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Halo Respirator Assessment of Reprocessing and Cleaning (ARC)

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ABSTRACT

Background: Reusable respirators are an important alternative source of respiratory protection in healthcare to alleviate N95 supply shortages faced during surge demand. These respirators must be cleaned and disinfected after use to assure safety for reuse.
Objective: This study aimed to evaluate whether use of conveniently available hospital chemical disinfectants alone removes influenza virus and facial contaminants similarly to use of a soap and water-based cleaning regimen along with disinfectant.
Methods: CleanSpace® Halo reusable respirators were contaminated with simulated facial oils and influenza A virus via fine mist spray. Facial contamination was verified by use of fluorescent lotion. Half of the respirators were processed by cleaning in soap and water followed by wiping with a standard hospital chemical disinfectant; the other half were only wiped with chemical disinfectants. Disinfectants included: 70% isopropyl alcohol, 0.5% hydrogen peroxide, 0.55% quaternary ammonium compound and 0.1% bleach. Respirators were tested for influenza presence and viability following initial contamination, after wiping with disinfectant and then spraying with disinfectant. Results of quantitative RT-PCR to quantify influenza virus and TCID50 assays to titrate viral infectivity results were compared between the two processing strategies, among the four disinfectant types, and in comparison to the pre and post disinfectant spray step. The decrease in the presence of facial contaminants and disinfectant residue was expressed as percent reduction from baseline.
Results: The lowest levels of influenza viral loads and the lowest levels of residual facial contaminants were observed on respirators undergoing cleaning with soap and water, disinfection with a chemical disinfectant, and with sleeve protection of the power unit. This was shown by both PCR and the TCID50 assays.
Conclusion: The findings from this study provide an evidence base to design hospital cleaning and disinfection protocols for reusable Halo respirators. The most protective protocols should include cleaning with soap and water and disinfection of the respirators after use.

Keywords: reusable elastomeric respirators, virus, disinfection, decontamination, N95 supply shortage

Respiratory Protection Recommendations and Guidance against COVID-19 in China

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The Chinese government has taken strong prevention and control measures to fight against the spread of coronavirus disease 2019 (COVID-19), such as promoting public awareness of disease prevention, stopping large gatherings, wearing masks, etc., to reduce the risk of human infection

The source of COVID-19 infection is mainly novel coronavirus infected patients. Asymptomatic infected persons can also become the sources of infection. Respiratory droplets and close contact transmissions have been regarded as the main routes of transmission. There is also a possibility of aerosol transmission in a relatively closed environment for a longer exposure time. Other routes of transmission need to be clarified. The whole population is susceptible (National Health Commission of the PRC, 2020.3.7).

Among all control measures, respiratory protection plays a key role in prevention and control of COVID-19. Based on the characteristics of different population groups, the Chinese Center for Disease Control and Prevention (CCDC) has issued recommendations and guidance on respiratory protection against COVID-19.

Developing home-disinfection and filtration efficiency improvement methods for N95 respirators and surgical facial masks: stretching supplies and better protection during the ongoing COVID-19 Pandemic

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ABSTRACT

The U.S. CDC announced on 04/03/2020 that all citizens should wear face coverings when in public, potentially increasing demand for medical face masks from the public and exacerbating mask shortages for Covid-19 response staff. One solution is reuse after disinfection for the general public. Prior studies have shown that heating for 30 mins at 70°C or above effectively kills SARS, including SARS-CoV-2, and Influenza viruses on masks. Black carbon (BC) particles generated from a kerosene-lamp were used as a proxy for Coronavirus aerosols to test mask performance after disinfection given overlapping size distributions. We determined filtration efficiency (FE) measurements by comparing BC values on both sides of the respirators or masks (Moldex N95 and 3M N95 respirators, HSI surgical masks) placed under vacuum on mannequins. To obtain the maximum FE, each mask type was first measured while taped or modified to tightly fit a mannequin's face when new and after each heating cycle. No reduction in average FE was observed even after 10 disinfection cycles, with FE statistically greater than 95% for N95 respirators and 70% for surgical masks. In sharp contrast, the FE of all medical masks with no additional sealing decreased to ~ 40%, confirming the effectiveness of facial masks relies upon a tight fit. For solving this issue, we designed a method for making individualized custom nose clips to hold a mask tightly to face; FE of 3M N95 respirators and surgical masks remained above 95% and 80%, respectively. Surprisingly, the FE of three homemade thick cloth coverings (in normal use) were 55%. Though more work is still needed, this result supports the public announcements that the public could wear cloth coverings instead of N95 respirators or surgical masks in low-risk environments. When worn with a customized nose clip, N95 respirators and surgical masks have higher FE than the CDC design for cloth coverings.

Keywords: COVID-19, disinfection, reusability, N95 respirator, surgical mask, homemade cloth covering, kitchen oven

A General Framework to Test and Evaluate Filtering Facepiece Respirators Considered for Crisis Capacity Use as a Strategy to Optimize Supply

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ABSTRACT

During a public health emergency, respirator shortages can have a profound impact on the national response, such as for the current coronavirus disease 2019 (COVID-19) pandemic. Due to a severe shortage of respirators (particularly filtering facepiece respirators [FFRs]), there may be contexts in which understanding the performance of FFRs that are approved for use as part of a crisis capacity strategy is desired. This includes FFRs that are not covered under the National Institute for Occupational Safety and Health (NIOSH) Respirator Approval Program because they have been stored past their designated shelf life, have been decontaminated, or are approved by international certification bodies other than NIOSH. The purpose of this document is to provide a general framework to assess the performance of FFRs that are only being used as a crisis capacity strategy. The intended audience are those who are responsible for managing large amounts of FFRs. This framework includes a four-step process consisting of: 1) defining the population of FFRs to be sampled; 2) providing sampling strategy options; 3) inspecting and testing the sampled units; and 4) evaluating the results. In addition to the four-step process, we provide an example of how NIOSH recently evaluated the quality of FFRs sampled from ten U.S. stockpiles.

Keywords: COVID-19, N95 respirator, filtering facepiece respirator, FFR, pandemic response, crisis capacity, respirator shortage, sampling strategy

Planning for Epidemics and Pandemics: Assessing the Potential Impact of Extended Use and Reuse Strategies on Respirator Usage Rates to Support Supply-and-Demand Planning Efforts

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ABSTRACT

During epidemics and pandemics healthcare personnel (HCP) are on the front line of disease containment and mitigation. Personal protective equipment (PPE), such as NIOSH-approved N95 filtering facepiece respirators (FFRs), serve an important role in minimizing HCP risks and are in high demand during public health emergencies. Because PPE demand can exceed supply, various public health strategies have been developed to reduce the rate of PPE consumption as supply dwindles. Extended use and limited reuse of N95 FFRs are strategies advocated by many governmental agencies used to increase the number of times a device can be used. Increased use of respirators designed for reuse—such as powered air-purifying respirators (PAPRs) and elastomeric half-mask and full facepiece air-purifying respirators— is another option designed to reduce the continuous need for new devices as the daily need for respirator use increases. Together, these strategies are designed to reduce the number of PPE units that must be discarded daily and, therefore, extend the longevity of available supply. The purpose of this paper is to theoretically estimate the impact of extended use and limited reuse strategies for N95 FFRs and the increased use of reusable respirator options on PPE consumed. The results suggest that a considerable reduction in PPE consumption would result from extended use and limited reuse of N95 FFRs and the increased use of respirators designed for reuse; however, the practical benefits must be balanced with the risks and economic costs. In addition, extended use and reuse strategies must be accompanied by proper procedures to reduce risk. The study is designed to support epidemic and pandemic PPE supply and demand planning efforts.

Keywords: COVID-19, N95 respirator, filtering facepiece respirator, pandemic response, crisis capacity, respirator shortage, reuse, extended use