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FACTSHEET

# All Workers Need Adequate Airborne Protection

## The Rationale for Fitted Filtering Facepiece Respirators (FFR) vs. Masks

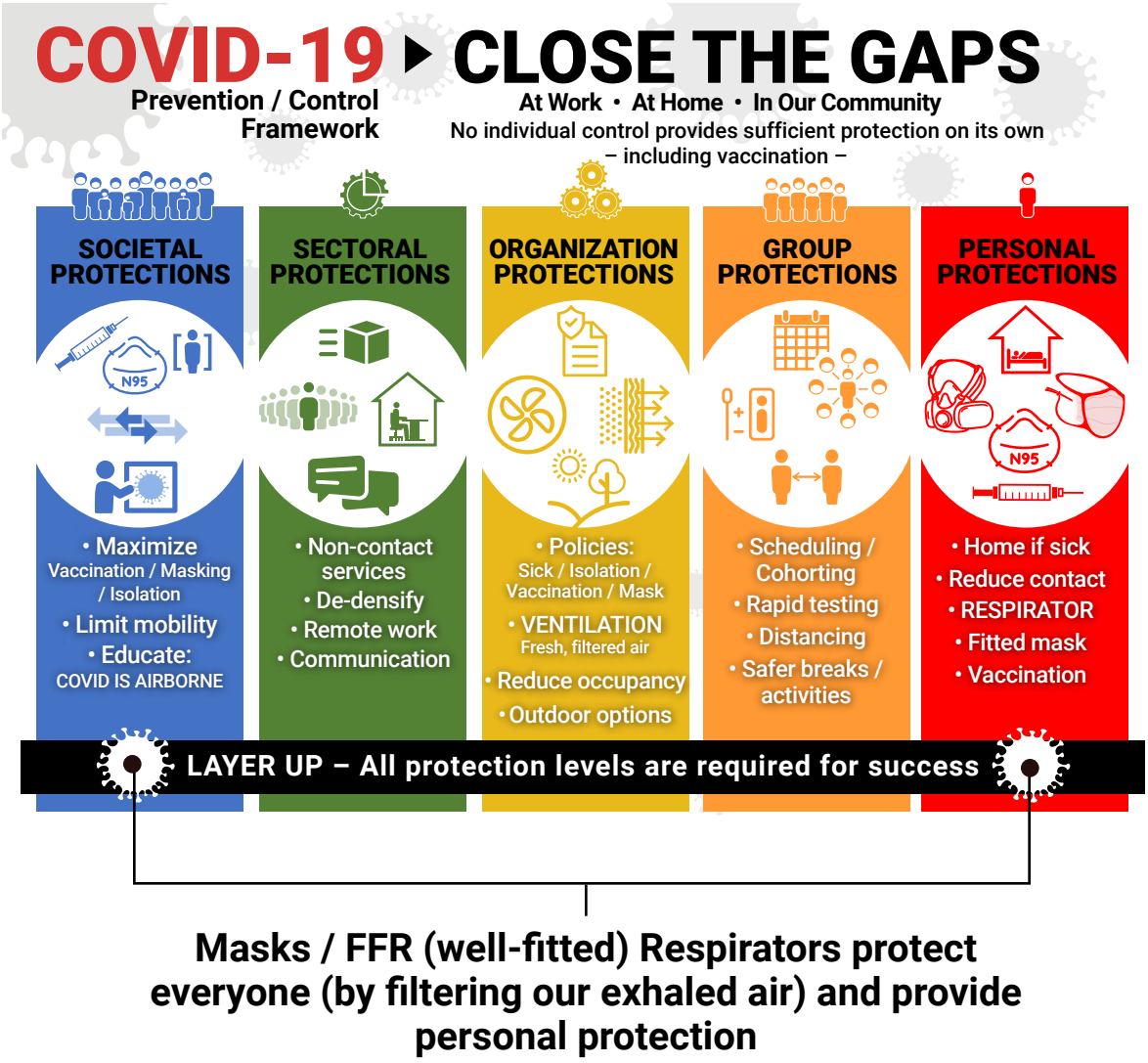
**January 2022**

# All Workers Need Adequate Airborne Protection

## The Rationale for Fitted Facepiece Filtering Respirators (FFR) vs. Masks

### 1. Will FFR (respirators) provide adequate protection on their own?

**No.** Masks (including FFRs) are part of a multi-layered approach and must be used in conjunction with other prevention strategies including "improved ventilation" "air filtration" and of course "full vaccination" (as shown in the following prevention framework). No single action provides a sufficient level of protection on its own.




**Masks / FFR (well-fitted) Respirators protect everyone (by filtering our exhaled air) and provide personal protection**


**The most up to date guidance indicates that FFR (Respirators) should be worn in *public* and *indoor workplace* spaces – especially in locations such as hospitals, nursing homes and schools.**

FFR or N95 respirators are designed to reduce the risk of inhaling hazardous airborne particles and aerosols. According to the Health Canada website FFR (respirators) (N95s) provide **95 percent** protection against exposure to respiratory viruses and bacteria when fit appropriately to the user's face.

**All workers** "potentially at risk" should wear an FFR respirator, N95 or better (such as a CAN99[17] which has greater filtration efficiency).

## 2. Will a respirator protect me even if others are unmasked?

**It depends on the type of exposure and how long you are exposed. It is important to consider your risk depending on <u>where you are, what you are doing, with whom, and how long you're there.</u>**

The following table demonstrates how face covering can reduce the risk of infection coverings especially indoors, where there is high occupancy and/or in poorly ventilated settings. It also demonstrates that face coverings (preferably respirators) and ventilation are both important to prevention.

**Graphical Representation of Relative Risks of Different Situations**

| Type and Level of Group Activity | LOW OCCUPANCY | | | HIGH OCCUPANCY | | |
|---|---|---|---|---|---|---|
| | Outdoor, Well Ventilated | Indoor, Well Ventilated | Poorly Ventilated | Outdoor, Well Ventilated | Indoor, Well Ventilated | Poorly Ventilated |
| **Wear face coverings, contact for short time** | | | | | | |
| Silent | <0.001% | 0.026% | 0.16% | 0.001% | 0.091% | 0.55% |
| Speaking | 0.002% | 0.13% | 0.78% | 0.005% | 0.45% | 2.7% |
| Shouting, singing | 0.009% | 0.78% | 4.6% | 0.033% | 2.7% | 15% |
| Heavy exercise | 0.022% | 1.8% | 10% | 0.077% | 6.2% | 32% |
| **Wear face coverings, contact for prolonged time** | | | | | | |
| Silent | 0.003% | 0.26% | 1.6% | 0.011% | 0.91% | 5.3% |
| Speaking | 0.016% | 1.3% | 7.5% | 0.055% | 4.5% | 24% |
| Shouting, singing | 0.094% | 7.5% | 37% | 0.33% | 24% | 81% |
| Heavy exercise | 0.22% | 17% | 67% | 0.76% | 47% | 98% |
| **No face coverings, contact for short time** | | | | | | |
| Silent | 0.001% | 0.074% | 0.45% | 0.003% | 0.26% | 1.6% |
| Speaking | 0.004% | 0.37% | 2.2% | 0.016% | 1.3% | 7.5% |
| Shouting, singing | 0.027% | 2.2% | 13% | 0.094% | 7.5% | 37% |
| Heavy exercise | 0.062% | 5.1% | 27% | 0.22% | 17% | 67% |
| **No face coverings, contact for prolonged time** | | | | | | |
| Silent | 0.009% | 0.74% | 4.4% | 0.031% | 2.6% | 14% |
| Speaking | 0.045% | 3.7% | 20% | 0.16% | 12% | 54% |
| Shouting, singing | 0.27% | 20% | 74% | 0.93% | 54% | >99% |
| Heavy exercise | 0.62% | 41% | 96% | 2.2% | 84% | >99% |

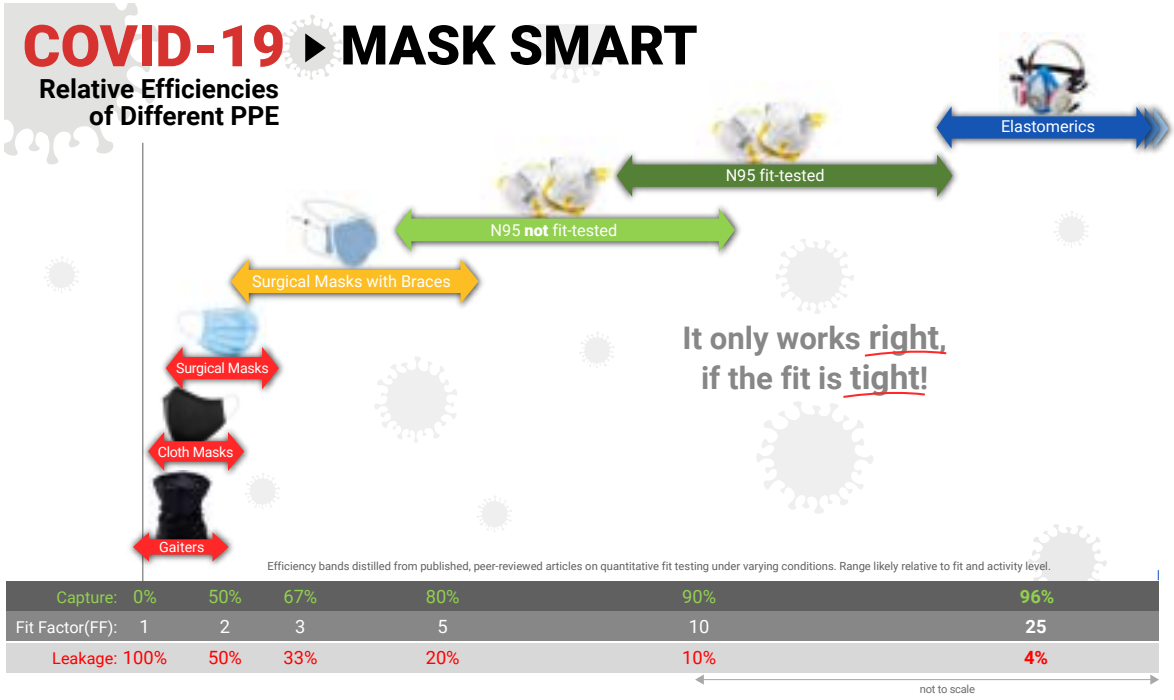
Source: Peng et al. 2022[1].

The <u>safest situation</u>, especially for prolonged contact in crowded settings, is when everyone is wearing well-fitting N95 respirators.

## 3. Do FFR (respirators) offer better protection (and source control) than face covering (barriers) such as surgical masks.

**Yes** (as shown below).

Filtering Facepiece Respirators provide much better protection (reduced inward leakage) as well as reduced outward leakage which reduces exposure to others[2,3]. **Modelling,** comparing two persons wearing well-fitted FFR while the infectious is speaking, versus two persons wearing surgical masks, has shown a major reduced risk of infection[2] for the FFRs compared to the surgical masks[3].




**Research results:**

**Real world** comparisons have demonstrated a significant (two-fold) reduced risk of infection for FFR vs. surgical masks[3]. A review (or meta analysis) of eight studies (9164 participants) showed statistically significant differences ($p < 0.05$) between FFR (N95 respirator) versus surgical mask for respiratory viral infections. The N95 respirator was most effective in reducing the risk of a viral infection in the hospital setting from the SARS-CoV 1 and 2 viruses compared to the other viruses included in this investigation[4]. The findings from the meta analysis were also confirmed in a recent study at a hospital in Cambridge: while using surgical masks, health care workers (HCW) working on red wards (confirmed COVID cases) faced an approximately 31-fold (on average, minimum five-fold) increased risk of direct, ward-based infection.

Conversely, after changing to FFP3 respirators, this risk was significantly reduced (52–100% protection) irrespective of whether aerosol generating medical procedures were performed or not[5]. The reduction in hospital acquired infections has also been confirmed by national UK National Health Service (NHS) analysis of Hospital-acquired infections (HAIs)[6].

The use of respiratory protective equipment was associated with a 33% reduction in the odds of HAI in the Delta wave and the recommendation was that all hospitals should prioritize airborne mitigations [6].

The COVID-19 Evidence Synthesis Network, comprised of organizations in Ontario's evidence synthesis and knowledge translation community, note the following:

> *"In comparing four different types of masks (i.e., N95 respirators, surgical masks, medical masks, non-medical masks), it was found that N95 masks (or equivalent: FFP2) should be the primary choice whenever possible in health care or community settings. Given the high transmissibility of the Omicron variant and the potential increased contribution of aerosol transmission, it is important to select a mask that optimizes fit (e.g., length of facial hair can affect fit) and filtration"* [7].

**Expert opinion** from ACGIH (formerly the American Conference of Governmental Industrial Hygienists), a professional scientific organization dedicated to advancing occupational and environmental health, have developed several COVID-19 fact sheets for workplace health and safety. Guidance provided includes a table that illustrates the degree of protection offered by different types of masks in comparison to a respirator. **It demonstrates that an FFR (N95), even if not fit-tested, offers more benefits as both source control and personal protection than any mask.**

Source ACGIH 2021: COVID-19 Fact Sheet: Workers Need Respirators.

> **An N95 filtering facepiece respirator (FFR) – has 1-10% inward leakage and outward leakage.**
>
> **A surgical mask – has 50% inward leakage and outward leakage.**

There are no requirements to test the fit of a surgical/procedural mask and it is clear that generally in public, most users have gaps around the nose and the cheeks.

It has been shown by quantitative fit testing that the surgical/procedural mask provides as much respiratory protection as placing one's hand over one's mouth and nose.

## 4. What is the relative protection offered by a typical cloth mask, typical surgical mask, fit tested FFR and non-fit tested FFR comparing time to infectious dose for 15 minutes, 5 minutes and 1 second?

It must be emphasized that the infectious dose of SARS-CoV-2 is unknown. We do know, however, that the newer variants of concern (VOC) (such as omicron) are much more transmissible. The following tables are therefore provided to compare different face coverings for different times to infection and should be only used to demonstrate relative efficacies. The 15 minute table developed through CIDRAP [8-9] and the ACGIH [10] did not account for the increased transmissibility of delta, nor the even greater transmissibility of omicron. We need to recognize (and respect) that the time to infectious dose is likely now greatly reduced.

Although the following (tables) are not based on any studies involving the more highly transmissible variants of concern (VOC), they do demonstrate relative levels of protection for hypothetical times to infectious dose from when no face coverings are used which may **fall somewhere between 1 second and 15 minutes**.

| **Time* to Infectious Dose –15 Minutes** (hypothetical) | | | | | | |
|---|---|---|---|---|---|---|
| *** MINUTES** | **Receiver is wearing** (% inward leakage) | | | | | |
| | | **Nothing** | **Cloth** | **Surgical** | **n-FT-N95** | **FT-N95** |
| **Source is wearing** (% outward leakage) | | 100% | 75% | 50% | 20% | 10% |
| **Nothing** | 100% | **15** | 20 | 30 | 75 | 150 |
| **Cloth** | 75% | 20 | 27 | 40 | 100 | 200 |
| **Surgical** | 50% | 30 | 40 | 60 (1) | 150 | 300 |
| **n-FT-N95** | 20% | 75 | 100 | 150 | 375 (6h) | 750 |
| **FT-N95** | 10% | 150 | 200 | 300 | 750 | 1500 (25h) |

* Times above are in SECONDS – unless otherwise indicated by minutes in (h)
FT = Fit Tested n-FT = non-Fit Tested

With a surgical mask there is a 50% inward leakage and outward leakage. A cloth face covering may be appropriate for the public to wear as source control, but they should limit proximity to others and time spent in an indoor space. Where these conditions cannot be met an FFR should be used.

| **Time* to Infectious Dose – 5 Minutes** (hypothetical) | | | | | | | |
|---|---|---|---|---|---|---|---|
| *** MINUTES** | **Receiver is wearing** (% inward leakage) | | | | | | |
| | | **Nothing** | **Cloth** | **Surgical** | **n-FT-N95** | **FT-N95** | **PAPR** |
| **Source is wearing** (% outward leakage) | | 100% | 75% | 50% | 20% | 10% | 2% |
| **Nothing** | 100% | **5** | 7 | 10 | 25 | 50 | 250 |
| **Cloth** | 75% | 7 | 9 | 13 | 33 | 67 | 333 |
| **Surgical** | 50% | 10 | 13 | 20 | 50 | 100 | 500 |
| **n-FT-N95** | 20% | 25 | 33 | 50 | 125 (2h) | 250 | 1250 |
| **FT-N95** | 10% | 50 | 67 | 100 | 250 | 500 (8h) | 2500 |
| **PAPR** | 2% | 250 | 333 | 500 | 1250 | 2500 | 12500 (208h) |

* Times above are shown in MINUTES – unless otherwise indicated by hours (h)
FT = Fit Tested n-FT = non-Fit Tested PAPR = powered air purifying respirator

| **Time* to Infectious Dose – 1 Second** (hypothetical) | | | | | | | |
|---|---|---|---|---|---|---|---|
| * SECONDS | **Receiver is wearing** (% inward leakage) | | | | | | |
| | | **Nothing** | **Cloth** | **Surgical** | **n-FT-N95** | **FT-N95** | **PAPR** |
| **Source is wearing** (% outward leakage) | | 100% | 75% | 50% | 20% | 10% | 2% |
| **Nothing** | 100% | **1** | 1 | 2 | 5 | 10 | 50 |
| **Cloth** | 75% | 1 | 2 | 3 | 7 | 13 | 67 |
| **Surgical** | 50% | 2 | 3 | 4 | 10 | 20 | 100 |
| **n-FT-N95** | 20% | 5 | 7 | 10 | 25 | 50 | 250 |
| **FT-N95** | 10% | 10 | 13 | 20 | 50 | 100 (1.5m) | 500 |
| **PAPR** | 2% | 50 | 67 | 100 | 250 | 500 | 2500 (42m) |

* Times above are shown in SECONDS – unless otherwise indicated by minutes in (m)
FT = Fit Tested n-FT = non-Fit Tested PAPR = powered air purifying respirator

**Notes:**

- These estimates are approximate, as there are many variables, including:
  - ventilation;
  - differences in filtration material (and wide ranges of filtration);
  - how well the masks and respirators fit;
  - along with the level of training to get an effective face seal.
- Time to infectious dose is not known but given Omicron spread and contact tracing indicating transient exposure could well be in the range from 1 second to 5 minutes

## 5. Will an FFR (N95) offer acceptable protection for all situations?

**No.** As can be seen from the above tables in 3.2 and 3.3, for continuous exposure, in a higher risk setting (s), meaning suspect or confirmed COVID cases along with sub-optimal ventilation [11]. PAPRs will provide much better protection [12].

## 6. Is there greater breathing resistance from wearing an FFR (respirator)?

**No.** The optimal engineering design of single use respirators has improved to the degree that an N99 respirator (e.g., CAN99) is not much different in breathing resistance than a tight fitting surgical/procedural mask[13].

## 7. Should workers who are not fit tested be allowed to wear N95 respirators?

**Ideally,** following the CSA Z94.4 Selection, use, and care of respirators standard, any worker using a respirator should be fit tested prior to using a respirator and this is the employer's responsibility as part of a full Respiratory Protection Program. However, research has shown that respirators provide enhanced protection so they should be adopted even before such testing can be arranged.

At minimum, some assessment for gaps and fit should be done visually and manually (feeling for any gaps). Plus, a proper fit / seal check (pushing the donned respirator against the face and checking for leakage) is recommended for each time you put on (don) a respirator. Further checks while in use can also confirm a proper seal – for instance, if your glasses "fog up", then the fit around the nose is inadequate; if you feel air passing over your cheeks / chin around the edges of the respirator, those are also indicators that your fit needs to be adjusted.

Experience and basic knowledge of these simple checks have been shown to be effective in establishing an acceptable fit.

Refer to Appendix for simple instructions on how to use an FFR (respirator).

## 8. Should a range of respirators be provided to accommodate for different face sizes and shapes?

**YES.** In a recent study, 6287 Australian healthcare workers (HCWs) were fit tested to N95 filtering facepiece respirators (FFRs), analysing how readily HCWs were fitted to eight FFRs and how age and sex influenced testing.

The key results showed some FFR N95s exhibited sub-optimal fit and a large proportion (45%) of HCWs required testing on multiple models[14].

## 9. Who is qualified and can assist in helping workplaces build a respiratory protection program in line with CSA 94.4?

Occupational Hygiene is the field that is responsible for prescribing protective equipment for workers.

In the field of Occupational Hygiene in Canada we reference CAN/CSA-Z94.4[18] Selection, use, and care of respirators to decide the appropriateness of respiratory protection.

**The minimum protection for an airborne exposure to SARS-CoV2 virus is an N95 respirator (preferably fit-tested and supplied within a respiratory protection program as specified in CAN/CSA-Z94.4 Selection, use, and care of respirators[18]).**

## 10. What common types of respirators should be used, and do we need to be careful of fakes?

**YES**. Only select approved / authorised FFR should be worn. **FFR that have straps that go around the back of the head result in a better face fit than those with ear loops.** N95s, CAN 95s or CAN 99s[17] with head straps are therefore preferred. Those with ear loops do not provide as good as a fit, but may offer enhanced protection

in lower risk settings. These include KN95 masks that meet a Chinese filtration standard, KF94 masks that meet a Korean filtration standard and FFP2 that meet a European standard. Health Canada has given interim authorization to a variety of masks that meet the standards, so checking that a brand is listed on their website is a good way to weed out counterfeits. See Health Canada Authorized medical devices for uses related to COVID-19: List of authorized medical devices other than testing devices[15] or NIOSH-Approved Particulate Filtering Facepiece Respirators[16].

## 11. What about if I am caring for an individual with suspect or confirmed COVID-19?

See the Public Health Ontario (PHO) Interim IPAC Recommendations for Use of Personal Protective Equipment for Care of Individuals with Suspect or Confirmed COVID-19 (Updated: December 15, 2021)[18].

> *"Given the undetermined impact of the Omicron (B.1.1.529) variant, the interim recommended PPE when providing direct care for patients with suspect or confirmed COVID-19 includes a fit-tested, seal-checked N95 respirator (or equivalent or greater protection), eye protection, gown, and gloves".*

## 12. What about if I am in the community or a public-facing worker?

Public Health Ontario (2021) are now endorsing respirators as part of community masking:

> *"In the current Omicron risk context, it is recommended that mask fit and filtration are optimized. Respirators are designed to closely fit or seal to the face. In Italy, since the Delta resurgence and emergence of Omicron, FFP2 (the European equivalent of N95) are required for bus drivers to wear on public transit" (PHO 2021)*[19].

According to Health Canada[20]:

> *"respirators are designed to fit snugly on the face, which may allow for a better fit than a medical mask or non-medical mask a respirator worn in the community doesn't need formal fit testing".*

## 13. Can FFR respirators be reused?

The same respirator can be used multiple times (up to 20) as long as it is clean and dry, the straps maintain their elasticity and the form around the face is still intact. Usually the straps will be first to fail.

Ideally, if supplies allow, rotate a different respirator each day of the week. For storage of those[5-7] respirators not worn, a paper bag will allow breathability and airing out[24].

## 14. Is there a simple way to decontaminate FFRs?

- If supplies are low, one proven way of decontaminating FFR (N95s) used by HCWs is by steaming in a microwave [26]. But then drying would still be required.

## 15. Are there advantages in using elastomeric respirators?

- Elastomeric respirators are much more cost effective, last longer and generally provide a better face fit.
- Unlike filtering facepiece respirators, elastomeric respirators allow for robust user seal checks[25].
- There is also some evidence to show that EHMR provide a better fit. A study looking at training and fit testing of health care personnel for reusable elastomeric half-mask respirators compared with disposable N95 respirators found that in the EHMR group, 92.2% passed fit testing during the first attempt compared with 88.5% in the N95 group [31].

## 16. Additional Information and Resources on Respirator Fit Check / Leak Seal Testing

Masks4Canada have a "How to do a self-seal check" – A Federal OSHA video on how to conduct a user seal check using an N95 respirator [29].

See the captions for:

a) Negative pressure seal check: take a quick deep breath to see if the facepiece collapses slightly (with hands cupped over respirator).

b) Positive pressure seal check: gently exhale to see if the respirator bulges slightly.

c) If you feel leakage, readjust the fit of your respirator and check the seal again.

A respirator does not fit properly if air leaks between your face and the face seal. This may also mean that you need to replace the respirator with one that is more suited to your face size and shape.

3M also provides an infographic – called "wear it right" "wearing your respirator" [30].

Not everyone has access to formal quantitative fit testing. Aside from performing a self-seal check, resources for do-it-yourself fit testing during increased demand conditions is provided by the US army – Guidance for do-it-yourself fit testing during increased demand conditions [27].

Performing Qualitative Mask Fit Testing Without a Commercial Kit: Fit Testing Which Can Be Performed at Home and at Work [28].

## 17. Does daily shaving improve face fit by providing a more effective seal?

**Yes, Definitely.** Refer to CDC Facial Hairstyles and Filtering Facepiece Respirators for advice on what facial hair is considered acceptable[32].

## 18. What is the general message from this fact sheet?

**The bottom line is to upgrade your mask to a proper filtering facepiece respirator!**

Refer to Refer to Masks4Canada [22], for useful resources and N95 and KN95 level respirators suppliers list [23].

**Time for better masks** – means snug fitting masks that are either: FFR (N95 or FFP2 or FFP3) (they should all have head straps).

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The Conversation: Time to upgrade from cloth and surgical masks to respirators? Your questions answered. https://theconversation.com/time-to-upgrade-from-cloth-and-surgical-masks-to-respirators-your-questions-answered-174877

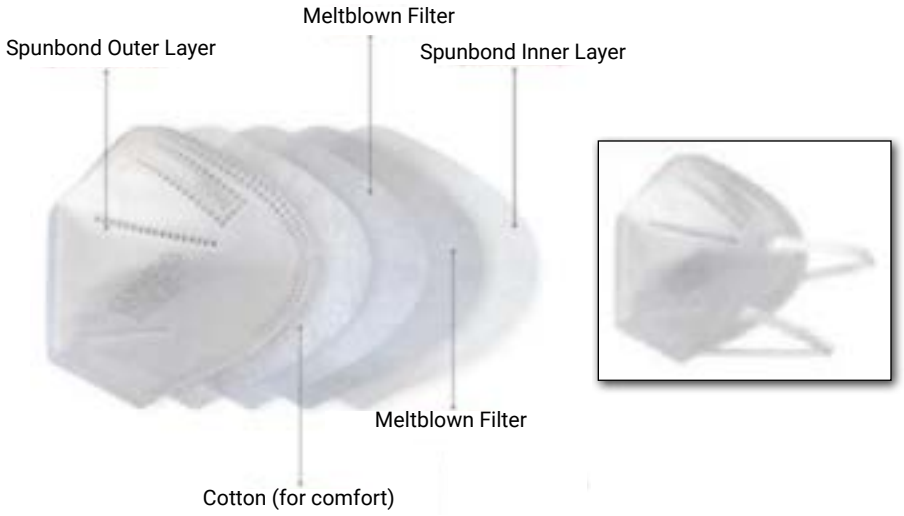
# Appendix
# Using the CAN99 Respirator

## Respirators Protect You – and Others

### Masks are NOT all the same.
### Three things matter: fit, filter and function

**Respirators** are the best kinds of masks on all counts.

They have special materials to **filter** the air you inhale and exhale (see picture). The materials will not work well if the respirator gets wet or dirty.




Used properly, these respirators will filter out almost every particle in the air. (You need a different kind for vapours or gases.)

Unlike other masks, respirators do not have ear loops. They have **two straps to give you a good fit**. Hair around the edges of the respirator stops a good fit. It allows leaks when you inhale or exhale.

For more information see ***The genius of N95 masks*** – a good YouTube video about putting on and taking off these kinds of respirators. English | Espanol

Prepared by the US Occupational Safety and Health Administration (OSHA).

## Putting On the Respirator

If you're going to wear a hat or something else around your head and neck, put the respirator on first.

Take the respirator from the package. Stretch the straps. Hold it with the logo facing up.

Open the top and bottom flaps all the way. Pinch the bottom and top flaps, and pull them out. Bend the nose piece around your thumb as you do this. Try not to touch the inside.

Hold the respirator in one hand. Get the straps on the outside of your hand.

Place it on your face with the metal nose piece on the bridge or top of your nose. (Picture from the company video.)

Make sure the bottom panel is snug under your chin.

Some people find it is easier to tuck the bottom part under the chin first.

Pull the **top strap** over your head. Get it high on the back of your head. When it's in the right place, pull the **bottom strap** over your head and position it below your ears around your neck. It should be against the skin, not around your hair.

The respirator should rest comfortably on your face. The flaps should be unfolded all the way. and securely in place.

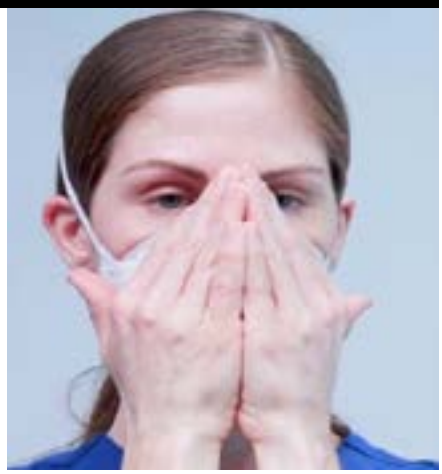
Make sure that nothing stops getting a good fit or seal to your face. (Hair, jewelry and clothing can do that.)

Use the fingertips of both hands to press the **metal nose piece** from the bridge of your nose down to the sides. Make it fit the shape of your nose. That gives a tight seal. (Picture from U.S. OSHA.)

Picture from US OSHA

## Checking the Fit (the Seal)

Put your hands over the center panel. Breathe in and out sharply. Be careful not to move the respirator. (Picture from the company video.)



If it doesn't have a good seal, you'll feel air escaping. If air leaks around the nose or your glasses fog up, adjust the metal strips. If air leaks from the sides, adjust the head straps. **Make sure the respirator is snug against your face.**

Check the seal each time you put on the respirator.

## Taking Off the Respirator

Gently hold the bottom strap, and pull it carefully over your head. Do the same thing with the top strap. They should come off easily.

Although particles should be trapped inside the filter material, try to touch only the straps.

Picture from US OSHA

## Respirator Re-use

These are ***disposable*** respirators. If you need to re-use one, put the respirator in a paper bag for four to five days and use a different one each day. **If it's wet or dirty, it won't work properly.**


When you're done with it, put the respirator in the garbage. Some places may have a recycling container just for respirators.

Clean your hands with soap and water or hand sanitiser.