N95 Alternatives for Highest-Risk Community Members

Many people live and work in low-risk settings, where universal masking and social distancing help to protect them well against the SARS-CoV-2 virus. Other people may encounter much higher levels of the virus, due to factors like overcrowding, poor ventilation, or being around people who are not masking. Examples include a worker who must share a truck with an unmasked partner, a waiter in a cramped cafe serving dozens of unmasked diners, and a person caring for a homebound relative with COVID-19. Anyone in such conditions should use a very good mask or respirator. A properly worn N95 respirator can provide very good air purification, but they are reserved for use by healthcare workers due to their high-risk work during this time of constrained supply.

The following devices are available to the wider community, and have been able to filter air at a level similar to an N95 in some laboratory research, although they are not yet proven to prevent infection or function safely or effectively for all community uses. See precautions at the end of this document. For information about reducing exposure with cloth masks, see our cloth mask report. Also consider CDC guidance on community respirator use.

System 1: A well-tested and well-fitting KN95 respirator with two headbands

The KN95 is a Chinese respirator type that promises an N95-quality filter, but only some have performed well in independent tests, and substandard counterfeiting has occurred. We value KN95 features like a well-known manufacturer, anti-counterfeiting technology, good filter performance in a U.S. re-testing program, FDA clearance for emergency healthcare use, around-the-head headbands, and an authorized U.S. distributor. Powecom’s elastic headband KN95 is an example of a KN95 with these features. To perform best, a respirator must also be very well-fitted, allowing little air leakage. Only official fit testing can determine whether a KN95 respirator is really well-fitted. The steps listed below cannot substitute for fit testing, but may be helpful when it is unavailable.

- Inspect the respirator for defects and for size.
  Inspect the facepiece for punctures, crushing, or loosening seams. Check that the tethers and nose clip seem securely attached. Position the respirator on your face, fully unfolded, with the nose clip right-side up. Does the facepiece reach from under your chin to your nose bridge, without gaps along your cheeks? If not, a different size may help.

- Gently reshape the nose clip to fit your nose.
  The nose clip should follow your nose’s contours. Use two fingers from each hand to gently shape the clip, as shown here. Be gentle, as pressing forcefully on a nose clip can cause injuries.

- Fasten the respirator around your entire head.
  Earloops allow more air leakage than elastic headbands. If you must use an earloop KN95, attaching the earloops to an ear saver may reduce leakage. Ear savers can be improvised if necessary. Do not overtighten.

- Inspect your fit closely in the mirror.
  Search for gaps along all the edges while smiling widely, counting, slowly turning the head side-to-side and up-and-down, and simulating a yawn. If you notice gaps try to adjust the head straps or nose clip to improve fit in that area.

- Use your own breath to check for leaks.
  1. Breathe in and out quickly three times while watching the center of the facepiece. The facepiece should move inward and outward, as shown here. 2. Repeat this with your fingers near the edges of the facepiece, to try to sense any leaking air. 3. If advisable, try a positive pressure seal check, illustrated in this OSHA video. However, the positive pressure check may not work for all respirators. Seek expert guidance if possible.

- If your respirator leaks, try additional adjustments.
  For elastic headband respirators, wear the upper headband on the crown of the head. The harness-style ear saver style shown at right may help masks not slip downward. It is a free 3D-printable design. A different method of nose clip shaping may help. A thin strip of 3M’s MicroFoam (padded medical tape) applied to the inside surface of the respirator directly under the nose clip may reduce slippage and pressure in that area.

- If your respirator still leaks, a different brand or style of respirator may fit better.
  The Korean KF94 respirator class has also filtered similarly to an N95 in limited research, has some similar specifications, and is preferred by some wearers for fit, comfort, and low profile, but is not yet recognized as an N95-like device by U.S. authorities.

*Note: EarlyKN95.*

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**System 2: A mask brace worn over a high-performance medical mask**

A mask brace is a frame worn over a medical mask to control leakage around the mask's edge. In preliminary research some mask braces seem to resemble the seal of a fitted N95 respirator. For example, the Essential Brace from Fix The Mask tested very well over a medical mask in a non-peer-reviewed fit testing study. To perform best, a mask brace must be paired with a breathable flat-style medical mask with superior filtering abilities. Some medical masks can filter viral particles at around 95% efficacy, but many do not. Some quality assurance is provided by masks that are ASTM Level 3 certified, made by a reputable medical manufacturer and sold directly to the public, such as from Armbrust American. All ASTM-rated masks are required to be relatively breathable.

**System 3: An elastomeric respirator**

NIOSH-approved elastomeric respirators fit a wide range of faces well, perform well in fit studies, and are designed for reuse, but most feature an exhalation valve, which is not appropriate for community use. Open Standard Industries' OSR-M1 is a small, lightweight, non-valved elastomeric respirator. It is not yet NIOSH-approved but has passed various laboratory tests. The MSA Advantage 290 is a non-valved NIOSH-approved elastomeric respirator that may soon be available to the public. These respirators require fit testing to assure a low-leakage fit, but when fit testing is unavailable careful seal-checks should be performed. Procedures for safe and effective use of elastomeric respirators vary, so consult the manufacturer for your specific model.

**Other suggestions for use of these systems**

- **The outermost edge of a mask or respirator should be in very close contact with your skin.** Nothing else should be under that edge. Even very short hair under the face seal can cause leakage.

- **Clean your air-filtering device only as recommended by the manufacturer.** Most such filters are damaged by soap, alcohol, and other chemicals.

- **Avoiding using force when fitting your device.** The skin and blood vessels in the face are delicate. Tighten your straps gently, avoid binding the ears, and press gently on the nose clip.

- **Limit vigorous facial movement and activity.** Respirators and mask braces may leak more with strong head motions, facial expressions, bending, breathing, vocalizing, or other vigorous activity.

- **Online resellers may provide incorrect information about these devices.** A reseller's advice about how to fit, operate, clean, or maintain a device may not be reliable. A reseller's website that includes your respirator's name in its web address may not be operated or even authorized by the manufacturer.

- **Replace your device within the manufacturer's recommended maximum hours of wear, or sooner if it shows significant wear or if you notice worsening fit or decreased breathability.** Disposable respirators and disposable medical masks were originally designed for a single use. They should only be reused under emergency circumstances and by following CDC guidance.

- **Learn as much as you can about how your device works.** For example, try initially wearing it in safe circumstances to become familiar with how it fits you over long and short periods, whether it develops leaks, and whether it feels breathable. Read authoritative information about the device's care and use.

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For more information

- For an explanation of workplace respirator fit testing, see this pamphlet from the CDC, and this more complete explanation from TSI, Inc. Without fit testing, respirators usually underperform.
- See n95decon.org for information on mask use, respirator reuse, and how to put on and take off a respirator. Some of this information only applies to healthcare workers.
- Information about how to keep some facial hair and still have a good seal is provided here.
- An explanation of similarities and differences for N95 and KN95 respirators is provided here.
- Information from the CDC about wearing masks in public is here.
- Information from the CDC about physiological burden when wearing tightly-sealed respirators is here.
- Information from the CDC about skin injuries from tightly-sealed respirators is here.
- Suggestions for reducing eyewear fogging are provided here. (Note: Medical adhesives can cause facial skin injuries, e.g., if tape is worn too long or applied, removed, or selected incorrectly.)
- Information about the problem of misrepresented or counterfeit respirators is provided here.
- The CDC’s PPE usage guidelines for family caregivers are summarized at question 3 here.

Cautions and disclaimers

There are many factors to consider when selecting and wearing a mask or respirator. Some are listed here.

Consider various health risks:
Wearing a tightly-fitted mask or respirator places an additional load on the body. Individuals with a known or suspected cardiovascular, respiratory, kidney or anxiety disorder, or any other potentially relevant conditions should consult a medical expert. ● For some individuals, such devices may be difficult to breathe through. Your initial evaluation should be done seated with minimal exertion until you are confident that you are experiencing no respiratory symptoms ● If you experience a change in your breathing pattern or other symptoms like breathing discomfort, pain, headaches, dizziness, nausea, grogginess, or malaise while using a tightly-worn respirator, take a fresh air break and consider seeking the advice of a health professional; symptoms may be due to CO2 buildup, hyperventilation, anxiety, and other factors; consider the CDC’s advice here. ● Pressure on the face from a tightly-worn respirator or mask may be high enough to cause skin pressure injuries or other sensitivity reactions, especially with long, uninterrupted wear, and especially around the nose and cheekbones. Check often for skin irritation or breakdown, take breaks to decompress the skin, and consult a medical expert if skin discomfort or skin changes occur. See CDC advice here. Any respiratory, skin, age, or other precautions that apply for N95 respirator use may also apply to a braced face mask or an international respirator ● Links to third-party resources are not endorsements of the advice that they provide. These products should only be considered for use during the declared COVID-19 public health emergency, and never in place of federally-approved workplace protection where available.

Consider device performance:
● Elastic tethers lose their strength over time, and weakened tethers can cause a poor fit. ● These respirators or masks may not filter as well after exposure to soap, detergent, solvents, disinfectants, paint, fumes, oils, acids, alkalis, or certain other chemicals. ● Intermittent wetting has not been found to rapidly compromise the filtering ability of most respirators and face masks, but the effect could be variable from device to device. ● Most of the above-mentioned respirators and masks were designed only for single-use, and their performance may worsen with extended use. Guidance on the cautious reuse of face masks and respirators is available elsewhere on our website. ● Performance may be worse for expired respirators and face masks; check the date code on the package. ● Falsified, expired or mishandled products may sometimes be sold, especially by unauthorized resellers ● No guarantee of safety or performance is possible for many reasons, including because device quality varies from sample to sample, falsified products exist, and fit will vary from person to person and over time. Performance is likely to be poor if the device’s fit is poor. ● The fit-checks described above have not been validated for community use; they simply resemble challenges used by OSHA to reveal leakage problems in N95 respirators during head and face movement. ● Most or all of these devices have not been approved or evaluated as appropriate for the prevention of specific diseases or infections, or for the filtering or control of viruses, bacteria, smoke, fumes, hazardous liquids or splashes; flammability; or for use in community, workplace or healthcare settings. The manufacturer and relevant regulatory agencies should be consulted for guidance on safe and effective use of such devices. ● No particular brand or model of device is endorsed or vouched for as suitable for any general or specific use. ● The colloquial use of the term respirator above does not mean that the referenced device has been approved or defined as a workplace or medical respirator by regulatory authorities.

Bibliography

Sources labeled with a “**” are not peer-reviewed.


brace” improves the fit and protection and protection of a basic surgical mask amidst covid-19 pandemic. bioRxiv. Published online May 22, 2020. www.doi.org/10.1101/2020.05.18.20099325


