
Commentary

Scientific Collaboration During the COVID-19 Pandemic: N95DECON.org

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Abstract

Many academics and researchers have responded to the COVID-19 pandemic by forming on-line national and international collaborative groups to rapidly investigate issues of prevention and treatment. This commentary describes the spontaneous formation of an international team of 115 researchers who summarized the literature on safe methods for decontaminating N95 filtering facepiece respirators in response to the supply crisis. The summary reports and fact sheets on the (www.n95decon.org) website have had more than 200 000 unique visits and the organization's webinars have reached health care professionals from more than 50 countries. The team is extending its mission to cover other personal protective equipment. The success of these collaborations may alter how scientific questions are tackled in the future.

Keywords: decontamination; infectious disease; pandemic; personal protective equipment

The COVID-19 pandemic has created unique collaborations for scientific discovery in order to address a global problem. On 16 March 2020, six Bay Area counties imposed a shelter-in-place order requiring everyone to stay at home, making an exception for certain essential needs. Across the country, universities blocked access to classrooms and laboratories, forcing faculty, researchers, post-docs, staff, and students to stay home. Many academics recognized the severity of the pandemic and wanted to contribute what they could to reduce the health impact while they were trapped at home. Researchers from various universities spontaneously linked up on emerging digital platforms to tackle questions related to epidemiology and modeling, treatments,

diagnostic testing, personal protective equipment, and other issues.

This convergence of events laid the foundations for strong scientific collaborations to foster. One such group, N95DECON.org, grew organically in early March to become a team of 115 researchers from many universities, including UC Berkeley, Boston, U of Chicago, Emory U, Georgetown, Harvard, U of Hawaii, UC Los Angeles, U Louisville, U of Maryland, U of Michigan, MIT, Northeastern, and UC San Francisco, Stanford, U of Toronto, U Wisconsin, and U of Utah to investigate safe methods for decontaminating N95 filtering facepiece respirators (FFRs) ([Supplementary data](#), available at *Annals of Work Exposures and Health* online).

The goal was to review the literature, identify promising decontamination methods, and summarize the review findings in technical reports and concise fact sheets that could assist hospitals and healthcare workers when considering N95 FFR decontamination. Over its short lifespan the N95DECON.org website has received over 200 000 unique visitors.

The focus on decontaminating N95 FFRs was driven by the national supply crisis of N95 FFRs for the anticipated demands, with the recognition that some hospitals would be unable to obtain an adequate number to supply their personnel. The group acknowledged upfront that N95 FFRs are not designed to be decontaminated and should normally be disposed of after each patient encounter to avoid risk of infection and cross contamination. However, given the crisis situation, and even with the CDC's guidance on extending the lifespan of N95 FFRs to a full day (CDC, 2020a), some hospitals quickly exhausted their supply of N95 FFRs, leaving nurses and doctors with no choice but to reuse the same N95 FFR day after day.

Spurred on by the challenges that healthcare workers were facing, N95DECON wrote summaries of the science on decontaminating N95 FFRs in technical reports and fact sheets. Fortunately, over the past 16 years, the FDA, NIH, and CDC/NIOSH had anticipated a potential N95 FFR supply problem after the international experiences with the recent major epidemics: 2003 Severe Acute Respiratory Syndrome (SARS), 2009 swine flu, 2012 MERS, and 2014–2016 Ebola. These agencies invested in laboratory research to evaluate various methods to safely decontaminate N95 FFRs. The methods tested include heat (moist and dry); submerging the mask in soapy water, solutions of alcohol, bleach, or hydrogen peroxide; hydrogen peroxide vapor; ethylene oxide; UV-C light; autoclave; and microwave irradiation. The studies investigated the effects of decontamination methods on N95 FFR performance and/or inactivation of microorganisms. Respirator performance was measured via filter efficiency, flow rate, and quantitative fit testing using mannequins. Effects of decontamination methods on microorganism inactivation were evaluated using biological indicators (e.g. spore strips) or N95 FFRs inoculated with microbes (e.g. *Geobacillus stearothermophilus* spores, phage, influenza) (Viscusi *et al.*, 2007, 2009; Bergman *et al.*, 2010, Battelle, 2016; Heimbuch and Harnish, 2019).

Several methods were found to damage filter efficiency or fit (e.g. submersion in soapy water, bleach, or alcohol). Three decontamination methods were promising: hydrogen peroxide vapor, UV-C, and moist heat.

N95DECON published ~12-page summaries of the literature for each promising decontamination method, highlighting the effects on respirator quality and viral attenuation for each implementation in technical reports. To deliver the information in a more concise manner for hospitals and healthcare workers, each method was also accompanied by a 1-page summary fact sheet. Over time, more fact sheets were published on the website (www.n95decon.org) regarding ineffective methods for decontamination, use of time for decontamination, donning and doffing N95 FFRs, and descriptions of different types of masks.

Also, in response to past epidemics, some hospitals had developed and pilot tested in-house systems for decontaminating N95 FFRs. For example, in response to the Ebola epidemic, University of Nebraska Medical Center developed a UV-C, whole room N95 FFR decontamination process with detailed standard operating procedures (SOPs) (Lowe *et al.*, 2020). Duke University Health System developed a decontamination process using hydrogen peroxide vapor (Schwartz *et al.*, 2020). With permission, the N95DECON website has posted these and other SOPs (MGH, U Iowa, UCLA) on different methods for decontamination and processes for quality control.

Soon after the technical reports were first posted (1 April 2020) to N95decon.org, the CDC/NIOSH released guidance on decontamination of N95 respirators during times of crisis (CDC, 2020b). The CDC recommendations closely matched those of n95decon.org. On 28 March 2020 the Battelle hydrogen peroxide vapor Critical Care Decontamination System™ (CCDS) received FDA Emergency Use Authorization (EUA) for decontamination of N95 FFRs for reuse. Since then the FDA has issued EUAs for five other hydrogen peroxide processes for decontaminating N95 FFRs.

As this commentary is being written, the N95DECON technical reports and fact sheets are being updated with new research findings. Another unusual scientific process associated with this pandemic is the reliance on non-peer reviewed preprints of manuscripts that are posted on the medRxiv website. These preprints provide a useful method for rapidly exchanging scientific findings, which is important during these times, but the studies must be interpreted with caution. The methods and findings in these preprints are reviewed in detail and have frequently led to recommended changes back to the authors that would improve the reporting of their findings.

The problem of lack of supply of N95 FFRs is not limited to the USA. N95DECON developed an

international webinar on decontaminating N95 FFRs that targeted low- and middle-income countries. So far, the recorded webinar has been viewed by more than 1500 healthcare providers and health and safety professionals from more than 50 countries. The fact sheets on the website are currently being translated into nine other languages.

The organization has expanded its mission to coordinate experiments on SARS-CoV-2 decontamination and is beginning to cover decontamination of other personal protective equipment, such as elastomeric and gowns. Soon a related site will be added to provide information to the public on differences between materials used to make homemade masks and best practices for cloth mask use.

It is not clear how long such pop-up scientific collaborations will continue to remain active. As universities open up and faculty and students return to teaching, classes, and their usual research, will they continue to participate in N95DECON? This and other similar collaborations have occurred without Federal research funding. Our country is now on notice that future SARS-like epidemics are likely and we need to prepare for them and take them seriously. Therefore, new research funding will be available for pandemic prevention. Will researchers drift away from these productive collaborative approaches to science and move back to competitive grant writing and research? COVID-19 will have a permanent impact on how we live. Perhaps it will have a permanent impact on collaborative science.

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Conflict of interest

The author declares no conflict of interest relating to the material presented. Its contents, including any opinions and/or conclusions expressed, are solely those of the author.

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