Reuse of N95 Filtering Facepiece Respirators: What Have We Learned and Where Do We Go Next?

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Background: In 2006, the Institute of Medicine (IOM) reported that for a 6-week pandemic, an estimated ~90 million disposable N95 filtering facepiece respirators (FFRs) would be needed to protect healthcare workers. FFR stockpiling is a preferred contingency plan for dealing with FFR shortages, but requires logistical expertise to distribute supplies in a timely manner. Decontamination and reuse of FFRs was identified as another possible solution for extending supplies. The IOM identified 3 criteria for assessing FFR biological decontamination methods: the method must (1) remove the viral threat; (2) be harmless to the user; and (3) not compromise the integrity of the FFR. When the report was issued, the IOM was unable to find data on decontamination of FFRs and recommended that research be done to address this gap. NIOSH then began a research effort to understand the efficacy and impact of FFR decontamination and the risks associated with handling an FFR contaminated by virus particles. This presentation will provide an update on this research.

Methods and approach: The study was conducted over a 5-year period and in collaboration with external partners including Battelle and the Air Force Research Laboratory. The six study phases were (1) Effect of decontamination on FFR filtration performance; (2) Development of standardized test protocols for measuring FFR decontamination efficacy; (3) Viability of viruses trapped on FFRs; (4) Reaerosolization of viruses from FFRs; (5) Assessment of decontamination method suitability; and (6) Effect of decontamination on FFR fit.

Results and discussion: FFRs are not inherently antimicrobial. Some viruses can survive on them for extended periods of time, but are unlikely to be reaerosolized by coughing, sneezing, or rough handling. Protocols for reproducibly contaminating FFR samples with viruses and assessing decontamination effectiveness were developed and published as ASTM test methods (E2720-10 and E2721-10). Using these protocols, some decontamination methods were found to render trapped MS2 and H1N1 influenza virus inactive. For the FFR models tested, decontamination by ultraviolet light, moist heat, and microwave generated steam did not significantly reduce FFR fit or filtration performance. Other decontamination methods such as autoclave, >100 °C heat, isopropyl alcohol, microwave (dry heating), and soap/water caused significant physical or filter degradation to some or all of the models tested, while bleach had noticeable odor and some off-gassing. Preliminary conclusions This project showed that decontamination of FFRs is possible, but work is still needed to make this a practical solution. The FFRs tested have differences in their design (e.g., number of layers, face seal enhancements) and materials (e.g., hydrophobicity), which affects their ability to withstand some processing conditions and impacts the efficacy of decontamination. The project was limited only to a few models, and the results cannot be generalized for all FFR models. Thus, NIOSH does not recommend decontamination of FFRs for the purpose of reuse. Potential next steps include field validation of some of the promising methods, inter-laboratory testing of ASTM E2720-10 and E2721-10, collaborations with manufacturers interested in FFR decontamination, and the development of a regulatory implementation plan for FFR decontamination and reuse.