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- v 'Respiratory Protection for the World' ISRP 2022 Complete Agenda
- 1 Review of the Effect of Continuous Use and Limited Reuse of N95 Respirators on Respirator Fit ... *Daniel Berger; Catherine Caldwell; Monica Zukowski; James Basting; Lauren Mazur; and Ravindra Gopaul*
- 26 Evaluation of a Shortened Fit Test Protocol for Elastomeric Half-Mask Respirators Using the OHD Quantifit® ... *Leshan J. Kimbrough*, Riley C. Duncan, and Olivia R. Dawson*
- 36 'Respiratory Protection for the World' ISRP 2022 Complete Abstracts



Review of the Effect of Continuous Use and Limited Reuse of N95 Respirators on Respirator Fit

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) has led to severe shortages of filtering facepiece respirators (FFRs). As a result, extended use, limited reuse, and FFR decontamination have been utilized to extend the life of single-use FFRs. Although some studies have raised concerns that reuse could affect the FFR's ability to form a seal, no comprehensive literature review of the effect of extended use or limited reuse on FFR seal exists.

Objective: The goal of this review was to assess the effect of extended use and reuse on respirator fit, with and without decontamination.

Methods: Searches of PubMed and Medrxiv yielded 24 papers that included assessment of fit after extended use or limited reuse on a human. One additional handpicked paper was added.

Results: Studies report a wide variation in the number of donnings and doffings before fit failure between different models of respirators. Additionally, while seal checks lack sufficient sensitivity to reliably detect fit failures, individuals who failed fit testing were often able to pass subsequent tests by re-positioning the respirator. Even with failure, respirators often maintained a substantially higher level of fit than a surgical mask, so they may still provide a level of protection in crisis settings.

Conclusion: Based on currently available data, this literature review was unable to establish a consensus regarding the amount of time a respirator can be worn or the number of uses before fit failure will occur. Furthermore, variations in reuses before fit failure between different models of N95 respirators limit the ability to offer a comprehensive recommendation of greater than one reuse or a specific amount of wear time.

Keywords: Continuous Use, Limited Reuse, N95 Respirator, Mask, Personal Protective Equipment (PPE), Filtering Facepiece Respirator (FFR), Coronavirus (COVID-19), Decontamination

ISRP members can read the full paper in the members-only section.

Evaluation of a Shortened Fit Test Protocol for Elastomeric Half-Mask Respirators Using the OHD Quantifit®

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ABSTRACT

Annual fit testing, as mandated by the Occupational Safety and Health Administration (OSHA), is required for every employee in the United States who wears a tight-fitting respirator. Considering the volume of fit tests performed annually, a reduced test duration would prove advantageous. This study evaluated a shortened fit test protocol for elastomeric half-mask respirators using Controlled Negative Pressure (CNP) technology. The new protocol is a modification of the OSHA-accepted CNP REDON protocol and would reduce the test duration to 1.9 minutes. The overall fit factor measured using the new method was compared to that of a reference method following the “Criteria for Evaluating New Fit Test Methods” outlined in American National Standards Institute (ANSI) publication Z88.10-2010, Annex A2. Sequential paired fit tests were performed on human test participants during the same respirator donning. Fit factors were measured using the Quantifit® CNP instrument. The exercise set for the reference method was the standard OSHA 8-exercise protocol for CNP-based instruments. The exercise set for the modified-REDON method included facing forward, facing parallel to the floor, head shaking, and two redon exercises. The results demonstrated that the sensitivity of the shortened method (0.98) was greater than the requirement (>0.95) defined in ANSI Z88.10-2010. The new method also met the test specificity, predictive value of a pass, predictive value of a failure, and kappa statistic recommended by ANSI. This study also evaluated the effect of reducing the number of redon exercises from two to one, further decreasing the test duration to 1.2 minutes. The results demonstrated the sensitivity (0.98) remained unchanged indicating removal of the second redon step would not negatively impact the ability of the new method to effectively identify poorly fitting respirators.

Keywords: respirator fit testing, quantitative fit test, elastomeric half-mask respirator, OHD Quantifit, controlled negative pressure.

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