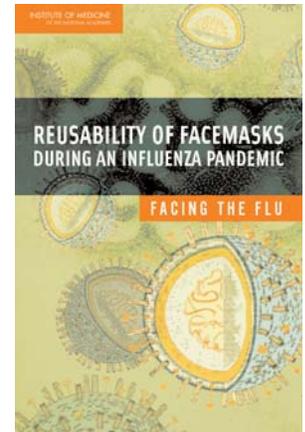


# REUSABILITY OF FACEMASKS DURING AN INFLUENZA PANDEMIC: FACING THE FLU

In the event of an influenza pandemic, public health officials will need to resort to multiple measures to reduce the impact. If effective vaccines and anti-viral medications do not exist or are not available in adequate quantities during a pandemic situation, respirators and medical masks could help prevent or slow influenza transmission. Non-pharmacological interventions (e.g., hand hygiene, social distancing, and respiratory hygiene/cough etiquette, including the use of masks by the public) will also play a critical role in pandemic preventive strategies.

Stockpiling or ramping up production of respirators and medical masks, in addition to adequate time and planning, would ensure a plentiful supply for those who need them, but it is possible that not enough masks and respirators will be available for healthcare workers and the general public. A shortage may require that disposable respirators and medical masks be pushed beyond their approved uses in the hope that they will provide some level of protection beyond their intended limits of use. Individuals with no access to respirators or masks, even disposables, may feel driven to invent their own measures. For example, they may put on woven masks not approved for medical uses in the United States, or use household items such as towels or sheets.

Based on the assumption that efforts to produce and stockpile sufficient supplies of disposable masks and/or respirators may fall short in the event of a pandemic, the Department of Health and Human Services asked the Institute of Medicine (IOM) to assess what measures can be taken to permit the reuse of disposable N95 respirators in healthcare settings and assess what is known about the need for reusable face masks for healthcare providers and the general public. The resulting report, *Reusability of Facemasks During an Influenza Pandemic: Facing the Flu*, concluded that very little is currently known regarding the potential to disinfect and reuse either medical masks or respirators. Fundamental research, both in the epidemiology of influenza and in the material properties of medical masks and respirators, is needed before methods of disinfection and reuse can be developed. In spite of that lack of research, the committee was able to develop a method of use that may allow for extended use of an N95 respirator.



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## USE OF RESPIRATORS AND MASKS TO PREVENT THE SPREAD OF INFLUENZA

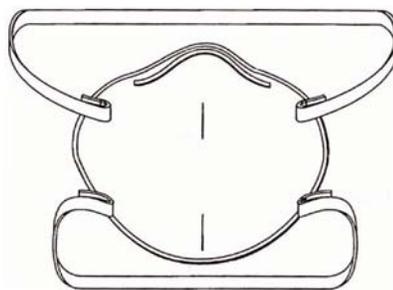
Medical masks are unfitted devices intended to reduce transfer of potentially infectious bodily fluids between individuals and are designed to be disposable. In contrast, a respirator (Figure 1) is a fitted device that protects the wearer against inhaling harmful contamination: that is, it protects the wearer from others who are or might be infected. Properly fitted respirators provide better protection against airborne transmission of infection than do medical masks. In addition, some respirators can be reusable. However, the less expensive and more common respirators, called “N95 filtering facepiece respirators,” or more simply “N95 respirators,” are designed to be disposable.

N95 respirators that are certified by the National Institute for Occupational Safety and Health and properly fitted are likely to provide the best protection against airborne influenza virus. Similarly, a closely fitting high-efficiency medical mask is also likely to provide appropriate protection against infectious fluids. Although not much is known about the effectiveness of medical masks as a form of respiratory protection against influenza, they are likely to provide better protection than woven masks, homemade alternatives such as handkerchiefs and scarves, or no protection at all. It is important to remember that no device is failsafe and effectiveness depends on fit, level of exposures, and appropriate use. Finally, none of these devices protect against contact transmission, and appropriate hand-hygiene is necessary when using and after removing these devices.

### CAN DISPOSABLE RESPIRATORS BE RE-USED?

A properly fitted N95 respirator is likely to be both the least expensive and the most widely available respirator for protecting healthcare workers and the public against airborne infection. However, without manufacturing modifications, disposable N95 respirators cannot be effectively cleaned or disinfected and should therefore be discarded after each use. In addition, the need for fit-testing respirators is critical and must be an integral part of any program that promotes their use.

- The committee could not identify or find any simple modifications to the manufacturing process that would permit disposable N95 respirators to be reused without increasing the likelihood of infection.
- Any method of decontaminating a disposable N95 respirator must remove the viral threat, be harmless to the user, and not destroy any part of the respirator. The committee found no method of decontamination that met all three criteria.
- The committee found no simple modifications to currently existing N95 respirators that would prevent the need for fit-testing.
- Many versions of reusable respirators on the market have facepieces that can be cleaned and reused. These respirators are more expensive than the disposable N95 respirators, but should be considered as an alternative to filtering facepieces.



**FIGURE 1.** Filtering Facepiece Respirator.

NOTE: An example of a filtering facepiece respirator – held to the user’s head with two elastomeric straps. The respirator also has a pliable metal nosepiece to allow for the user to adjust the fit at the nose.

A properly fitted N95 respirator is likely to be both the least expensive and the most widely available respirator for protecting healthcare workers and the public against airborne infection.

Despite these findings about the constraints of reuse, if an individual user needs to reuse his or her own disposable N95 respirator, it should be done in the following manner:

1. Protect the respirator from external surface contamination when there is a high risk of exposure to influenza (i.e., by placing a medical mask or cleanable faceshield over the respirator so as to prevent surface contamination but not compromise the device's fit).
2. Use and store the respirator in such a way that the physical integrity and efficacy of the respirator will not be altered.
3. Practice appropriate hand-hygiene before and after removal of both the respirator and, if necessary and possible, appropriately disinfect the object used to shield it.

## **USE OF MEDICAL MASKS AND IMPROVISED PROTECTION**

Medical masks are made of materials that are likely to degrade with standard means of disinfection (e.g., chemicals, heat, radiation) and are intended for disposal after use. However, several disposable masks currently on the market can be used repeatedly by the *same* wearer until they become damaged, moist, difficult to breathe through while wearing, or visibly soiled. In addition, because reuse of the same device by infected patients is unlikely to increase the risk of contamination, medical masks can be reused by patients until they reach this state.

- Any method of decontaminating a medical mask must remove the viral threat, be harmless to the user, and not compromise the integrity of the various elements of the mask (e.g., tear or deform the filter, stretch the elastic attachments, bend the nose clip). No validated method of decontamination meets these criteria.

Regulatory standards require that a medical mask should not permit blood or other potentially infectious fluids to pass through to or reach the wearer's skin, mouth, or other mucous membranes under normal conditions of use and for the duration of use. It is not clear that cloth masks or improvised masks (e.g., towels, sheets) can meet these standards. Without better testing and more research, cloth masks or improvised masks can not be recommended as effective respiratory protective devices or as devices that would prevent exposure to splashes.

However, these masks and improvised devices may be the only option available for some individuals during a pandemic. Given the lack of data about the effectiveness of these devices in blocking influenza transmission, the committee hesitates to discourage their use but cautions that they are not likely to be as protective as medical masks or respirators. The committee is concerned that their use may give users a false sense of protection that will encourage risk-taking and/or decrease attention to other hygiene measures.

## **NEED FOR ACCURATE INFORMATION AND PUBLIC EDUCATION**

Many factors will influence the effectiveness of respiratory protection used by health-care workers and the public to slow or prevent infection in the event of an influenza pandemic. Experience with previous efforts to improve infection control in the hospital and elsewhere have demonstrated that the efficacy of an intervention alone does not guarantee its success. The best respirator or medical mask will do little to protect the individual who refuses, or who misunderstands how and when, to use it correctly. Any public health effort aimed at extending the usefulness of existing devices must be delivered with clarity and truthfulness and proper education.

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### **FOR MORE INFORMATION...**

Copies of *Reusability of Facemasks During an Influenza Pandemic: Facing the Flu* are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, <http://www.nap.edu>. The full text of this report is available at <http://www.nap.edu>.

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