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Practice points

When weighing universal precautions, filtration efficiency is not universal

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Interest in homemade face masks for personal use and hospital donation has surged in the past month due to personal protective equipment shortages and updated US Centers for Disease Control and Prevention guidelines for public use. Though existing studies show low filtration efficiency of certain homemade mask materials, this does not diminish the potential usefulness of homemade masks in combating the coronavirus disease 2019 (COVID-19) pandemic [1]. Most published studies have investigated masks made of cotton, but there are many promising materials that have not been formally tested, ranging from medical textiles such as surgical wrap to consumer goods such as non-woven polypropylene shopping bags. These materials have piqued interest in engineering communities due to their similarity to existing mask textiles. Because many of the properties that contribute to an effective mask, such as diffusion characteristics and electrostatic forces, are not routinely measured in alternative materials, particulate filtration efficiency (PFE) testing is necessary to determine which are most suitable for constructing masks.

Recently, a widely circulated story claimed that sterilization wrap, which boasts a filtration efficiency of 99%, could be used to make masks more effective than N95 masks. This innovation was publicized in the media before it was noted that the 99% efficiency of the surgical wrap refers to a measure called the bacterial filtration efficiency (BFE), and thus could not be meaningfully compared with N95 masks that are tested on their ability to remove much smaller particles.

This confusion stems, in part, from the variety of metrics that the Food and Drug Administration (FDA) accepts to prove filtration efficiency. The most common metric comes from a testing procedure developed by the National Institute for Occupational Safety and Health, in which uncharged NaCl particles 0.075 μm in diameter are sent through the test filter at a rate of 85 L/min. This method uses smaller particles and a higher flow rate than what is typically encountered in medical settings, therefore giving a conservative estimate of filtration efficiency [2]. Other FDA-recognized filtration tests measure PFE, BFE, and viral filtration efficiency using transmission of 0.1 μm polystyrene latex particles, *Staphylococcus aureus* or *Escherichia coli*, and the phiX 174 virus, respectively [3]. Because each method uses different-sized particles to test filtration, the significance of different metrics varies greatly and meaningful conclusions cannot be drawn by comparing, say, a standalone BFE to an N95 efficiency.

Understanding the distinction between various filtration metrics is crucial for physicians and other decision-makers so that they can accurately interpret study results on alternative mask materials and translate them into much-needed recommendations for their communities.

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