MARJEN
EDUCATION SERVICES
ABN 87 170 789 310

Margaret Jennings (B.App.Sc.), 33 Stanley Avenue, Eltham, Victoria 3095
Tel/Fax: (03) 9439 2436 Mobile: 0404 088 754 Email: marjenes@optusnet.com.au

www.marjenes.com.au

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July e newspage # 6 – Masks – notes from Jeremy Howard (see below). I have copied this for interest and thought.

Masks for COVID: Updating the evidence

Written: 04 Jul 2022 by *Jeremy Howard*
These are notes I took whilst preparing a paper on mask efficacy from Nov 2021 to Jan 2022. In the end, I gave up on the paper, because I felt like people had given up on masks, so there wasn't much point in finishing it. I've decided to publish these notes in the hope some people will find them a useful starting point for their own research, and since I've noticed some signs in recent weeks that people might be open to avoiding COVID again. My previous paper on this topic, in which I led a team of 19 experts, was written in April 2020, and published here in the Proceedings of the National Academy of Science.

Respirators can be reused

According to mask manufacturer 3M, respirators (which they refer to as "Filtering Facepiece Respirators (FFRs)") "can be used many times." They say that "There is no time limit to wearing an FFR. Respirators can be worn until they are dirty, damaged or difficult to breathe through."

In reporting from CNN, Linsey Marr, a professor of civil and environmental engineering at Virginia Tech, explained that an N95 mask's material and filtration ability aren't "going to degrade unless you physically rub it or poke holes in it. "You'd have to be in really polluted air … for several days before it lost its ability to filter out particles. So, you can really wear them for a long time. People have been talking about 40 hours – I think that's fine. Really, it's going to get gross from your face or the straps will get too loose or maybe break before you're going to lose filtration ability… One of the first indicators of being able to change it if it looks nice and clean is that it just feels a little harder to breathe through. There appears to be more resistance with every breath." She also noted that the contamination risk in reusing N95 masks is "lower, much lower, than the risk of you not wearing an N95 and breathing in particles".

The CDC has prepared guidelines for optimizing the supply of respirators which recommend reusing respirators at most five times. This guidelines were created for people "implementing policies and procedures for preventing pathogen transmission in healthcare settings". They have been widely shared, incorrectly, by reporters as being recommendations for community use.

The inventor of N95 mask material, Peter Tsai, says that "N95 masks can be rotated, 1 mask every 3–4 days", and that in doing this "there is no change in the mask's properties."

According to the NIOSH Guide to the Selection and Use of Particulate Respirators N95 respirators must maintain at least 95% filtration after a total mass loading of 200mg. This is designed to ensure they continue to work in sites with high particulate matter, such as some construction environment. However in normal use, even outside in a city with high levels of population, it would take over 200 days of 24 hour per day use to get to this level. The guide says that "generally, the use and reuse of N-series □ lters would also be subject only to considerations of hygiene, damage, and increased breathing resistance". The NIOSH guidelines are well supported by research.

Fit tests are not required for respirators to be effective

In one study non-experts were asked to read the instructions that come with a respirator, and then to don the respirator without assistance and complete a fit test. The average fit factor achieved was 88, and the lowest fit factor of the subjects was 15, with nearly half achieving a fit factor greater than 100.

Surgical masks have been found to have a much poorer fit in practice. One study showed that for surgical masks "quantitative fit factors ranged from 2.5 to 9.6", and another found an average fit factor of 3.0.

Guidance from the US Food and Drug Administration (FDA) explains that:

"Fit Factor is a means of expressing the difference in particle concentration inside the mask and outside the mask during use. For example, a fit factor of 2 means that the concentration of particles within the mask is ½ or 50% of the concentration outside the mask; a fit factor of 5 means the concentration of particles within the mask is 1/5 th or 20% of the concentration outside the mask."
The guidance says that failing to achieve a fit factor of 2 "may suggest that respirator fit will not be sufficient to assure that the device will help reduce wearer exposure to pathogenic biological airborne particulates."

An analysis of the fitted filtration efficiency (FFE) of surgical masks found that, unmodified, they only achieved an FFE of 38.5%. The "knot and tuck" technique improved that to 60.3%, and a DIY mask fitter consisting of three rubber bands increased it to 78.2%. A 3-layer cotton mask had an FFE of just 26.5%. An N95, on the other hand, achieved an FFE of 98.4%. Furthermore, the N95 FFE had a standard deviation of only 0.5% — that is, it was effective for multiple tests during "a series of repeated movements of the torso, head, and facial muscles". Interestingly, a 2-layer nylon mask had an FFE of 79.0% (standard deviation 4.3%), showing that some cloth masks can be quite effective. These findings were replicated in a study of numerous types of cloth mask, which found that hybrids of 600 TPI cotton with silk, chiffon, or polypropylene achieved 72-96% filtration efficiency.

Researchers have calculated that "the particle size most likely to deposit in the respiratory tract when wearing a mask is ~2µm". Unfortunately, this particle size is not considered in N95 or similar standards. Instead, 0.3 µm particles are used.

A 2010 study of fit testing respirators for public health medical emergencies found that 98% of non-experts wearing masks without training achieved a fit factor of over 5 (20% leakage) and 75% of them achieved a fit factor of over 10 (10% leakage).

Margaret Jennings
Microbiologist and Infection Prevention & Control Consultant/Educator