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LETTER TO THE EDITOR

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The importance of the minimum dosage necessary for UVC decontamination of N95 respirators during the COVID-19 pandemic

To the Editor,

The World Health Organization (WHO) recently released a press report highlighting the severe shortage of personal protective equipment (PPE) that is endangering healthcare workers worldwide during the COVID-19 pandemic.[1] To meet this urgent need, healthcare institutions across the world have begun to utilize the germicidal properties of ultraviolet C (UVC) to decontaminate N95 respirators so that they can be reused.[2] It is clearly crucial that the dose of UVC delivered is sufficient to kill any viable SARS-CoV-2, the causative virus of the COVID-19 pandemic that may be present on the respirators.

Currently, there is a significant amount of variability in the UVC dosages used to decontaminate N95 respirators.[3,4] While no published data are available on the UVC dose needed to decontaminate respirators from SARS-CoV-2, other coronaviruses such as severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV)[5] could potentially serve as surrogate markers. Heimbuch et al evaluated the doses of UVC needed to decontaminate circular coupons prepared from 3M 1870 N95 filtering facepiece respirators (FFRs) using a variety of viruses including influenza A (H1N1), avian influenza A virus (H5N1), influenza A (H7N9) A/Anhui/1/2013, influenza A (H7N9) A/Shanghai/1/2013, MERS-CoV, and SARS-CoV. There was no detectable viable virus for all six strains after UVC decontamination using 1 J/cm^2.[6] This dose is now reflected in the Centers for Disease Control and Prevention (CDC)[7] and N95Decon's websites.[8]

However, it is important to note that in the above study, the viruses were only tested on circular coupons from one type of N95 respirator. As Mills et al[9] and Heimbuch et al[6] further illustrated in their studies, the 1 J/cm^2 dose may not be adequate to kill the tested viruses depending on the material/type of respirator used. Mills et al found that only facepieces on 12 of 15 models and straps on 7 of 15 models showed a significant (≥3 log) reduction of H1N1 influenza viability. Similarly, Heimbuch et al found that only facepieces on 11 of 15 models and straps on 4 of 15 models showed a significant (≥3 log) reduction of H1N1 influenza viability. In addition, there were differences in many cases between whether mucin or sebum was used as an artificial soiling agent, highlighting the importance of making sure that no shadowing (when materials such as cosmetics or sunscreens are deposited on the respirators) occurs because this can block UVC penetration and hinder UVC decontamination.[6,8]

During this crisis, there is a myriad of UVC devices being discussed for possible use in health care settings which have variable output and design. There is the urgent need to raise awareness that at least 1 J/cm^2 is used to all surfaces for UVC decontamination methods to ensure that we are not endangering our healthcare workers. It should also be emphasized that there are significant limitations to UVC decontamination methods due to the variety of respirators used in healthcare facilities. Consequently, this process should only be considered as a risk mitigation effort during severe shortage of N95 respirators but is one of the most effective and best studied options available to front-line personnel.

KEYWORDS

coronaviruses, COVID-19, dosage, filtering facepiece respirators, N95, pandemic, reuse, risk mitigation, SARS-CoV-2, ultraviolet C

CONFLICTS OF INTEREST

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