**Clinical Librarian Service Search Results**

**Request:** Can FFP3 masks be reprocessed/repatriated?

**Summary**

I have searched the databases listed at the end of this document and have found a small number of evidence-based articles concerning your question. Many of the articles refer to reusing N95 masks, rather than FFP3 masks.I have organised the results into the following sections: [Guidance and Reports](#Guidance)and [Journal Articles](#JournalArticles).

Of particular relevance is the recent technical report from the **European Centre for Disease Prevention and Control** (ECDC 2020)1 concerning ‘Cloth masks and mask sterilisation as options in case of shortage of surgical masks and respirators’.

The guidance asks, *“Are there cleaning/sterilisation methods that make it possible to reuse single-use respirators (FFP2 and FFP3)?”*. The report states the following:

*SARS-CoV-2, the virus causing COVID-19, survives in the environment, including on surfaces of various materials such as iron, cardboard and tissue. This explains that there is a risk that the outer surface of respirators and surgical masks used in patient care can quickly become contaminated. Contamination of the surface of respirators and surgical masks entails a risk for infection when reusing a mask or respirator.*

*A 2006 report by the US National Academy of Sciences on the possibility of reusing respirators during an influenza pandemic discourages this practice for a number of reasons. First, the committee could not identify any existing method that effectively removes the viral threat, is harmless to the user, and does not compromise the integrity of the various elements of the facemask. The report recommended alternative approaches, such as extended use. Contamination of the respirator surface can be avoided by placing a medical mask over it, or wearing a face shield that can be cleaned [3].*

*Because of severe shortages of respirators and surgical masks in the COVID-19 pandemic, a number of methods could be considered for the sterilisation of used masks, mostly respirators.*

***Steam sterilisation*** *is a routinely used procedure in hospitals. Mask deformation or failing fit test after steam sterilisation at 134 °C has been reported in a study performed in the Netherlands, depending on the type of FFP2 mask used [4]. Steam sterilisation at lower temperatures is under study.*

*One study commissioned by the US Food and Drug Administration (FDA) showed that hydrogen peroxide vapour (HPV) was effective in decontaminating N95 respirators from a single organism for multiple cycles of decontamination. The respirator maintained its function even after 10–20 cycles of HPV, but showed signs of degradation after this. A pilot study in the Netherlands indicated that the method is effective for two decontamination cycles without deformation while retaining filtration capacity as assessed by a rapid fit test1 , suggesting that the tested FFP2 masks (models without cellulose) can be re-used up to two times. A possible caveat of this method is that harmful concentrations of hydrogen peroxide may remain on the mask for days after decontamination. Another concern is that more decontamination cycles can lead to deformation. Also, filtration has not been assessed adequately [4].*

***Gamma irradiation*** *is a method commonly used for the large-scale sterilisation of medical devices and food items. The necessary equipment is not commonly available in hospitals. A study indicated that a dose of 20kGy (2MRad) is sufficient for the inactivation of coronaviruses [5]. Ongoing studies on using gamma irradiation with a 24kGy dose to sterilise respirators have shown the possible deformation of the mask, compromising the inner filtering layer and the mask fitting on the face. A study in the Netherlands showed no deformation of one FFP2 mask after gamma irradiation with 25kGy, but the fit test after the decontamination process failed [4] (updated results as of 20 March 2020).*

*Other methods such as* ***ozone decontamination, ultraviolet germicidal irradiation*** *and* ***ethylene oxide*** *have also been considered [6].*

*The above-mentioned methods are only considered as extraordinary last-resort methods in the event of imminent shortages of PPE. They should only be applied after a careful evaluation of the situation and after exploring the possibility of resource-conscious, rational PPE use, for example by extending a respirator’s lifespan beyond its normal limits. National public health authorities, and groups studying such methods are encouraged to share their results as soon as they become available.*

*Cleaning of reusable equipment before sterilisation is recommended but there are no data available on the effective and non-damaging cleaning methods for single-use equipment such as masks. Quality checks of the applied sterilisation methods (including the establishment of quality indicators) are necessary to ensure the safety of the equipment to be reused.*

Interim guidance from the **World Health Organization** (2020)3 concerning ‘Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages’ states the following:

*Many medical devices are designed to be reusable, hence their compatibility with decontamination methods; this is not the case for face shields, medical masks, and respirators. Normally, for any reprocessing methods, cleaning before disinfection and sterilization is required. This is a problem for masks and respirators because they cannot be cleaned without losing their properties.” (p. 8)*

*“In the current exceptional crisis scenario of the COVID-19 pandemic, reprocessing of disposable PPE is an evolving area where research and development is ongoing and urgently needed. In this document, only methods that have been tested and either published in peer-reviewed journals or commissioned by the US Food and Drug Administration (FDA) are reported. However, WHO is aware of ongoing studies that are testing promising approaches (e.g. steam or heat sterilization of medical masks if performed in standardized conditions). As more evidence becomes available, WHO will update these considerations accordingly and hence this document should be considered interim guidance.” (p. 9)*

Guidance from the **Centers for Disease Control and Prevention** (CDC 2020)4 states the following:

*“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. This document summarizes research about decontamination of FFRs before reuse.”*

I hope that I have interpreted your request correctly. Please let me know if you would like me to search further.

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**Accessing Articles**

Links are provided where online access to the full text is available. An OpenAthens username and password may be required for online access to articles. You can register for one here: <https://openathens.nice.org.uk/>

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**Feedback**

Once you have read this report, I would appreciate it if you would complete our online literature search feedback form at:

<https://www.smartsurvey.co.uk/s/LiteratureSearchFeedback20202021/>

This relates to this specific search and will help us to monitor and improve our service. Many Thanks.

Suzanne Toft

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Ext. 88148

**Current at:** 15 April 2020

**Time taken for search:** 5 hours.

**Please acknowledge this work in any resulting paper or presentation as:**

Evidence Search: Can FFP3 masks be reprocessed/repatriated? Suzanne Toft. (15 April 2020). Derby, UK: University Hospitals of Derby & Burton NHS Foundation Trust Library and Knowledge Service.

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**Guidance and Reports**

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1. **Cloth masks and mask sterilisation as options in case of shortage of surgical masks and respirators**

**Authors:** European Centre for Disease Prevention and Control (ECDC)

**Date:** 26 March 2020

**Scope of this document** This document aims to provide advice on the use of cloth face masks and sterilisation of respirators and surgical masks as an alternative in healthcare settings with suspected or confirmed COVID-19 cases if there is a shortage of specialised surgical masks and respirators.

**Target audience** Public health authorities and hospital administrators in EU/EEA countries and the United Kingdom.

<https://www.ecdc.europa.eu/sites/default/files/documents/Cloth-face-masks-in-case-shortage-surgical-masks-respirators2020-03-26.pdf>

# Strategies to Optimize the Supply of PPE and Equipment

**Authors:** Centers for Disease Control and Prevention (CDC)

**Page last reviewed:** April 3, 2020

**Available at**

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/index.html>

Personal protective equipment (PPE) is used every day by healthcare personnel (HCP) to protect themselves, patients, and others when providing care. PPE helps protect HCP from potentially infectious patients and materials, toxic medications, and other potentially dangerous substances used in healthcare delivery.

1. **Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages**

**Author(s):** World Health Organization

**Source:** World Health Organization; 6 April 2020

Interim Guidance

Available at [WHO](https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3-eng.pdf)

“The reuse of any item without a reprocessing/decontamination process is considered inadequate and unsafe**.** The reprocessing should be performed by trained staff in the sterile services department of a health care facility or at bigger scale under controlled and standardized conditions. **Many medical devices are designed to be reusable, hence their compatibility with decontamination methods**; **this is not the case for face shields, medical masks, and respirators. Normally, for any reprocessing methods, cleaning before disinfection and sterilization is required. This is a problem for masks and respirators because they cannot be cleaned without losing their properties.”** (p. 8)

“In the current exceptional crisis scenario of the COVID-19 pandemic, **reprocessing of disposable PPE is an evolving area where research and development is ongoing and urgently needed**. In this document, only methods that have been tested and either published in peer-reviewed journals or commissioned by the US Food and Drug Administration (FDA) are reported. However, **WHO is aware of ongoing studies that are testing promising approaches (e.g. steam or heat sterilization of medical masks if performed in standardized conditions)**. As more evidence becomes available, WHO will update these considerations accordingly and hence this document should be considered interim guidance.” (p. 9)

1. **Decontamination and Reuse of Filtering Facepiece Respirators**

**Author(s):** Centers for Disease Control and Prevention (CDC)

**Source:** CDC

**Last reviewed:** 17 March 2020

Available at [CDC](https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html)

“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. This document summarizes research about decontamination of FFRs before reuse.”

1. **Personal protective equipment during the COVID‐19 pandemic – a narrative review**

**Author(s):** Cook, TM

**Source:** Anaesthesia; April 2020

Available at [Anaesthesia](https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.15071) – from Wiley

NB: **Accepted Article:** This article has been accepted for publication and undergone full peer review, but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/anae.15071

**Abstract:** Personal protective equipment has become an important and emotive subject during the current coronavirus (COVID‐19) epidemic. COVID‐19 is predominantly caused by contact or droplet transmission attributed to relatively large respiratory particles which are subject to gravitational forces and travel only approximately one metre from the patient. Airborne transmission may occur if patient respiratory activity or medical procedures generate respiratory aerosols. These aerosols contain particles that may travel much longer distances and remain airborne longer, but their infective potential is uncertain. Contact, droplet and airborne transmission are each relevant during airway manoeuvres in infected patients, particularly during tracheal intubation. Personal protective equipment is an important component, but only one part, of a system protecting staff and other patients from COVID‐19 cross‐infection. Appropriate use significantly reduces risk of viral transmission. Personal protective equipment should logically be matched to the potential mode of viral transmission occurring during patient care – contact, droplet, or airborne. Recommendations from international organisations are broadly consistent, but equipment use is not. Only airborne precautions include a fitted high‐filtration mask, and this should be reserved for aerosol‐generating procedures. **Uncertainty remains around certain details of personal protective equipment including use of hoods, mask type and the potential for re‐use of equipment.**

**Quote:** “Evaluation of the possibility of decontaminating and reusing N95 masks has been undertaken, **with early results suggesting promise for both steam and UV sterilisation. However, these results are not yet peer reviewed or published and cannot be widely applied.** Repeated steam application led to degradation of filtering capacity and alcohol and chlorine-based solutions damaged the fabric. For the time being single-use masks should remain just that [41].”

(Ref 41: [Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff.](https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD011621.pub3/full)

Verbeek\_JH, Rajamaki\_B, Ijaz\_S et al.

Cochrane Database of Systematic Reviews 2019, Issue 7. Art. No.: CD011621.

DOI: 10.1002/14651858.CD011621.pub3)

1. **Disinfection of N95 Respirators: UV Light May Be Considered For Limited Reuse Situations**

**Author(s):** Emergency Care Research Institute (ECRI)

**Source:** ECRI

**Last Updated:** 6April 2020

Available at [ECRI](https://assets.ecri.org/PDF/COVID-19-Resource-Center/COVID-19-Clinical-Care/COVID-Alert-Large-Vol-Infusion-Pumps-2.pdf)

“Consider developing a policy for implementation of UV disinfection. The policy may include:

* Before first use, label the respirator strap with the wearer’s name.
* After use of a respirator, follow protocol for doffing. Avoid touching the internal surface.
* Place the respirator in a paper bag, marked to identify the wearer, for transport to a UV disinfection location.
* UV disinfection device operators should wear appropriate PPE (i.e., gloves, gown, respirator) when handling respirators.

For disinfection using countertop UV disinfection systems:

* Place the respirator in the device. Conical (duckbill) respirators that fold flat should be propped open to enable sufficient surface exposure.
* Follow the UV device manufacturer’s recommendations for disinfection cycle time, which ranges from 30 seconds to 2 minutes. Aim to achieve a UV dose of at least 18 mJ/cm2 (most devices will achieve this within the manufacturer-specified disinfection cycle time); doses over 59 mJ/cm2 are preferred.

For disinfection using UV room disinfection systems:

* Hang respirators in the center of a clean, empty storage area. Place a UV room disinfection device 5 feet in front of the respirators.
* Space respirators appropriately. Do not allow them to touch one another.
* Be aware of the distance between each respirator and the UV device. If the distance increases beyond about 7 feet (about a 45° angle from the UV device), longer cycle times may be required to achieve the desired dose. Required cycle time varies by device.
* Ensure that each respirator has a clear line of sight to the UV device. Conical (duckbill) respirators that fold flat should be propped open to enable sufficient surface exposure. Attempt to limit shadowing, which may reduce the UV dose that reaches the surface of the respirator.
* When enough respirators are present, run a disinfection cycle for 5 minutes, or as recommended by the UV device manufacturer.
* Move the device to the opposite side of the respirators, and repeat the cycle to ensure that both the inside and outside of the respirator are disinfected.”

“**Effectiveness of UV disinfection:**

* Studies have shown that UV disinfection may be effective against influenza strains on the surface of N95 respirators (Mills5, Heimbuch6, Lore7). These studies did not test all models of N95 respirators, but included many common models.
* Based on data available for other coronaviruses (Walker8, Weiss9, Duan10, Kariwa11), ECRI has calculated (Kowalski book12) that a dose of 18.4mJ/cm2 at 254 nm wavelength may be sufficient to achieve a 3-log reduction of SARS-COV-2 on smooth surfaces.
* Based on data from Fisher13, UV light reaching the internal filter layers of N95 respirators, where airborne viruses are likely to be caught, may be dramatically reduced.”

[**References:**

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10. **Safety of Extended Use and Reuse of N95 Respirators**

**Author(s):** Emergency Care Research Institute (ECRI)

**Source:** ECRI; March 2020

Available at [Elsevier](https://www.elsevier.com/__data/assets/pdf_file/0006/997863/COVID-ECRI-N95-Respirators_2020-03.pdf)

“Published clinical studies are not available to assess the safety of N95 reuse and extended use during critical shortages, so we examined 21 laboratory studies because they may provide at least some rational basis for actions during a crisis. Also, clinical studies are likely unavailable and infeasible because of major ethical and logistical barriers since N95 reuse/extended use practices are associated with sporadic, unpredictable, variable crisis situations. Nonetheless, **limited evidence from laboratory studies supports prioritizing extended use over reuse** because N95s may readily spread infection by touch if donned and doffed and are prone to mechanical failure upon reuse. Studies testing more than 30 respirator N95 models found that covering respirators with surgical masks had no clinically significant effect on breathing effort and gas exchange. **Decontamination of N95 respirators by steam, disinfectants (e.g., bleach, hydrogen peroxide vapor), or ultraviolet germicidal irradiation (UVGI) may be safe and effective in some settings, but each method needs to be tested on each model because model materials vary**.”

*This manuscript has been accepted to Applied Biosafety, publication forthcoming. This is a* ***peer reviewed*** *preprint.*

1. **Decontamination and Reuse of N95 Respirators with Hydrogen Peroxide Vapor to Address Worldwide Personal Protective Equipment Shortages during the SARS‐CoV‐2 (COVID‐19) Pandemic**

**Author(s):** Antony Schwartz; Matthew Stiegel; Nicole Greeson; Andrea Vogel; Wayne Thomann; Monte Brown; Gregory D. Sempowski; Thomas Scott Alderman; James Patrick Condreay; James Burch; Cameron Wolfe; Becky Smith; Sarah Lewis

**Source:** Applied Biosafety; 2020

Available at [Applied Biosafety](https://journals.sagepub.com/doi/full/10.1177/1535676020919932) – from Sage Journals

**Abstract:** The SARS‐CoV‐2 (COVID‐19) pandemic has placed a tremendous amount of strain on resources in the healthcare setting. One of the most pressing issues is the rapid depletion of personal protective equipment (PPE) used in the care of patients. This is a significant concern for healthcare workers’ health and safety. Many entities have depleted or soon will exhaust their stockpile of PPE despite adopting PPE sparing practices as the number of COVID‐19 cases in the U.S. increases at an almost exponential rate and manufacturers struggle to keep up with the worldwide demand. This potential shortage is particularly concerning for commonly used N95 respirators and Powered‐Air Purifying Respirators (PAPRs). Recently, the U.S. Occupational Safety and Health Administration (OSHA) even temporarily suspended the requirement to perform annual fit testing of respirators to allow entities to conserve respirators and preserve them for patient care. These measures are unprecedented and highlight the urgent need for entities to develop solutions to proactively address what could be potentially a grave occupational health issue.

**Database:** WHO | COVIDWHO | ID: covidwho-42159

1. **N95 Mask Decontamination using Standard Hospital Sterilization Technologies**

**Author(s):** Anand Kumar; Samantha B. Kasloff; Anders Leung; Todd Cutts; James E. Strong; Kevin Hills; Gloria Vazquez-Grande; Barret Rush; Sylvain Lother; Ryan Zarychanski; Jay Krishnan

**Source:** medRxiv; published 8th April 2020

Available at [medRxiv](https://www.medrxiv.org/content/10.1101/2020.04.05.20049346v1)

**Abstract:** The response to the COVID19 epidemic is generating severe shortages of personal protective equipment around the world. In particular, the supply of N95 respirator masks has become severely depleted with supplies having to be rationed and health care workers having to use masks for prolonged periods in many countries. We sought to test the ability of 4 different decontamination methods including **autoclave treatment, ethylene oxide gassing, ionized hydrogen peroxide fogging and vaporized hydrogen peroxide exposure** to decontaminate 4 different N95 masks of experimental contamination with SARS-CoV-2 or vesicular stomatitis virus as a surrogate. In addition, we sought to determine whether masks would tolerate repeated cycles of decontamination while maintaining structural and functional integrity. **We found that one cycle of treatment with all modalities was effective in decontamination and was associated with no structural or functional deterioration. Vaporized hydrogen peroxide treatment was tolerated to at least 5 cycles by masks. Most notably, standard autoclave treatment was associated with no loss of structural or functional integrity to a minimum of 10 cycles for the 3 pleated mask models.** The molded N95 mask however tolerated only 1 cycle. This last finding may be of particular use to institutions globally due to the virtually universal accessibility of autoclaves in health care settings.

1. **Can N95 respirators be reused after disinfection? And for how many times?**

**Author(s):** Lei Liao, Wang Xiao, Mervin Zhao, Xuanze Yu, Haotian Wang, Qiqi Wang, Steven Chu, Yi Cui

**Source:** medRxiv; published 7th April 2020

Available at [medRxiv](https://www.medrxiv.org/content/10.1101/2020.04.01.20050443v1)

**Abstract:** The Coronavirus Disease 2019 (COVID-19) pandemic has led to a major shortage of N95 respirators, which protect healthcare professionals and the public who may come into contact with the virus. It is necessary to determine the conditions that would allow the safe reuse respirators and personal protection in this crisis. We found that heating (<100 °C) under various humidities (up to 100% RH at 75 °C) and ultraviolet (UV) irradiation were the most promising candidates for mask reuse in the modern hospital infrastructure (up to 20 cycles), when tested on a fabric with particle filtration efficiency ≥95%. Treatments involving certain liquids and vapors may require caution, as steam, alcohol, and bleach all led to degradation in filtration efficiency, leaving the user vulnerable to viral aerosols.

1. **UV Sterilization of Personal Protective Equipment with Idle Laboratory Biosafety Cabinets during the COVID-19 Pandemic**

**Author(s):** Kyle J. Card; Dena Crozier; Andrew Dhawan; Mina Dinh; Emily Dolson; Nathan Farrokhian; Vishhvaan Gopalakrishnan; Emily Ho; Eshan S. King; Nikhil Krishnan; Gleb Kuzmin; Jeff Maltas; Julia Pelesko; Jessica A. Scarborough; Jacob G. Scott; Geoff Sedor; Davis T. Weaver

**Source:** GitHub

Available at [GitHub](https://github.com/TheoryDivision/covid19_biosafety_cabinet/blob/master/PPE_UV_Manuscript.pdf)

**Abstract:** Personal protective equipment (PPE), including surgical masks and N95 respirators, is crucially important to the safety of both patients and medical personnel, particularly in the event of an infectious pandemic. As the incidence of Coronavirus Disease (COVID-19) increases exponentially in the United States and worldwide, healthcare provider demand for these necessities is currently outpacing supply. As such, strategies to safely extend the lifespan of the supply of medical equipment are critically important. In the midst of the current pandemic, there has been a concerted effort to identify viable ways to conserve PPE, including decontamination after use. Some hospitals have already begun using UV-C light to decontaminate N95 respirators, but many lack the space or equipment to implement existing protocols. In this study, we outline a procedure by which PPE may be decontaminated using ultraviolet (UV) radiation in biosafety cabinets (BSCs), a common element of many academic, public health, and hospital laboratories, and discuss the dose ranges needed for both solid and porous PPE given CDC recommendations, and publically available protocols. We further discuss obstacles to this approach including the possibility that the UV radiation levels vary within BSCs. To account for potential variation in dosing across the base of the BSC, we tested the UV-C radiation in two randomly chosen idle BSCs in our research institute and observed a maximum ratio between the minimum and maximum recorded intensities within a given BSC to be 1.98. Based on these values, we calculated that the surface of an N95 mask placed within a BSC with a manufacturer’s reported fluence of 100 µWcm−2 should receive a dose appropriate to decontaminate a solid surface after approximately 15-20 minutes per side. The degree of decontamination achieved at these doses for the inner filtration layers of an N95 is under investigation, but per CDC guidelines requires a significantly higher dose, necessitating an exposure of approximately 5.5 hours (although we discuss possible way to speed this process up). Our results are intended to provide support to healthcare organizations looking for alternative methods to extend their reserves of PPE. We recognize that institutions will require robust quality control processes to guarantee the efficacy of their implemented decontamination protocol, and we believe that this document demonstrates the importance of assessing appropriate dose delivery at the surface of the targeted objects for the specific institutional implementation. We also recognize that in certain practice situations such institutional resources may not be available; while we subscribe to the general principle that some degree of decontamination is preferable to re-use without decontamination, we would strongly advise that in such cases at least some degree of on-site verification of UV dose delivery be performed.

1. **Nebraska Medicine COVID-19 PPE Guidance: Extended Use and Limited Reuse of Disposable Facemasks, Respirators and Protective Eyewear**

**Source:** Nebraska Medicine

**Last Updated:** 19 March 2020

Available at [Nebraska Medicine](https://www.nebraskamed.com/sites/default/files/documents/covid-19/COVID-Extended-Use-Reuse-of-PPE-and-N95.pdf?date03212020)

**Overview:** Respirators include powered air purifying respirators (PAPRs) and disposable N95 respirators. Protective eyewear includes face shields and goggles. These recommendations are temporary while there are national and international shortages of protective equipment.

1. **COVID-19 Response: Guidance for Extended Use and Reuse of Facemasks, Respirators, and Protective Eyewear**

**Source:** Maryland Hospital Association

**Last Updated:** 12 March 2020

Available at [MHA Online](https://www.mhaonline.org/docs/default-source/resources/coronavirus/guidance-for-extended-use-and-reuse-of-facemasks-respirators-and-protective-eyewear-(mar-12).pdf)

These recommendations should be applied across all UMMS entities where surgical and procedural masks (henceforth in this document collectively referred to as facemasks) and respirators are worn. Respirators include powered air purifying respirators (PAPRs), N95s referred to as “disposable N95 respirators” and elastomeric respirators referred to as “reusable elastomeric respirators.” These recommendations are temporary while there are national and international shortages of respiratory protection products.

Guiding Principles: • Extended use (i.e., wearing mask continuously for several hours) is preferred over re-use (i.e., taking the mask off and putting back on) on the assumption that it is safer for the employee to leave their mask in place, and reduce the risk of self-contamination through frequent donning and doffing of the SAME mask.

1. **N95 Decon: A scientific consortium for data-driven study of N95 filtering facepiece respirator decontamination**

Available at [N95 Decon](https://www.n95decon.org/)

**About** Shortages of personal protective equipment (PPE), including medical N95 masks, are forcing hospitals, care centers, and first responders across the country to, in some cases, reuse their limited supply of these critical resources during this unprecedented COVID-19 crisis. The lack of crucial protective devices puts health care workers at increased risk of infection by the SARS-CoV-2 virus, which causes the COVID-19 disease. On March 31, 2020, the CDC released Crisis Standards of Care Recommendations for N95 Decontamination. In this time of crisis, hospitals and clinics in the US and around the world would need to decide on the best risk-management approaches to protect their medical staff since there is a limited supply of new N95s.

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**Miscellaneous**

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1. **FOI 0503 2019/20 FFP3 Respiratory Protective Equipment**

**Source:** University Hospitals Birmingham NHS Foundation Trust

Available at

<https://hgs.uhb.nhs.uk/foi-0503-2019-20-ffp3-respiratory-protective-equipment/>

FREEDOM OF INFORMATION REQUEST: 0503 2019/20

I am writing to you under the Freedom of Information Act 2000 to request the following information from the department responsible for the issuing and fit testing of FFP3 respiratory protective equipment used within your organisation to control risks arising from the exposure of staff to respiratory infectious diseases:

1. Does your organisation currently utilise any reusable FFP3 respiratory protective equipment in clinical areas for interactions with patients with respiratory infectious diseases? If so, what models are used?    Yes, 3M powered Hoods are used
2. If your organisation utilises reusable FFP3 respiratory protective equipment in clinical areas, are disposable FFP3 masks also used? If so, under what circumstances would a reusable FFP3 mask be used in place of a disposable FFP3 mask? Yes, disposable FFP3 masks are used, however, if a member of staff has failed fit testing with the disposable masks, or has facial hair, in which case the disposable masks are not effective, reusable powered hoods are available.
3. If your organisation uses reusable FFP3 masks in clinical areas, what systems of practice are in place regarding storage and decontamination to ensure that these are maintained to a clinically acceptable standard? The maintenance and monthly checks of the powered hoods is monitored by Infection Prevention & Control.

This information covers all sites within the trust.

1. **3M™ Reusable Half Masks for use in the Healthcare Industry**

**Publication:** 3M 2009. CH7500HCARE v1 12/08. Technical Bulletin

Available at

<http://www.3m.co.uk/intl/uk/ohes/segments/healthcare/(9666a)OH_ReusableTechBulletin_lft.pdf>

**Extract:**

Q- How should the 3M™ 7500 Series Reusable Half Mask fitted with 3M™ 6035 P3R Encapsulated Filters be decontaminated?

A - The User Instruction booklet accompanying the 3M 7500 series reusable half mask gives general information about cleaning and disinfecting. It discusses the use of 3M™ 105 Face Seal Wipes and immersion of the mask in detergent or disinfectant solutions followed by rinsing in clean water and drying.

However, the use of reusable respirators for protection of healthcare staff in an influenza pandemic is a recent development which gives rise to additional questions around decontamination and infection control. For this reason 3M has been looking to the hospital microbiology and infection control communities to give guidance on appropriate materials and procedures in healthcare settings.

Some Trusts are taking the view, on advice from their Microbiology and Infection Control Departments, that use of existing detergent or alcohol (70% IPA) hospital wipes on the mask and on the exterior surfaces of the filters will provide adequate decontamination between patients and aerosol generating procedures, as the flu virus is easily destroyed.

Deeper cleaning, involving immersion of the mask for approximately 5 minutes in detergent or disinfectant solution may be required as an additional measure, for example, when it is heavily contaminated. Please note that the filters must not be immersed in cleaning or any other solutions and so should be removed from the mask before immersion. The mask should be thoroughly rinsed and dried before refitting filters. Gloves should be worn at all times. Also note that the 3M 105 face seal wipes mentioned above is a ‘face seal cleaner’ and not a ‘decontamination wipe’ and is intended only for cleaning the face seal and inside of the mask as a basic hygiene measure before re-use.

Where hospitals and Trusts have their own alternative cleaning materials and methods, 3M will work with them on a case by case basis to verify whether their decontamination process is likely to damage the respirator or filters.

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**Journal Articles**

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**Article in Press, Pre-Proof**

1. **Challenges and solutions for addressing critical shortage of supply chain for personal and protective equipment (PPE) arising from Coronavirus disease (COVID19) pandemic – Case study from the Republic of Ireland**

**Authors:** Rowan, Neil J.; Laffey, John G.

**Source:** Science of The Total Environment; Available online 6 April 2020.138532,

## **Available at** <https://www.sciencedirect.com/science/article/pii/S0048969720320453>

## **Highlights:** •There is pressing need to find solutions for reprocessing of PPE for COVID19 •Reprocessing of PPE is challenging as made for one-time-use •Most sterilization technologies are not suitable for PPE reprocessing •Use of vaporised hydrogen peroxide and UV irradiation may prove effective for PPE

## **Abstract:** Coronavirus (COVID-19) is highly infectious agent that causes fatal respiratory illnesses, which is of great global public health concern. Currently, there is no effective vaccine for tackling this COVID19 pandemic where disease countermeasures rely upon preventing or slowing person-to-person transmission. Specifically, there is increasing efforts to prevent or reduce transmission to front-line healthcare workers (HCW). However, there is growing international concern regarding the shortage in supply chain of critical one-time-use personal and protective equipment (PPE). PPE are heat sensitive and are not, by their manufacturer's design, intended for reprocessing. Most conventional sterilization technologies used in hospitals, or in terminal medical device sterilization providers, cannot effectively reprocess PPE due to the nature and severity of sterilization modalities. Contingency planning for PPE stock shortage is important. Solutions in the Republic of Ireland include use of smart communication channels to improve supply chain, bespoke production of PPE to meets gaps, along with least preferred option, use of sterilization or high-level disinfection for PPE reprocessing. Reprocessing PPE must consider material composition, functionality post treatment, along with appropriate disinfection. Following original manufacturer of PPE and regulatory guidance is important. Technologies deployed in the US, and for deployment in the Republic of Ireland, are eco-friendly, namely vaporised hydrogen peroxide (VHP), such as for filtering facepiece respirators. UV irradiation is also been pursed in Ireland. Safeguarding supply chain of PPE will sustain vital healthcare provision and will help reduce mortality.

## **Database:** WHO |COVIDWHO | ID: covidwho-35086

**Article in Press: Accepted Manuscript**

1. **Inactivation of coronaviruses by heat**

**Author(s):** Kampf G.; Voss A.; Scheithauer S.

**Source:** The Journal of Hospital Infection; Mar 2020

**Publication Date:** Mar 2020

**Publication Type(s):** Letter

**PubMedID:** 32243951

Available at [The Journal of hospital infection](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.jhin.2020.03.025) - from ClinicalKey

Available at [The Journal of hospital infection](https://doi.org/10.1016/j.jhin.2020.03.025) - from Unpaywall

**First Lines:** The global spread of COVID-19 has resulted in a huge demand for personal protective equipment including face masks [1]. Even some hospitals face a substantial shortage of suitable face masks (e.g. FFP masks or N95 masks) resulting in an evaluation of various procedures to reprocess them for a limited re-use. Although they are classified as single use products the question was raised if a thermal disinfection may be effective to reduce coronaviruses. That is why published data were reviewed to find out which temperature and exposure time is necessary for inactivation of coronaviruses.

**Database:** EMBASE

1. **Waste Not, Want Not: The Re-Usability of N95 Masks**

**Author(s):** Nathan N.

**Source:** Anesthesia and Analgesia; Mar 2020

**Publication Date:** Mar 2020

**Publication Type(s):** Article

**PubMedID:** 32243299

Available at [Anesthesia and analgesia](https://journals.lww.com/anesthesia-analgesia/Abstract/publishahead/Waste_Not,_Want_Not__The_Re_Usability_of_N95_Masks.95722.aspx) - from Unpaywall

**Abstract:** As the spread of COVID-19 illnesses continues to escalate amidst a substandard supply of protective equipment for health care providers, the question of extended use or reuse of N95 masks has emerged. As well, the relative effectiveness of the N95 compared to other mask types have been entertained. A recent article by Abd-Elsayed and Karri aim to put these topics into focus. Additionally, personal correspondence between Drs. Richard Prielipp (University of Minnesota Department of Anesthesiology) and Peter Tsai (inventor of the N95 mask) offers perspectives on managing the reuse of this central element of protective equipment.

**Database:** EMBASE and WHO| COVIDWHO | ID: covidwho-23190

1. **Opinion to address a potential personal protective equipment shortage in the global community during the COVID-19 outbreak**

**Authors**: Dargaville, Tim; Spann, Kirsten; Celina, Mathew.

**Source:** Polymer Degradation and Stability 2020, Apr 5: 109162-109162

Available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7131747/>

**Abstract:** The current COVID-19 pandemic is stretching the global supply situation for face masks and PPE beyond production capacity. This is a call for the R&D community, particularly in the polymer degradation and stability arena, to engage and collaborate with virology and bio-medical experts. We require comparative R&D for extended, reuse and recyclability options, as well as large scale approaches and methods that could quickly be applied on the local level by the public who are not experts and may only have limited resources.

**Database:** PubMed and WHO| COVIDWHO | ID: covidwho-31519

1. **Utility of Substandard Face Mask Options for Health Care Workers During the COVID-19 Pandemic.**

**Author(s):** Abd-Elsayed, Alaa; Karri, Jay

**Source:** Anesthesia and Analgesia; Mar 2020

**Publication Date:** Mar 2020

**Publication Type(s):** Journal Article

**PubMedID:** 32243300

Available at [Anesthesia and analgesia](https://journals.lww.com/anesthesia-analgesia/Citation/publishahead/Utility_of_Substandard_Face_Mask_Options_for.95723.aspx) - from Unpaywall

**Extract:** CONCLUSION With the exponential spread of COVID-19, HCWs are faced with a diminishing supply of respirators (N95 masks). HCWs, especially those in more impoverished areas of the world, are faced with using substandard options such as surgical facemasks, cloth masks, and even extended-use or re-use of respirators. Surgical masks afford varying degrees of respiratory protection, which can be optimized with proper face seal and fit and with proper handwashing techniques. Cloth masks carry unclear and variable benefit and may be a last resort option only when respirators and surgical masks are unavailable. Respirator extended-use and re-use can be utilized with compliance of above U.S, CDC considerations to prevent viral transmission.

**Database:** Medline

1. **Custom-made 3D-printed face masks in case of pandemic crisis situations with a lack of commercially available FFP2/3 masks**

**Author(s):** Swennen G.R.J.; Pottel L.; Haers P.E.

**Source:** International Journal of Oral and Maxillofacial Surgery; 2020

**Publication Date:** 2020

**Publication Type(s):** Article

Available at [International journal of oral and maxillofacial surgery](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ijom.2020.03.015) - from ClinicalKey

**Abstract:** In the case of pandemic crisis situations, a crucial lack of protective material such as protective face masks for healthcare professionals can occur. A proof of concept (PoC) and prototype are presented, demonstrating a reusable custom-made three-dimensionally (3D) printed face mask based on materials and techniques (3D imaging and 3D printing) with global availability. The individualized 3D protective face mask consists of two 3D-printed reusable polyamide composite components (a face mask and a filter membrane support) and two disposable components (a head fixation band and a filter membrane). Computer-aided design (CAD) was used to produce the reusable components of the 3D face mask based on individual facial scans, which were acquired using a new-generation smartphone with two cameras and a face scanning application. 3D modelling can easily be done by CAD designers worldwide with free download software. The disposable non-woven melt-blown filter membrane is globally available from industrial manufacturers producing FFP2/3 protective masks for painting, construction, agriculture, and the textile industry. Easily available Velcro fasteners were used as a disposable head fixation band. A cleaning and disinfection protocol is proposed. Leakage and virological testing of the reusable components of the 3D face mask, following one or several disinfection cycles, has not yet been performed and is essential prior to its use in real-life situations. This PoC should allow the reader to consider making and/or virologically testing the described custom-made 3D-printed face masks worldwide. The surface tessellation language (STL) format of the original virtual templates of the two reusable components described in this paper can be downloaded free of charge using the hyperlink (Supplementary Material online). Copyright © 2020

**Database:** EMBASE and WHO| COVIDWHO | ID: covidwho-27399​

1. **Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility - King County, Washington, March 2020.**

**Author(s):** Kimball, Anne; Hatfield, Kelly M; Arons, Melissa; James, Allison; Taylor, Joanne; Spicer, Kevin; Bardossy, Ana C; Oakley, Lisa P; Tanwar, Sukarma; Chisty, Zeshan; Bell, Jeneita M; Methner, Mark; Harney, Josh; Jacobs, Jesica R; Carlson, Christina M; McLaughlin, Heather P; Stone, Nimalie; Clark, Shauna; Brostrom-Smith, Claire; Page, Libby C; Kay, Meagan; Lewis, James; Russell, Denny; Hiatt, Brian; Gant, Jessica; Duchin, Jeffrey S; Clark, Thomas A; Honein, Margaret A; Reddy, Sujan C; Jernigan, John A; Public Health – Seattle & King County; CDC COVID-19 Investigation Team

**Source:** MMWR. Morbidity and Mortality Weekly Report; Apr 2020; vol. 69 (no. 13); p. 377-381

**Publication Date:** Apr 2020

**Publication Type(s):** Journal Article

**PubMedID:** 32240128

Available at [MMWR. Morbidity and mortality weekly report](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=32240128) - from EBSCO (MEDLINE Complete)

Available at [MMWR. Morbidity and mortality weekly report](http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2004&res_id=xri:pqm&req_dat=xri:pqil:pq_clntid=145298&rft_val_fmt=ori/fmt:kev:mtx:journal&genre=article&issn=0149-2195&volume=69&issue=13&spage=377) - from ProQuest (Health Research Premium) - NHS Version

Available at [MMWR. Morbidity and mortality weekly report](https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6913e1-H.pdf) - from Unpaywall

**Abstract:** Older adults are susceptible to severe coronavirus disease 2019 (COVID-19) outcomes as a consequence of their age and, in some cases, underlying health conditions (1). A COVID-19 outbreak in a long-term care skilled nursing facility (SNF) in King County, Washington that was first identified on February 28, 2020, highlighted the potential for rapid spread among residents of these types of facilities (2). On March 1, a health care provider at a second long-term care skilled nursing facility (facility A) in King County, Washington, had a positive test result for SARS-CoV-2, the novel coronavirus that causes COVID-19, after working while symptomatic on February 26 and 28. By March 6, seven residents of this second facility were symptomatic and had positive test results for SARS-CoV-2. On March 13, CDC performed symptom assessments and SARS-CoV-2 testing for 76 (93%) of the 82 facility A residents to evaluate the utility of symptom screening for identification of COVID-19 in SNF residents. Residents were categorized as asymptomatic or symptomatic at the time of testing, based on the absence or presence of fever, cough, shortness of breath, or other symptoms on the day of testing or during the preceding 14 days. Among 23 (30%) residents with positive test results, 10 (43%) had symptoms on the date of testing, and 13 (57%) were asymptomatic. Seven days after testing, 10 of these 13 previously asymptomatic residents had developed symptoms and were recategorized as presymptomatic at the time of testing. The reverse transcription-polymerase chain reaction (RT-PCR) testing cycle threshold (Ct) values indicated large quantities of viral RNA in asymptomatic, presymptomatic, and symptomatic residents, suggesting the potential for transmission regardless of symptoms. Symptom-based screening in SNFs could fail to identify approximately half of residents with COVID-19. Long-term care facilities should take proactive steps to prevent introduction of SARS-CoV-2 (3). Once a confirmed case is identified in an SNF, all residents should be placed on isolation precautions if possible (3), with considerations for extended use or reuse of personal protective equipment (PPE), as needed (4).

**Database:** Medline

1. **Ultraviolet germicidal irradiation: possible method for respirator disinfection to facilitate reuse during COVID-19 pandemic.**

**Author(s):** Hamzavi, Iltefat H; Lyons, Alexis B; Kohli, Indermeet; Narla, Shanthi; Parks-Miller, Angela; Gelfand, Joel M; Lim, Henry W; Ozog, David

**Source:** Journal of the American Academy of Dermatology; Apr 2020

**Publication Date:** Apr 2020

**Publication Type(s):** Journal Article; Accepted Pre-Proof

Available at [Journal of the American Academy of Dermatology](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.jaad.2020.03.085) - from ClinicalKey

**PubMedID:** 32246972

**First Lines:** To the Editor: The ability to disinfect and reuse disposable N95 filtering facepiece respirators (FFRs) is urgently needed during the current COVID-19 pandemic as supplies are running low in hospitals throughout the United States and abroad. Ultraviolet germicidal irradiation (UVGI) is one possible method for respirator disinfection to facilitate the reuse of dwindling supplies. Dermatology offices often use narrow band ultraviolet B (UVB) to treat skin diseases. If necessary, we propose a possible repurposing of phototherapy devices, including these UVB units, to serve as a platform for ultraviolet C (UVC) germicidal disinfection…..**Therefore, considering that many of our healthcare providers are using substitutes for N95 FFRs that offer very limited degree of protection, using UVGI and repurposing phototherapy devices could be the best practical solution at this time**.”

**Database:** Medlineand WHO | COVIDWHO | ID: covidwho-23661

1. **Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff.**

**Author(s):** Verbeek, Jos H; Rajamaki, Blair; Ijaz, Sharea; Tikka, Christina; Ruotsalainen, Jani H; Edmond, Michael B; Sauni, Riitta; Kilinc Balci, F Selcen

**Source:** The Cochrane Database of Systematic Reviews; Jul 2019; vol. 7; p. CD011621

**Publication Date:** Jul 2019

**Publication Type(s):** Research Support, Non-U.S. Gov't Journal Article Research Support, U.S. Gov't, P.H.S. Systematic Review

**PubMedID:** 31259389

Available at [The Cochrane database of Systematic Reviews](http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD011621.pub3/full) - from Cochrane Collaboration (Wiley)

**Abstract:** BACKGROUND: In epidemics of highly infectious diseases, such as Ebola Virus Disease (EVD) or Severe Acute Respiratory Syndrome (SARS), healthcare workers (HCW) are at much greater risk of infection than the general population, due to their contact with patients' contaminated body fluids. Contact precautions by means of personal protective equipment (PPE) can reduce the risk. It is unclear which type of PPE protects best, what is the best way to remove PPE, and how to make sure HCW use PPE as instructed. OBJECTIVES: To evaluate which type of full body PPE and which method of donning or doffing PPE have the least risk of self-contamination or infection for HCW, and which training methods increase compliance with PPE protocols. SEARCH METHODS: We searched MEDLINE (PubMed up to 15 July 2018), Cochrane Central Register of Trials (CENTRAL up to 18 June 2019), Scopus (Scopus 18 June 2019), CINAHL (EBSCOhost 31 July 2018), and OSH-Update (up to 31 December 2018). We also screened reference lists of included trials and relevant reviews, and contacted NGOs and manufacturers of PPE. SELECTION CRITERIA: We included all controlled studies that compared the effects of PPE used by HCW exposed to highly infectious diseases with serious consequences, such as Ebola or SARS, on the risk of infection, contamination, or noncompliance with protocols. This included studies that used simulated contamination with fluorescent markers or a non-pathogenic virus. We also included studies that compared the effect of various ways of donning or doffing PPE, and the effects of training in PPE use on the same outcomes. DATA COLLECTION AND ANALYSIS: Two authors independently selected studies, extracted data and assessed risk of bias in included trials. We planned to perform meta-analyses but did not find sufficiently similar studies to combine their results. MAIN RESULTS: We included 17 studies with 1950 participants evaluating 21 interventions. Ten studies are Randomised Controlled Trials (RCTs), one is a quasi RCT and six have a non-randomised controlled design. Two studies are awaiting assessment. Ten studies compared types of PPE but only six of these reported sufficient data. Six studies compared different types of donning and doffing and three studies evaluated different types of training. Fifteen studies used simulated exposure with fluorescent markers or harmless viruses. In simulation studies, contamination rates varied from 10% to 100% of participants for all types of PPE. In one study HCW were exposed to Ebola and in another to SARS. Evidence for all outcomes is based on single studies and is very low quality. Different types of PPEPPE made of more breathable material may not lead to more contamination spots on the trunk (Mean Difference (MD) 1.60 (95% Confidence Interval (CI) -0.15 to 3.35) than more water repellent material but may have greater user satisfaction (MD -0.46; 95% CI -0.84 to -0.08, scale of 1 to 5).Gowns may protect better against contamination than aprons (MD large patches -1.36 95% CI -1.78 to -0.94).The use of a powered air-purifying respirator may protect better than a simple ensemble of PPE without such respirator (Relative Risk (RR) 0.27; 95% CI 0.17 to 0.43).Five different PPE ensembles (such as gown vs. coverall, boots with or without covers, hood vs. cap, length and number of gloves) were evaluated in one study, but there were no event data available for compared groups. Alterations to PPE design may lead to less contamination such as added tabs to grab masks (RR 0.33; 95% CI 0.14 to 0.80) or gloves (RR 0.22 95% CI 0.15 to 0.31), a sealed gown and glove combination (RR 0.27; 95% CI 0.09 to 0.78), or a better fitting gown around the neck, wrists and hands (RR 0.08; 95% CI 0.01 to 0.55) compared to standard PPE. Different methods of donning and doffing procedures. Double gloving may lead to less contamination compared to single gloving (RR 0.36; 95% CI 0.16 to 0.78).Following CDC recommendations for doffing may lead to less contamination compared to no guidance (MD small patches -5.44; 95% CI -7.43 to -3.45).Alcohol-based hand rub used during the doffing process may not lead to less contamination than the use of a hypochlorite based solution (MD 4.00; 95% CI 0.47 to 34.24).Additional spoken instruction may lead to fewer errors in doffing (MD -0.9, 95% CI -1.4 to -0.4).Different types of training. The use of additional computer simulation may lead to fewer errors in doffing (MD -1.2, 95% CI -1.6 to -0.7). A video lecture on donning PPE may lead to better skills scores (MD 30.70; 95% CI 20.14,41.26) than a traditional lecture. Face to face instruction may reduce noncompliance with doffing guidance more (OR 0.45; 95% CI 0.21 to 0.98) than providing folders or videos only. There were no studies on effects of training in the long term or on resource use. The quality of the evidence is very low for all comparisons because of high risk of bias in all studies, indirectness of evidence, and small numbers of participants. AUTHORS' CONCLUSIONS: We found very low quality evidence that more breathable types of PPE may not lead to more contamination, but may have greater user satisfaction. Alterations to PPE, such as tabs to grab may decrease contamination. Double gloving, following CDC doffing guidance, and spoken instructions during doffing may reduce contamination and increase compliance. Face-to-face training in PPE use may reduce errors more than video or folder based training. Because data come from single small studies with high risk of bias, we are uncertain about the estimates of effects. We still need randomised controlled trials to find out which training works best in the long term. We need better simulation studies conducted with several dozen participants to find out which PPE protects best, and what is the safest way to remove PPE. Consensus on the best way to conduct simulation of exposure and assessment of outcome is urgently needed. HCW exposed to highly infectious diseases should have their use of PPE registered and should be prospectively followed for their risk of infection in the field.

**Database:** Medline

1. **Ultraviolet germicidal irradiation of influenza-contaminated N95 filtering facepiece respirators.**

**Author(s):** Mills, Devin; Harnish, Delbert A; Lawrence, Caryn; Sandoval-Powers, Megan; Heimbuch, Brian K

**Source:** American Journal of Infection Control; Jul 2018; vol. 46 (no. 7); p. e49

**Publication Date:** Jul 2018

**Publication Type(s):** Evaluation Study Journal Article Research Support, U.S. Gov't, P.H.S.

**PubMedID:** 29678452

Available at [American journal of infection control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2018.02.018) - from ClinicalKey

Available at [American journal of infection control](http://www.ajicjournal.org/article/S0196655318301408/pdf) - from Unpaywall

**Abstract:** BACKGROUND Safe and effective decontamination and reuse of N95 filtering facepiece respirators (FFRs) has the potential to significantly extend FFR holdings, mitigating a potential shortage due to an influenza pandemic or other pandemic events. Ultraviolet germicidal irradiation (UVGI) has been shown to be effective for decontaminating influenza-contaminated FFRs. This study aims to build on past research by evaluating the UVGI decontamination efficiency of influenza-contaminated FFRs in the presence of soiling agents using an optimized UVGI dose. METHODS Twelve samples each of 15 N95 FFR models were contaminated with H1N1 influenza (facepiece and strap), then covered with a soiling agent-artificial saliva or artificial skin oil. For each soiling agent, 3 contaminated FFRs were treated with 1 J/cm2 UVGI for approximately 1 minute, whereas 3 other contaminated FFRs remained untreated. All contaminated surfaces were cut out and virus extracted. Viable influenza was quantified using a median tissue culture infectious dose assay. RESULTS Significant reductions (≥3 log) in influenza viability for both soiling conditions were observed on facepieces from 12 of 15 FFR models and straps from 7 of 15 FFR models. CONCLUSIONS These data suggest that FFR decontamination and reuse using UVGI can be effective. Implementation of a UVGI method will require careful consideration of FFR model, material type, and design.

**Database:** Medline

**NB: not specific to Coronaviruses or COVID-19**

1. **Assessment of half-mask elastomeric respirator and powered air-purifying respirator reprocessing for an influenza pandemic.**

**Author(s):** Lawrence, Caryn; Harnish, Delbert A; Sandoval-Powers, Megan; Mills, Devin; Bergman, Michael; Heimbuch, Brian K

**Source:** American Journal of Infection Control; Dec 2017; vol. 45 (no. 12); p. 1324-1330

**Publication Date:** Dec 2017

**Publication Type(s):** Journal Article

**PubMedID:** 28844381

Available at [American journal of infection control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2017.06.034) - from ClinicalKey

Available at [American journal of infection control](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6193495) - from Unpaywall

**Abstract:** BACKGROUND Health care facilities are considering the use of reusable respiratory protective devices (RPDs) to mitigate a potential N95 filtering facepiece respirator shortage caused by an influenza pandemic. US regulators are also considering stockpiling reusable RPDs for pandemic preparedness, but limited data exist on the effectiveness of cleaning and disinfection of these devices. This study defines reprocessing protocols and evaluates their effectiveness against a pandemic influenza strain in a laboratory setting. METHODS Five half-mask elastomeric respirator models and 3 powered air-purifying respirator models were contaminated with influenza virus and artificial skin oil on multiple surfaces. RPDs were then manually treated with 1 of 2 methods: cleaned or cleaned and disinfected. Presence of viable influenza was determined via swab sampling and a median tissue culture infectious dose assay. RESULTS Across 41 RPD surfaces, a mean log reduction in viable influenza of 4.54 ± 0.97 log10 median tissue culture infectious dose was achieved for all treated surfaces, which included both cleaned and cleaned and disinfected surfaces. CONCLUSIONS The methods defined as part of this study are effective for eliminating viable influenza in the presence of artificial skin oil on most of the RPD surfaces tested. Material type and RPD design should be considered when implementing RPD reprocessing protocols.

**Database:** Medline

1. **Transfer of bacteriophage MS2 and fluorescein from N95 filtering facepiece respirators to hands: Measuring fomite potential.**

**Author(s):** Brady, Tyler M.; Strauch, Amanda L.; Almaguer, Claudia M.; Niezgoda, George; Shaffer, Ronald E.; Yorio, Patrick L.; Fisher, Edward M.

**Source:** Journal of Occupational & Environmental Hygiene; Nov 2017; vol. 14 (no. 11); p. 898-906

**Publication Date:** Nov 2017

**Publication Type(s):** Academic Journal

Available at [Journal of occupational and environmental hygiene](http://europepmc.org/articles/pmc5705010?pdf=render) - from Unpaywall

**Abstract:** Contact transmission of pathogens from personal protective equipment is a concern within the healthcare industry. During public health emergency outbreaks, resources become constrained and the reuse of personal protective equipment, such as N95 filtering facepiece respirators, may be needed. This study was designed to characterize the transfer of bacteriophage MS2 and fluorescein between filtering facepiece respirators and the wearer's hands during three simulated use scenarios. Filtering facepiece respirators were contaminated with MS2 and fluorescein in droplets or droplet nuclei. Thirteen test subjects performed filtering facepiece respirator use scenarios including improper doffing, proper doffing and reuse, and improper doffing and reuse. Fluorescein and MS2 contamination transfer were quantified. The average MS2 transfer from filtering facepiece respirators to the subjects' hands ranged from 7.6–15.4% and 2.2–2.7% for droplet and droplet nuclei derived contamination, respectively. Handling filtering facepiece respirators contaminated with droplets resulted in higher levels of MS2 transfer compared to droplet nuclei for all use scenarios (p = 0.007). MS2 transfer from droplet contaminated filtering facepiece respirators during improper doffing and reuse was greater than transfer during improper doffing (p = 0.008) and proper doffing and reuse (p = 0.042). Droplet contamination resulted in higher levels of fluorescein transfer compared to droplet nuclei contaminated filtering facepiece respirators for all use scenarios (p = 0.009). Fluorescein transfer was greater for improper doffing and reuse (p = 0.007) from droplet contaminated masks compared to droplet nuclei contaminated filtering facepiece respirators and for improper doffing and reuse when compared improper doffing (p = 0.017) and proper doffing and reuse (p = 0.018) for droplet contaminated filtering facepiece respirators. For droplet nuclei contaminated filtering facepiece respirators, the difference in MS2 and fluorescein transfer did not reach statistical significance when comparing any of the use scenarios. The findings suggest that the results of fluorescein and MS2 transfer were consistent and highly correlated across the conditions of study. The data supports CDC recommendations for using proper doffing techniques and discarding filtering facepiece respirators that are directly contaminated with secretions from a cough or sneeze.

**Database:** CINAHL

1. **Respiratory Protection Toolkit.**

**Author(s):** Bien, Elizabeth Ann; Gillespie, Gordon Lee; Betcher, Cynthia Ann; Thrasher, Terri L.; Mingerink, Donna R.

**Source:** Workplace Health & Safety; Dec 2016; vol. 64 (no. 12); p. 596-602

**Publication Date:** Dec 2016

**Publication Type(s):** Academic Journal

Available at [Workplace health & safety](https://journals.sagepub.com/doi/pdf/10.1177/2165079916657831) - from Unpaywall

**Abstract:** International travel and infectious respiratory illnesses worldwide place health care workers (HCWs) at increasing risk of respiratory exposures. To ensure the highest quality safety initiatives, one health care system used a quality improvement model of Plan-Do-Study-Act and guidance from Occupational Safety and Health Administration’s (OSHA) May 2015 Hospital Respiratory Protection Program (RPP) Toolkit to assess a current program. The toolkit aided in identification of opportunities for improvement within their well-designed RPP. One opportunity was requiring respirator use during aerosol-generating procedures for specific infectious illnesses. Observation data demonstrated opportunities to mitigate controllable risks including strap placement, user seal check, and reuse of disposable N95 filtering facepiece respirators. Subsequent interdisciplinary collaboration resulted in other ideas to decrease risks and increase protection from potentially infectious respiratory illnesses. The toolkit’s comprehensive document to evaluate the program showed that while the OSHA standards have not changed, the addition of the toolkit can better protect HCWs.

**Database:** CINAHL

1. **Clinician Beliefs and Attitudes Regarding Use of Respiratory Protective Devices and Surgical Masks for Influenza.**

**Author(s):** Pillai, Satish K; Beekmann, Susan E; Babcock, Hilary M; Pavia, Andrew T; Koonin, Lisa M; Polgreen, Philip M

**Source:** Health Security; 2015; vol. 13 (no. 4); p. 274-280

**Publication Date:** 2015

**Publication Type(s):** Journal Article Research Support, U.S. Gov't, P.H.S.

**PubMedID:** 26173092

Available at [Health security](http://europepmc.org/articles/pmc4648351?pdf=render) - from Unpaywall

**Abstract:** While influenza transmission is thought to occur primarily by droplet spread, the role of airborne spread remains uncertain. Understanding the beliefs and attitudes of infectious disease physicians regarding influenza transmission and respiratory and barrier protection preferences can provide insights into workplace decisions regarding respiratory protection planning. Physicians participating in the Infectious Diseases Society of America's Emerging Infections Network were queried in November 2013 to determine beliefs and attitudes on influenza transmission. A subset of physicians involved in their facility's respiratory protection decision making were queried about respirator and surgical mask choices under various pandemic scenarios; availability of, and challenges associated with, respirators in their facility; and protective strategies during disposable N95 shortages. The majority of 686 respondents (98%) believed influenza transmission occurs frequently or occasionally via droplets; 44% of respondents believed transmission occurs via small particles frequently (12%) or occasionally (32%). Among the subset of respondents involved in respiratory protection planning at their facility, over 90% preferred surgical masks during provision of non-aerosol-generating patient care for seasonal influenza. However, for the same type of care during an influenza pandemic, two-thirds of respondents opted for disposable N95 filtering facepiece respirators. In settings where filtering facepiece (disposable) N95 respirators were in short supply, preferred conservation strategies included extended use and reuse of disposable N95s. Use of reusable (elastomeric facepiece) respirator types was viewed less favorably. While respondents identified droplets as the primary mode of influenza transmission, during a high-severity pandemic scenario there was increased support for devices that reduced aerosol-based transmission. Use of potentially less familiar respirator types may partially relieve shortages of disposable N95s but also may require significant education efforts so that clinicians are aware of the characteristics of alternative personal protective equipment.

**Database:** Medline

1. **Disinfection of reusable elastomeric respirators by health care workers: a feasibility study and development of standard operating procedures.**

**Author(s):** Bessesen, Mary T; Adams, Jill C; Radonovich, Lewis; Anderson, Judith

**Source:** American Journal of Infection Control; Jun 2015; vol. 43 (no. 6); p. 629-634

**Publication Date:** Jun 2015

**Publication Type(s):** Research Support, U.S. Gov't, Non-P.H.S. Journal Article

**PubMedID:** 25816692

Available at [American journal of infection control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2015.02.009) - from ClinicalKey

Available at [American journal of infection control](https://doi.org/10.1016/j.ajic.2015.02.009) - from Unpaywall

**Abstract:** BACKGROUND: This was a feasibility study in a Department of Veterans Affairs Medical Center to develop a standard operating procedure (SOP) to be used by health care workers to disinfect reusable elastomeric respirators under pandemic conditions. Registered and licensed practical nurses, nurse practitioners, aides, clinical technicians, and physicians took part in the study. METHODS: Health care worker volunteers were provided with manufacturers' cleaning and disinfection instructions and all necessary supplies. They were observed and filmed. SOPs were developed, based on these observations, and tested on naïve volunteer health care workers. Error rates using manufacturers' instructions and SOPs were compared. RESULTS: When using respirator manufacturers' cleaning and disinfection instructions, without specific training or supervision, all subjects made multiple errors. When using the SOPs developed in the study, without specific training or guidance, naïve health care workers disinfected respirators with zero errors. CONCLUSION: Reusable facial protective equipment may be disinfected by health care workers with minimal training using SOPs.

**Database:** Medline

**NB: not specific to Coronaviruses or COVID-19**

1. **Facemasks for the prevention of infection in healthcare and community settings.**

**Author(s):** MacIntyre, C Raina; Chughtai, Abrar Ahmad

**Source:** BMJ (Clinical Research Ed.); Apr 2015; vol. 350; p. h694

**Publication Date:** Apr 2015

**Publication Type(s):** Research Support, Non-U.S. Gov't Journal Article Review

**PubMedID:** 25858901

Available at [BMJ (Clinical research ed.)](https://go.openathens.net/redirector/nhs?url=https%3A%2F%2Fwww.bmj.com%2Flookup%2Fdoi%2F10.1136%2Fbmj.h694) - from BMJ Journals - NHS

**Abstract:** Facemasks are recommended for diseases transmitted through droplets and respirators for respiratory aerosols, yet recommendations and terminology vary between guidelines. The concepts of droplet and airborne transmission that are entrenched in clinical practice have recently been shown to be more complex than previously thought. Several randomised clinical trials of facemasks have been conducted in community and healthcare settings, using widely varying interventions, including mixed interventions (such as masks and handwashing), and diverse outcomes. Of the nine trials of facemasks identified in community settings, in all but one, facemasks were used for respiratory protection of well people. They found that facemasks and facemasks plus hand hygiene may prevent infection in community settings, subject to early use and compliance. Two trials in healthcare workers favoured respirators for clinical respiratory illness. The use of reusable cloth masks is widespread globally, particularly in Asia, which is an important region for emerging infections, but there is no clinical research to inform their use and most policies offer no guidance on them. Health economic analyses of facemasks are scarce and the few published cost effectiveness models do not use clinical efficacy data. The lack of research on facemasks and respirators is reflected in varied and sometimes conflicting policies and guidelines. Further research should focus on examining the efficacy of facemasks against specific infectious threats such as influenza and tuberculosis, assessing the efficacy of cloth masks, investigating common practices such as reuse of masks, assessing compliance, filling in policy gaps, and obtaining cost effectiveness data using clinical efficacy estimates.

**Database:** Medline

1. **A cluster randomised trial of cloth masks compared with medical masks in healthcare workers.**

**Author(s):** MacIntyre, C Raina; Seale, Holly; Dung, Tham Chi; Hien, Nguyen Tran; Nga, Phan Thi; Chughtai, Abrar Ahmad; Rahman, Bayzidur; Dwyer, Dominic E; Wang, Quanyi

**Source:** BMJ Open; Apr 2015; vol. 5 (no. 4); p. e006577

**Publication Date:** Apr 2015

**Publication Type(s):** Research Support, Non-U.S. Gov't Randomized Controlled Trial Journal Article

**PubMedID:** 25903751

Available at [BMJ open](http://europepmc.org/search?query=(DOI:10.1136/bmjopen-2014-006577)) - from Europe PubMed Central - Open Access

Available at [BMJ open](http://bmjopen.bmj.com/cgi/doi/10.1136/bmjopen-2014-006577) - from HighWire - Free Full Text

Available at [BMJ open](http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2004&res_id=xri:pqm&req_dat=xri:pqil:pq_clntid=145298&rft_val_fmt=ori/fmt:kev:mtx:journal&genre=article&issn=2044-6055&volume=5&issue=4&spage=e006577) - from ProQuest (Health Research Premium) - NHS Version

Available at [BMJ open](https://bmjopen.bmj.com/content/5/4/e006577.full.pdf) - from Unpaywall

**Abstract:** OBJECTIVE: The aim of this study was to compare the efficacy of cloth masks to medical masks in hospital healthcare workers (HCWs). The null hypothesis is that there is no difference between medical masks and cloth masks. SETTING: 14 secondary-level/tertiary-level hospitals in Hanoi, Vietnam. PARTICIPANTS: 1607 hospital HCWs aged ≥18 years working full-time in selected high-risk wards. INTERVENTION: Hospital wards were randomised to: medical masks, cloth masks or a control group (usual practice, which included mask wearing). Participants used the mask on every shift for 4 consecutive weeks. MAIN OUTCOME MEASURE: Clinical respiratory illness (CRI), influenza-like illness (ILI) and laboratory-confirmed respiratory virus infection. RESULTS: The rates of all infection outcomes were highest in the cloth mask arm, with the rate of ILI statistically significantly higher in the cloth mask arm (relative risk (RR)=13.00, 95% CI 1.69 to 100.07) compared with the medical mask arm. Cloth masks also had significantly higher rates of ILI compared with the control arm. An analysis by mask use showed ILI (RR=6.64, 95% CI 1.45 to 28.65) and laboratory-confirmed virus (RR=1.72, 95% CI 1.01 to 2.94) were significantly higher in the cloth masks group compared with the medical masks group. Penetration of cloth masks by particles was almost 97% and medical masks 44%. CONCLUSIONS: This study is the first RCT of cloth masks, and the results caution against the use of cloth masks. This is an important finding to inform occupational health and safety. Moisture retention, reuse of cloth masks and poor filtration may result in increased risk of infection. Further research is needed to inform the widespread use of cloth masks globally. However, as a precautionary measure, cloth masks should not be recommended for HCWs, particularly in high-risk situations, and guidelines need to be updated. TRIAL REGISTRATION NUMBER: Australian New Zealand Clinical Trials Registry: ACTRN12610000887077.

**Database:** Medline

1. **Current practices and barriers to the use of facemasks and respirators among hospital-based health care workers in Vietnam.**

**Author(s):** Chughtai, Abrar Ahmad; Seale, Holly; Chi Dung, Tham; Maher, Lisa; Nga, Phan Thi; MacIntyre, C Raina

**Source:** American Journal of Infection Control; Jan 2015; vol. 43 (no. 1); p. 72-77

**Publication Date:** Jan 2015

**Publication Type(s):** Research Support, Non-U.S. Gov't Journal Article

**PubMedID:** 25564127

Available at [American journal of infection control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2014.10.009) - from ClinicalKey

**Abstract:** BACKGROUND This study aimed to examine the knowledge, attitudes, and practices towards the use of facemasks among hospital-based health care workers (HCWs) in Hanoi, Vietnam. METHODS A qualitative study incorporating 20 focus groups was conducted between August 2010 and May 2011. HCWs from 7 hospitals in Vietnam were invited to participate. RESULTS Issues associated with the availability of facemasks (medical and cloth masks) and respirators was the strongest theme to emerge from the discussion. Participants reported that it is not unusual for some types of facemasks to be unavailable during nonemergency periods. It was highlighted that the use of facemasks and respirators is not continuous, but rather is limited to selected situations, locations, and patients. Reuse of facemasks and respirators is also common in some settings. Finally, some participants reported believing that the reuse of facemasks, particularly cloth masks, is safe, whereas others believed that the reuse of masks put staff at risk of infection. CONCLUSIONS In low and middle-income countries, access to appropriate levels of personal protective equipment may be restricted owing to competing demands for funding in hospital settings. It is important that issues around reuse and extended use of medical masks/respirators and decontamination of cloth masks are addressed in policy documents to minimize the risk of infection.

**Database:** Medline

1. **Validation and application of models to predict facemask influenza contamination in healthcare settings.**

**Author(s):** Fisher, Edward M; Noti, John D; Lindsley, William G; Blachere, Francoise M; Shaffer, Ronald E

**Source:** Risk Analysis: an official publication of the Society for Risk Analysis; Aug 2014; vol. 34 (no. 8); p. 1423-1434

**Publication Date:** Aug 2014

**Publication Type(s):** Validation Study Journal Article

**PubMedID:** 24593662

Available at [Risk analysis: an official publication of the Society for Risk Analysis](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=24593662) - from EBSCO (MEDLINE Complete)

Available at [Risk analysis: an official publication of the Society for Risk Analysis](http://europepmc.org/articles/pmc4485436?pdf=render) - from Unpaywall

**Abstract:** Facemasks are part of the hierarchy of interventions used to reduce the transmission of respiratory pathogens by providing a barrier. Two types of facemasks used by healthcare workers are N95 filtering facepiece respirators (FFRs) and surgical masks (SMs). These can become contaminated with respiratory pathogens during use, thus serving as potential sources for transmission. However, because of the lack of field studies, the hazard associated with pathogen-exposed facemasks is unknown. A mathematical model was used to calculate the potential influenza contamination of facemasks from aerosol sources in various exposure scenarios. The aerosol model was validated with data from previous laboratory studies using facemasks mounted on headforms in a simulated healthcare room. The model was then used to estimate facemask contamination levels in three scenarios generated with input parameters from the literature. A second model estimated facemask contamination from a cough. It was determined that contamination levels from a single cough (≈19 viruses) were much less than likely levels from aerosols (4,473 viruses on FFRs and 3,476 viruses on SMs). For aerosol contamination, a range of input values from the literature resulted in wide variation in estimated facemask contamination levels (13-202,549 viruses), depending on the values selected. Overall, these models and estimates for facemask contamination levels can be used to inform infection control practice and research related to the development of better facemasks, to characterize airborne contamination levels, and to assist in assessment of risk from reaerosolization and fomite transfer because of handling and reuse of contaminated facemasks.

**Database:** Medline

1. **Policies on facemasks use to protect HCWs from respiratory infections: A cross sectional survey**

**Author(s):** Chughtai A.A.; MacIntyre R.; Seale H.; Peng Y.; Wang Q.; Toor Z.I.; Dung T.C.

**Source:** International Journal of Infectious Diseases; Apr 2014; vol. 21; p. 417

**Publication Date:** Apr 2014

**Publication Type(s):** Conference Abstract

Available at [International Journal of Infectious Diseases](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ijid.2014.03.1281) - from ClinicalKey

Available at [International Journal of Infectious Diseases](http://www.ijidonline.com/article/S120197121401340X/pdf) - from Unpaywall

**Abstract:** Background: Currently there is an ongoing debate and a dearth of evidence on the selection of masks and respirators for the prevention of respiratory infections in HCWs. The aim of this study was to explore the recommendations around the facemask use in the national guidelines in low/middle income countries. Methods & Materials: A cross sectional survey was conducted in China, Pakistan and Vietnam. A range of health and infectious disease stakeholders were invited to participate. The survey was completed via face to face interviews. Three diseases were selected for this study; influenza (including seasonal, avian and pandemic influenza), SARS and TB. Result(s): In all three countries surveyed, recommendations regarding the use of masks/respirators are captured in both general and disease specific infection control guidelines. In Pakistan and China, the guidelines were developed in line with WHO and CDC recommendations and participants from Vietnam highlighted that their guidelines are in line with the WHO recommendations only. While the guidelines from both Pakistan and China discuss at length the use of masks/respirators, only the Chinese policy includes information regarding the regulation over use and certification processes for respirators. All guidelines document the need for training and fit testing; however no system exists to monitor the training and fit testing programs in three countries. There was some consistency in regards to the types of masks recommended for influenza, SARS and TB. Various types of facemasks (paper mask, cloth mask, surgical masks and respirators) are recommended for routine care in three countries; however surgical masks and respirators are the preferred options during high risk situations. The description of what constitutes a low and high risk situation also varied in the guidelines. Extended use of facemasks is not recommended in the Chinese and Vietnamese guidelines; however, participants in Pakistan indicated that extended use is suggested. Even though the practice is common, the reuse of masks after decontamination is not recommended in any guideline. Conclusion(s): There is a need to examine the available evidence and develop a comprehensive policy on the use of facemasks in various respiratory infections. The policy should address critical areas, like regulation, training and fit testing.

**Database:** EMBASE

1. **Availability, consistency and evidence-base of policies and guidelines on the use of mask and respirator to protect hospital health care workers: a global analysis.**

**Author(s):** Chughtai, Abrar Ahmad; Seale, Holly; MacIntyre, Chandini Raina

**Source:** BMC Research Notes; May 2013; vol. 6; p. 216

**Publication Date:** May 2013

**Publication Type(s):** Journal Article

**PubMedID:** 23725338

Available at [BMC research notes](https://bmcresnotes.biomedcentral.com/articles/10.1186/1756-0500-6-216) - from BioMed Central

Available at [BMC research notes](http://europepmc.org/search?query=(DOI:10.1186/1756-0500-6-216)) - from Europe PubMed Central - Open Access

Available at [BMC research notes](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=23725338) - from EBSCO (MEDLINE Complete)

Available at [BMC research notes](https://bmcresnotes.biomedcentral.com/track/pdf/10.1186/1756-0500-6-216) - from Unpaywall

**Abstract:** BACKGROUND Currently there is an ongoing debate and limited evidence on the use of masks and respirators for the prevention of respiratory infections in health care workers (HCWs). This study aimed to examine available policies and guidelines around the use of masks and respirators in HCWs and to describe areas of consistency between guidelines, as well as gaps in the recommendations, with reference to the WHO and the CDC guidelines. METHODS Policies and guidelines related to mask and respirator use for the prevention of influenza, SARS and TB were examined. Guidelines from the World Health Organization (WHO), the Center for Disease Control and Prevention (CDC), three high-income countries and six low/middle-income countries were selected. RESULTS Uniform recommendations are made by the WHO and the CDC in regards to protecting HCWs against seasonal influenza (a mask for low risk situations and a respirator for high risk situations) and TB (use of a respirator). However, for pandemic influenza and SARS, the WHO recommends mask use in low risk and respirators in high risk situations, whereas, the CDC recommends respirators in both low and high-risk situations. Amongst the nine countries reviewed, there are variations in the recommendations for all three diseases. While, some countries align with the WHO recommendations, others align with those made by the CDC. The choice of respirator and the level of filtering ability vary amongst the guidelines and the different diseases. Lastly, none of the policies discuss reuse, extended use or the use of cloth masks. CONCLUSION Currently, there are significant variations in the policies and recommendations around mask and respirator use for protection against influenza, SARS and TB. These differences may reflect the scarcity of level-one evidence available to inform policy development. The lack of any guidelines on the use of cloth masks, despite widespread use in many low and middle-income countries, remains a policy gap. Health organizations and countries should jointly evaluate the available evidence, prioritize research to inform evidence gaps, and develop consistent policy on masks and respirator use in the health care setting.

**Database:** Medline

1. **Impact of multiple consecutive donnings on filtering facepiece respirator fit**

**Author(s):** Bergman M.S.; Palmiero A.J.; Viscusi D.J.; Zhuang Z.; Powell J.B.; Shaffer R.E.

**Source:** American Journal of Infection Control; May 2012; vol. 40 (no. 4); p. 375-380

**Publication Date:** May 2012

**Publication Type(s):** Article

Available at [American Journal of Infection Control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2011.05.003) - from ClinicalKey

**Abstract:** Background: A concern with reuse of National Institute for Occupational Safety and Health-certified N95 filtering facepiece respirators (FFRs) is that multiple donnings could stress FFR components, impairing fit. This study investigated the impact of multiple donnings on the facepiece fit of 6 N95 FFR models using a group of 10 experienced test subjects per model. Method(s): The TSI PORTACOUNT Plus and N95 Companion accessory were used for all tests. After qualifying by passing a standard Occupational Safety and Health Administration fit test, subjects performed up to 20 consecutive tests on an individual FFR sample using a modified protocol. Regression analyses were performed for the percentage of donnings resulting in fit factors (FFs) >=100 for all 6 FFR models combined. Result(s): Regression analyses showed statistical significance for donning groups 1-10, 1-15, and 1-20. The mean percentage of donnings with an FF >=100 was 81%-93% for donning group 1-5, but dropped to 53%-75% for donning group 16-20. Conclusion(s): Our results show that multiple donnings had a model-dependent impact on fit for the 6 N95 models evaluated. The data suggest that 5 consecutive donnings can be performed before FFs consistently drop below 100. © 2012 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

**Database:** EMCARE

1. **A pandemic influenza preparedness study: use of energetic methods to decontaminate filtering facepiece respirators contaminated with H1N1 aerosols and droplets.**

**Author(s):** Heimbuch, Brian K; Wallace, William H; Kinney, Kimberly; Lumley, April E; Wu, Chang-Yu; Woo, Myung-Heui; Wander, Joseph D

**Source:** American Journal of Infection Control; Feb 2011; vol. 39 (no. 1); p. e1

**Publication Date:** Feb 2011

**Publication Type(s):** Research Support, Non-U.S. Gov't Evaluation Study Journal Article

**PubMedID:** 21145624

Available at [American journal of infection control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2010.07.004) - from ClinicalKey

**Abstract:** BACKGROUND: A major concern among health care experts is a projected shortage of N95 filtering facepiece respirators (FFRs) during an influenza pandemic. One option for mitigating an FFR shortage is to decontaminate and reuse the devices. Many parameters, including biocidal efficacy, filtration performance, pressure drop, fit, and residual toxicity, must be evaluated to verify the effectiveness of this strategy. The focus of this research effort was on evaluating the ability of microwave-generated steam, warm moist heat, and ultraviolet germicidal irradiation at 254 nm to decontaminate H1N1 influenza virus. METHODS: Six commercially available FFR models were contaminated with H1N1 influenza virus as aerosols or droplets that are representative of human respiratory secretions. A subset of the FFRs was treated with the aforementioned decontamination technologies, whereas the remaining FFRs were used to evaluate the H1N1 challenge applied to the devices. RESULTS: All 3 decontamination technologies provided >4-log reduction of viable H1N1 virus. In 93% of our experiments, the virus was reduced to levels below the limit of detection of the method used. CONCLUSIONS: These data are encouraging and may contribute to the evolution of effective strategies for the decontamination and reuse of FFRs.

**Database:** Medline

* **Face mask decontamination and reuse: Is it ok?**

**Author(s):** Wiwanitkit V.

**Source:** American Journal of Infection Control; Sep 2011; vol. 39 (no. 7); p. 615

**Publication Date:** Sep 2011

**Publication Type(s):** Letter

Available at [American Journal of Infection Control](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajic.2010.12.021) - from ClinicalKey

To the Editor: I read the recent article by Heimbuch et al. on decontamination and reuse of N95 filtering facepiece respirators (FFRs) with great interest. The authors concluded that microwave-generated steam, warm moist heat, or ultraviolet germicidal irradiation could be effective options for decontaminating FFRs to allow reuse. I have some questions regarding this conclusion. First, there is no doubt that the proposed decontamination techniques can destroy viruses, but whether these techniques also threaten the FFRs’ structural integrity is unclear. Alterations in FFR structure might significantly decrease the device’s protective action. Second, the effectiveness of the proposed techniques in destroying other viruses and pathogens that might contaminate FFRs should be assessed as well. Third, there is a chance that some unwanted residual chemicals may remain on FFRs after decontamination. Whether the proposed technique can eliminate these residual chemicals is of concern.

These questions should be answered before FFR decontamination and reuse can be deemed safe.

**Database:** EMCARE

1. **A method to determine the available UV-C dose for the decontamination of filtering facepiece respirators**

**Author(s):** Fisher E.M.; Shaffer R.E.

**Source:** Journal of Applied Microbiology; Jan 2011; vol. 110 (no. 1); p. 287-295

**Publication Date:** Jan 2011

**Publication Type(s):** Article

**PubMedID:** 21054699

Available at [Journal of applied microbiology](http://www.ingentaconnect.com/openurl?genre=article&issn=1364-5072&volume=110&issue=1&spage=287) - from IngentaConnect - Open Access

Available at [Journal of applied microbiology](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2672.2010.04881.x) - from Wiley Online Library Free Content - NHS

**Abstract:** Aims: To develop a method to assess model-specific parameters for ultraviolet-C (UV-C, 254 nm) decontamination of filtering facepiece respirators (FFRs). Methods and Results: UV-C transmittance was quantified for the distinct composite layers of six N95 FFR models and used to calculate model-specific alpha-values, the percentage of the surface UV-C irradiance available for the internal filtering medium (IFM). Circular coupons, excised from the FFRs, were exposed to aerosolized particles containing MS2 coliphage and treated with IFM-specific UV-C doses ranging from 38 to 4707 J m-2. Models exposed to a minimum IFM dose of 1000 J m-2 demonstrated at least a 3 log reduction (LR) in viable MS2. Model-specific exposure times to achieve this IFM dose ranged from 2 to 266 min. Conclusion(s): UV-C transmits into and through FFR materials. LR of MS2 was a function of model-specific IFM UV-C doses. Significance and Impact of the Study: Filtering facepiece respirators are in high demand during infectious disease outbreaks, potentially leading to supply shortages. Reuse of disposable FFRs after decontamination has been discussed as a possible remediation strategy, but to date lacks supporting scientific evidence. The methods described here can be used to assess the likelihood that UV-C decontamination will be successful for specific FFR models. Journal of Applied Microbiology ©2010 The Society for Applied Microbiology. No claim to US Government works.

**Database:** EMBASE

1. **IOM panel: don't reuse N95 masks in pandemic: if there's no choice, then double-mask**

**Author(s):**

**Source:** Hospital Employee Health; Jul 2006; vol. 25 (no. 7); p. 75-77

**Publication Date:** Jul 2006

**Publication Type(s):** Periodical

**Database:** CINAHL

1. **Got N-95s? CDC guidance if you are running short: surgical mask better than nothing.**

**Author(s):**

**Source:** Hospital Infection Control; Jun 2003; vol. 30 (no. 6); p. 76-76

**Publication Date:** Jun 2003

**Publication Type(s):** Periodical

**Database:** CINAHL

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**Databases searched:**

* + **Evidence-Based Reviews:** The Cochrane Library.
  + **Guidance:** NICE Guidance, Scottish Intercollegiate Guidelines Network (SIGN) guidance, selected International Guidelines.
  + **Healthcare Databases:** MEDLINE, EMBASE, CINAHL, EMCARE, BNI, PubMed, NICE Evidence Search.
  + **Other:** Google, World Health Organization.

**Local Guidance:** Local guidance has not been searched as part of this literature search. However, local guidelines, policies and procedures are available via the red button on the intranet.

**Search Terms:**

|  |  |
| --- | --- |
| ***Subject Headings*** | ***Free Text Words*** |
| "EQUIPMENT REUSE"/ | 2019 nCoV |
| \*"FACE MASK"/ | Covid-19 |
| MASKS/ | “face mask” |
|  | facemask |
|  | FFP3 mask\* |
|  | repatriate\* |
|  | reprocess\* |
|  | reuse |
|  | SARS-CoV-2 |
|  | sterilise |
|  | sterilize |

**Search Limits:** No limits.

**Search Date:** 14/04/2020

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