full facepiece respirators offer a greater level of respiratory protection, as well as eye protection. Disadvantages in healthcare settings include the lack of healthcare personnel experienced in their use; the need for devices to be routinely inspected, cleaned, and disinfected; interference with communication with patients and coworkers and the presence of exhalation valves precluding their use in sterile fields. Effective communication with patients and other personnel is also generally limited when wearing these devices. Although elastomeric respirators may not be a practical option for use in many patient care settings, their use even in limited situations, such as aerosol-generating procedures and in clinical laboratory settings would increase the supply of disposable N95 respirators for other uses.

## Where can I find more information on the various types of respirators?

Information on all types of respirators is available at:

<http://www.cdc.gov/niosh/npptl/topics/respirators/>. A listing of all NIOSH-approved disposable respirators is available at [www.cdc.gov/niosh/npptl/topics/respirators/disp\\_part/](http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/).