

COVID-19: Tackling the N95 shortage with novel decontamination

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The ongoing COVID-19 pandemic has placed significant strain on health care systems across the world, leading to dangerous shortages of personal protective equipment (PPE), including N95 filtering facepiece respirators. To combat this shortage, the University of Nebraska Medical Center (UNMC) faced a dire choice of continuing as is and face running out of supplies or find a solution to reuse N95 masks. Their solution? A decontamination procedure involving the delivery of ultraviolet germicidal irradiation (UVGI).

But this isn't new to UNMC. In 2014, UV light was used to disinfect rooms when the center was treating Ebola patients. Now, UV lights are being used to preserve PPE. This experimental procedure is used to decontaminate N95 masks with ultraviolet light to allow them to be used for a week or longer.

“We continue to have—like everywhere else in the country, particularly in the beginning of the pandemic—problems with getting patients tested, as many or as quickly as we would like, and we continue to experience challenges with that,” said Mark Rupp, MD, professor and chief of the division of infectious diseases at UNMC. “That’s been a real Achilles heel for our approach to this from a public health standpoint and from an epidemiologic standpoint. To some degree we’re all flying a little bit blind.”

“We’re also having issues with our supply line and we’re doing everything we can to try to preserve the ability to use appropriate PPE in the care of patients,” said Dr. Rupp who is also the medical director of the department of infection control and epidemiology at UNMC. “So, we started this UV decontamination and reuse of N95 respirators, which I think is really an innovative approach.”

Here is how the University of Nebraska Medical Center is using UV light to decontaminate N95s.

Adopting extended wear

When a physician, nurse or other health professional first dons an N95 respirator mask, they label it with their name and the date. During this time, everyone is encouraged to adopt extended wear of the respirator to maintain availability.

“If you can wear the respirator for hours at a time while you care for a series of patients, we are certainly encouraging that,” said Dr. Rupp. “We think that’s a better way to go—and safer—rather than necessarily putting it on and taking it off and trying to reuse the respirator multiple times.”

“When we’re finished with it for that care period or for that shift, the providers are putting it into a brown bag” that is labeled with the health professional’s name and information, he said.

Reprocessing with UV lights

The brown bags with used masks are collected and taken to a “repurposed hospital room,” said Dr. Rupp. “Within this room we have painted the walls with UV reflective paint and a series of clotheslines that are stretched across the room.”

The clotheslines contain clothes pins that hold the respirators, which are hung in “a certain orientation so that it’s open and exposed as much as possible,” he said, adding that there are “two UV towers on either side of the room with the clotheslines stretched between them.”

“We irradiate the N95s with germicidal irradiation to achieve a level that is well above that which kills bacteria and respiratory viruses,” said Dr. Rupp. “We’ve done validation studies to demonstrate that we have a large margin of safety.”

Taking on new roles

“Because we’re not doing nearly as much surgery, we actually have folks that have a lot of skills and they aren’t doing what they normally do, because we’ve essentially eliminated elective procedures,” said Dr. Rupp.

The health professionals who previously worked in the central supply and processing have been trained to reprocess the respirators—a process that takes about 15 minutes to deliver the radiation.

Once the respirators are decontaminated, they are placed in a white bag.

“We’ve tried to really carefully have a brown bag for dirty and a white bag for clean,” said Dr. Rupp, adding that the team will “label the white bag with the health care provider’s name on it and they will put a little tick mark on the respirator so we know how many times it’s gone through the recycling.”

“They deliver those bags with the respirators back to the unit from where they came. And they’re pretty much doing this full time now,” he said.

Checking fit and seal

“We’ve reviewed the literature carefully and it appears that you can deliver up to 20 reprocessing procedures with up to a full joule of irradiation each time,” said Dr. Rupp, adding that “we’re not using that much irradiation and we hope to reprocess about 10 times.”

After each reprocessing procedure, everyone is asked to “do a good fit check and seal check when they get the respirator back,” he said. “If it doesn’t fit correctly or form a tight seal, then we’re telling personnel to throw it out.”

Additionally, it is important to “stress the elastic bands because the elasticity of the bands is probably one of the first things to wear out when radiated,” said Dr. Rupp. “If we find that the bands aren’t as elastic or that they snap, obviously that’s a respirator that has lived its life and it’s time to throw it away.”

The AMA created a physician’s guide to COVID-19, which features resources on how to optimize the supply of PPE. Physicians can also stay informed and updated with the AMA’s COVID-19 resource center.

Meanwhile, *JAMA* has put out a call for ideas on how to conserve the supply of PPE that already has generated hundreds of responses. Additionally, the *AMA Code of Medical Ethics* offers foundational guidance for health care professionals and institutions responding to the COVID-19 pandemic.

The Centers for Disease Control and Prevention (CDC) notes that disposable filtering facepiece respirators (FFRs) are not approved for routine decontamination and reuse as standard of care. However, FFR decontamination and reuse may need to be considered as a crisis capacity strategy to ensure continued availability.

Based on the limited research available, ultraviolet germicidal irradiation, vaporous hydrogen peroxide, and moist heat showed the most promise as potential methods to decontaminate FFRs. Learn more about decontamination from the CDC.

Additionally, the Food and Drug Administration approved an emergency use authorization for Battelle's Decontamination System for use in decontaminating compatible N95s.