# Cost-Benefit Comparison of Respirators

| Device | Unit Cost* | Advantages | Disadvantages |
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| **Facemasks** | $0.12-$0.20 | • Reduces exposure to splashes of large droplets. • Tested for fluid resistance. • Easier to breathe through than a respirator. • Does not reduce exposure to small inhalable particles. | • Cannot be decontaminated, may be shortages during a pandemic. • Not designed to form a seal to the face. |
| **N95 respirator (filtering facepiece)** | $0.50-$1.20 | • Reduces exposure to small inhalable particles and large droplets. • Designed to form a tight seal to the face. • Filtration efficiency-certified. | • Cannot be decontaminated, may be shortages during a pandemic. • Must be fit-tested to assure full protection. • Cannot be worn with facial hair that interferes with the seal between the face and respirator • Harder to breathe through than a facemask. • Not designed to be used in surgery. |
| **N95 respirator w/ exhalation valve (filtering facepiece)** | $1.30-$3 | • Reduces exposure to small inhalable particles and large droplets. • Designed to form a tight seal to the face. • Filtration efficiency-certified. • Exhalation valve makes it easier to exhale and reduces moisture buildup inside the facepiece compared to other filtering facepiece respirators. | • Cannot be decontaminated, may be shortages during a pandemic. • Must be fit-tested to assure full protection. • Cannot be worn with facial hair that interferes with the seal between the face and respirator. • Harder to breathe through than a facemask. • Should not be used when others must be protected from contamination by the wearer. • Not designed to be used in surgery. |
| **Surgical respirator (filtering facepiece)** | $1-$1.10 | • Reduces exposure to small inhalable particles and splashes of large droplets that would require a facemask.• Designed to form a tight seal to the face. • Filtration efficiency-certified. • Tested for fluid resistance, biocompatibility, and flammability rated. | • Cannot be decontaminated, may be shortages during a pandemic. • Must be fit-tested to assure full protection. • Cannot be worn with facial hair that interferes with the seal between the face and respirator. • Harder to breathe through than a facemask. • Limited availability compared to other filtering facepiece respirators. |
| **Elastomeric respirator (flexible, rubber-like facepiece)** | Facepiece: $10-$40 Filters: $2-$10 | • Reduces exposure to small inhalable particles and large droplets. • Designed to form a tight seal to the face. • Filtration efficiency-certified. • Can be decontaminated & reused, can reduce/eliminate the impact of potential N95 shortages. • Higher initial cost, but may be more cost-effective than filtering facepieces for longer-term use. • Filters are replaceable. • After decontamination, respirators can be used by different individuals. • Full facepiece type provides eye protection. • Full facepiece type provides a higher level of protection than a half-facepiece type. | • Must be fit-tested to assure full protection. • Cannot be worn with facial hair that interferes the seal between the face and respirator. • Harder to breathe through than a facemask. • May interfere with voice communication. • Requires cleaning and disinfection between uses. • Should not be used when others must be protected from contamination by the wearer. |

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| **Powered Air-Purifying Respirator (PAPR) (head/face covering with battery-powered blower unit)** | PAPR: $400-$1,200<br>Spare battery: $120-$200<br>Extra hood: $75-$100<br>Filters: $20-$35 | • Reduces exposure to small inhalable particles. • Provides greater level of protection than filtering facepiece or elastomeric respirators. • Filtration efficiency-certified. • Can be decontaminated & reused, can reduce/eliminate the impact of potential N95 shortages. • Hooded PAPRs do not need to be fit-tested and can be worn with facial hair. • Reduces/eliminates breathing resistance and moisture buildup inside the facepiece/hood. • Filters are replaceable.• After decontamination, PAPRs can be used by different individuals. • Full facepiece type provides eye protection. | • Significantly more expensive than other respirators. • Blower unit/battery typically worn on belt (weighs 1.5-3 lbs.). • On some units, fan noise can make communication and medical care delivery more difficult. • Requires cleaning and disinfection between uses. • Should not be used when others must be protected from contamination by the wearer. |

*Cost estimates are current as of publication and intended only for planning purposes. Actual pricing will vary depending on the make, model, and quantity of respiratory protection devices selected.

*Source:* U.S. Occupational Safety and Health Administration, Washington, DC; 2008.

Before deciding how many respirators to stockpile, hospitals should consider the types of respirators that would best suit their needs. Based on the cost comparison, elastomeric respirators would be the cheapest alternative.

VISN 8, the Veterans Health Administration health care network that encompasses Florida, southern Georgia, Puerto Rico, and the U.S. Virgin Islands, has purchased some elastomeric respirators in addition to N95s, says Radonovich.

Reusable respirators offer a clear advantage during a pandemic, he says. "We anticipate, based on warnings, that the manufacturers won't be able to produce enough disposable N95s during a pandemic to meet the demand. We needed another option," he says.

Yet elastomeric respirators pose issues as well. They must be fit-tested, just as N95s are. The facepiece may make it harder to communicate with patients. And they aren't comfortable to wear for long periods of time, says **William Buchta**, MD, MPH, medical director of the Employee Occupational Health Service at the Mayo Clinic in Rochester, MN.

Mayo has purchased 200,000 N95 respirators and 300,000 face masks for a pandemic stockpile. "We want to be able to last for a 2½-month period," he says. Mayo also has powered air-purifying respirators (PAPRs), which do not require fit-testing and, in some cases are recommended for high-risk procedures such as bronchoscopy.

The Marshfield (WI) Clinic has a warehouse full of N95 respirators, gloves, and gowns for a potential pandemic. Elastomerics sound like a good idea but have some drawbacks, says **Bruce Cunha**, RN, MS, COHN-S, manager of employee health and safety. "People just do not understand how uncomfortable it is to wear a [half-face] respirator for any length of time," he says. "You have a rubbery substance against your skin and you're breathing 98.6° air. The inside of those things get very warm, very quickly."

The reusables also need proper handling and cleaning. "You're going to have to train employees how to clean them properly, or you're going to have to have someone who cleans them on a daily basis," he says.

Schwartz urges health care employers at least to consider the elastomeric respirators — perhaps by trialing them at the hospital. The key is to have respirators that will be available in an emergency situation — and reusable respirators have an obvious advantage.

"While elastomerics may not be a solution for routine health care, I think it's important for planners to realize the primacy for maintaining services during an emergency," he says.

In fact, in pandemic planning, flexibility is the key, says **Michael Bell**, MD, CDC's associate director for infection control. What protection is most appropriate and who will be at greatest risk, may depend partly on the nature of the pandemic, he says. For example, a pandemic strain may cause gastrointestinal symptoms, which would require