**Clinical Librarian Service Search Results**

**Request:** Decontamination and reprocessing of disposable FFP3 masks – methods used.

**Summary**

I have searched the databases listed at the end of this document and have found a number of documents related to your question. I have organised the results into the following sections: [Guidance and Technical Reports](#GuidanceandTechnicalReports), [Journal Articles](#JournalArticles) and [Non-English Language](#NonEnglishLanguage).

The European Centre for Disease Prevention and Control, in their technical report concerning ‘Cloth masks and mask sterilisation as options in case of shortage of surgical masks and respirators’(26 March 2020)9, gives the following information:

***Are there cleaning/sterilisation methods that make it possible to reuse single-use respirators (FFP2 and FFP3)?***

*Surgical masks are made for single use. Respirators are usually discarded after use, but can also be considered limited-use devices, that is, they can be reused for a limited time, unless there is a risk for contamination through the deposition of infectious particles on the surface. For example, when used for the care of patients with tuberculosis, it is acceptable that respirators are reused for a limited number of times by the same healthcare worker. When the respirator becomes soiled with bodily fluids, when it gets wet, when it can no longer be properly fitted, or if breathing through the respirator becomes difficult, it has to be discarded. It also needs to be discarded after being used in an aerosol-generating procedure (AGP), as it is considered heavily contaminated. So far, manufacturers have had no reason or incentive to develop methods for decontamination or introduce reusable masks, but it is obvious that there is an urgent need to develop reusable masks that can be decontaminated.*

*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.*

The Society of American Gastrointestinal and Endoscopic Surgeons, in their document concerning ‘N95 Mask Re-Use Strategies’ (17 April 2020)2, give the following information:

### *What are my options for extending the life of my N95 mask?*

*It is important to differentiate between extended use, re-use, and mask re-processing.*

### *Extended use*

*The*[*CDC*](https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html)*reports that prolonged N95 mask use (including between patients) can be safe for up to 8 hours, and encourages each user to review each manufacturer’s recommendations prior to following this strategy. Current guidelines encourage wearing a face shield over the N95 to decrease the chances of soiling the mask.*

### *Re-use*

*Because coronaviruses lose their viability significantly after 72 hours**[[3]](https://www.sages.org/n-95-re-use-instructions/" \l "_edn3),**[[4]](https://www.sages.org/n-95-re-use-instructions/" \l "_edn4), many organizations have promoted a rotation and re-use strategy. Assuming there is no soiling and minimal to no viral contamination to the mask, the CDC suggests that masks can be re-used up to 5 times with the following strategy:*

### *Mask Rotation*

*Acquire a set number of N95 masks (at least 5 per the CDC), and rotate their use each day, allowing them to dry for long enough that the virus is no longer viable (> 72 hours). Proper storage for this technique requires either hanging the respirators to dry, or keeping them in a clean, breathable container like a paper bag between uses. Make sure the masks do not touch each other, and that you do not share your respirator with other people. A*[*user seal check*](https://www.youtube.com/watch?v=pGXiUyAoEd8)*should be performed before each use.*

*Importantly, when planning to reuse an N-95 mask,*practice fastidious donning/doffing to avoid contamination of the inside or outside of the mask at all times*(see below methods for donning and doffing). If the mask is damaged or significantly contaminated from aerosol-generating procedures or bodily fluids, the CDC recommends discarding it.*

### *Reprocessing/Decontamination*

*Mask decontamination strategies are actively being investigated by the*[*CDC*](https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html)*,*[*mask companies*](https://multimedia.3m.com/mws/media/1824869O/decontamination-methods-for-3m-n95-respirators-technical-bulletin.pdf)*, and*[*large academic/industry collaboratives*](https://www.n95decon.org/)*. General principles of re-processing include:*

1. *The method must sufficiently inactivate the viral load on the mask.*
2. *The mask cannot be soiled (bodily fluids, makeup*[*[a]*](https://www.sages.org/n-95-re-use-instructions/#_ftn1)*).*
3. *The filtration capacity and electrostatic charge must be preserved as much as possible.*
4. *The fit of the mask cannot be compromised.*

*Most studies on N95 decontamination were performed with flu virus or bacterial spores and cautious extrapolation to the current pandemic is being exercised. Fortunately, recent publications have started to test SARS-CoV-2 specifically, and have found*[*promising results*](https://www.medrxiv.org/content/10.1101/2020.04.11.20062018v1)*.*

*Below is a brief summary of the decontamination methods supported by current data. Due to the rapid nature of this research, some publications are not yet peer-reviewed. Additionally, note that there are many*[*versions*](https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/n95list1.html)*of N95 masks, with different strap materials and shapes. Thus, one method may work well for one mask type, and not for another.*

### Hydrogen Peroxide Vaporization

*Hydrogen peroxide vapor (HPV) decontamination has been shown in pilot studies to allow multiple cycles of N95 processing with acceptable preservation of function.*[*[5]*](https://www.sages.org/n-95-re-use-instructions/#_edn5)*It is now approved by the FDA as an emergency method for N95 decontamination for healthcare personnel during the COVID-19 pandemic.*[*[6]*](https://www.sages.org/n-95-re-use-instructions/#_edn6)*This method of decontamination can only be used on N95 models that do not contain cellulose, such as the 1860. It is being utilized in industrial facilities such as*[*Battelle*](https://www.battelle.org/inb/battelle-critical-care-decontamination-system-for-covid19)*(up to 20 cycles) as well as individual hospitals via*[*Sterrad*](https://www.asp.com/sites/default/files/covid-19/2000014-Fact_Sheet_for_Healthcare_Personnel_on_Emergency_Use_of_STERRAD_Sterilization_Systems_to_Reprocess_N95_Respirators.pdf)*(up to 2 cycles) or*[*Steris*](https://www.steris.com/-/media/documents/pdfs/covid19-landing-page/4-10/instructions-for-healthcare-facilities.ashx)*equipment (up to 10 cycles).*

### UV treatment

*Proper UV treatment of N95 masks requires specific dosing protocols and full surface area illumination to ensure proper inactivation of viral particles with minimal mask degradation.*[*[7]*](https://www.sages.org/n-95-re-use-instructions/#_edn7)*Due to the precision required, home UV light use is not recommended. This method of decontamination has been implemented by some hospital systems in the United States.*[*[8]*](https://www.sages.org/n-95-re-use-instructions/#_edn8)*,*[*[9]*](https://www.sages.org/n-95-re-use-instructions/#_edn9)

### Moist Heat

*Moist heat (heating at 60-70°C and 80-85% relative humidity) has been shown to be effective for flu viruses, but there is limited data on the temperature, humidity, and time required to completely inactivate SARS-COV-2 viral particles. Moreover, the parameters required to kill the virus may adversely affect filtration efficacy of the mask. Due to the dearth of specific data on a protocol to achieve both aims, this method is not currently recommended.*[*[10]*](https://www.sages.org/n-95-re-use-instructions/#_edn10)

### Dry Heat

*Dry heating of the mask at 70°C for 30 minutes has been suggested as a method of decontamination which can adequately kill virus and preserve the filter integrity for re-use.*[*[11]*](https://www.sages.org/n-95-re-use-instructions/#_edn11)*,*[*[12]*](https://www.sages.org/n-95-re-use-instructions/#_edn12)*Recent tests at the NIH utilizing SARS-CoV-2 specifically indicated that this method can be used for two cycles to kill the virus without compromising fit.*[*[13]*](https://www.sages.org/n-95-re-use-instructions/#_edn13)*Research efforts are ongoing to determine optimal parameters (temperature and duration), and this is not yet recommended by the CDC.*

They refer the reader to their Covid-19 Medical Device Repository which states the following:

***N95 Facepiece Respirator Decontamination Systems***

| Company | Method of Decontamination | Max number of respirators | Decontamination Cycles | Links |
| --- | --- | --- | --- | --- |
| Battelle CCDS | Vapor Phase Hydrogen Peroxide | 80,000/per machine/day | 20 | FDA EUA  IFU |
| Steris V-Pro | Vapor Phase Hydrogen Peroxide | 10/machine/10 min | 10 | FDA EUA  IFU |

<https://www.sages.org/covid-19-medical-device-repository/>

The authors also ask, “What methods are pending/promising?”. The following information is given:

*The*[*CDC*](https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html)*lists a few methods undergoing investigation that may eventually become viable:*

* Steam
* Liquid Hydrogen Peroxide

### *Which methods are NOT approved?*

* Bleach
* Alcohol
* Baking
* Boiling
* Ethylene oxide
  + *May be toxic to the wearer*
* Microwave
  + *At-home microwaving is not recommended because of variable power settings, and metal portions of the masks may catch fire.*
* Sanitizing wipes
* Soapy Water

# The U.S. Centers for Disease Control and Prevention (2020)3 have produced information concerning ‘Decontamination and Reuse of Filtering Facepiece Respirators’ (FFRs). In it they state that *“…****Decontamination and subsequent reuse of FFRs should only be practiced where FFR shortages exist…”* and *“…****At present, FFRs are considered one time use products and there are no manufacturer authorized methods for FFR decontamination before reuse..”.* However, regarding decontamination methods, they state that *“…Vaporous hydrogen peroxide, ultraviolet germicidal irradiation, and moist heat are the most promising FFR decontamination methods…”* and that *“…Steam treatment and liquid hydrogen peroxide are promising methods with some limitations”.*

The Federal Agency for Medicines and Health Products of Belgium (6 & 7 April 2020)6, 7 asks the reprocessor of surgical masks and filtering facepiece respirators (FFP2, FFP3) to provide the following:

*- A justification for the selected method(s) used for cleaning, disinfection and sterilisation of the specified surgical masks and filtering facepiece respirators (FFP2, FFP3) …*

*- A description of the process for disinfection/sterilisation…*

*- Validation of bioburden reduction/disinfection…*

*- Description of chain of custody and safeguards to prevent inadvertent exposure…*

*- Material compatibility…*

*- The performance of the surgical masks and respirators is not reduced (after the intended number of times of reprocessing) …*

From the journal articles, methods such as ultraviolet germicidal irradiation14 and steam sterilization16 are discussed. Mackenzie (2020)35, in her article on the ‘Reuse of N95 Masks’, discusses the use of ultraviolet radiation and fumigation, hot water heating and steaming, and baking.

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**

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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:** 22 May 2020

**Time taken for search:** 6 hours.

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

Evidence Search: Decontamination and reprocessing of disposable FFP3 masks – methods used. Suzanne Toft. (22 May 2020). Derby, UK: University Hospitals of Derby & Burton NHS Foundation Trust Library and Knowledge Service.

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**Guidance and Technical Reports**

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1. **Considerations for acute personal protective equipment (PPE) shortages**

**Author:** Public Health England

**Updated:** 21 May 2020

1.Update 3 May 2020

* HSE has examined the use of FFP2 respirators as an alternative to Type IIR surgical face masks in non-surgical settings
* if risk assessment identifies a need for FFP2 respirators the user must be face fit tested to ensure they are providing the intended level of protection
* in circumstances where a lower level of user protection is required, such as that provided by a surgical mask, an FFP2 worn without a face fit test will offer protection similar to the levels from a surgical face mask
* this is a pragmatic approach for times of severe shortage of respiratory protective equipment (RPE), FFP2 respirators being used in this way will not be carrying out the function they were designed to perform
* all healthcare settings are reminded that where their risk assessment has identified the requirement for a tight-fitting respirator users must pass a face fit test for that respirator model before it can be used
* employers and users of respirators need to be assured protective equipment is protecting the wearer

Note: Surgical masks may sometimes be used for source control, if feasible and if the mask can be tolerated by the individual; for example, a surgical mask worn by a patient with COVID-19 during transfer within a hospital. When an FFP2 respirator needs to be used in place of a surgical mask for this specific purpose, it should an unvalved FFP2 respirator (that is, no exhale valve).

4. Medical masks

4.1 Fluid repellent surgical face masks (FRSM) and disposable respirators (FFP3/ FFP2/ N95)

This excludes re-usable respirators, that can be re-used according to manufacturer’s instructions.

FFP3/FFP2/N95 respirators have a large capacity for the filtration and retention of airborne contaminants. Sessional use or re-use over the course of a day in health or social care, would not approach anywhere near that capacity.

Sessional use

The use of masks for one HCW to use in one work area. This is currently recommended in the UK Infection Prevention and Control guidance.

* it should be disposed of if it becomes moist, damaged, visibly soiled
* the duration (number of hours) of sessional use is dependent on local (for example, heat, activity length, shift-length) and individual factors. In practice, this may vary from 2 to 6 hours
* if masks are touched or adjusted, hand hygiene should be performed immediately
* if the mask is removed for any reason (for example, upon exiting the ward area, taking a break or completing a shift), they are disposed of as clinical waste, unless they can be safely reused as outlined below

Reuse

Important requirements are as follows:

* the mask should be removed and discarded if soiled, damaged, or hard to breathe through
* masks with elastic ear hooks should be re-used (tie-on face masks are less suitable because they are more difficult to remove)
* hand hygiene should be performed before removing the face mask
* face masks should be carefully folded so the outer surface is held inward and against itself to reduce likely contact with the outer surface during storage
* the folded mask should be stored between uses in a clean sealable bag/ box which is marked with the person’s name and is then properly stored in a well-defined place
* hand hygiene should be performed after removing the face mask
* some models of PPE cannot be physically reused as they deform once being donned and do not go back to original condition (meaning it would be difficult to re-don and achieve a fit check). Fit checks should be performed each time a respirator is donned if it is reused

Alternatives to standard PPE

There is insufficient evidence to consider homemade masks or cloth masks in health and care settings.

<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/managing-shortages-in-personal-protective-equipment-ppe>

* **PPE: Guidance on reusing and substituting PPE during shortages**

**Date:** 7 May 2020

Report on official guidance from Public Health England.

**Source:** Pulse Today

<http://www.pulsetoday.co.uk/clinical/clinical-specialties/respiratory-/ppe-guidance-on-reusing-and-substituting-ppe-during-shortages/20040789.article>

1. **N95 Mask Re-Use Strategies**

**Authors:** Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).

**Date:** April 17, 2020

Personal protective equipment (PPE) shortages during the COVID-19 pandemic have precipitated a wave of creative solutions for repurposing of N95 masks. A growing influx of new information can make it difficult to discern best practices for mask re-use.

**Source:** Society of American Gastrointestinal and Endoscopic Surgeons.

<https://www.sages.org/n-95-re-use-instructions/>

* **Includes:** **Covid-19 Medical Device Repository**

**Date**: May 8, 2020

<https://www.sages.org/covid-19-medical-device-repository/>

# Decontamination and Reuse of Filtering Facepiece Respirators

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

**Page last reviewed:** April 30, 2020

**Content source:** National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases

**Extract: While disposable filtering facepiece respirators (FFRs), like N95s, are not approved for routine decontamination as conventional standards of care, FFR decontamination and reuse may be needed during times of shortage to ensure continued availability. Based on the limited research available, as of April 2020, ultraviolet germicidal irradiation, vaporous hydrogen peroxide, and moist heat have shown the most promise as potential methods to decontaminate FFRs. This webpage summarizes research about decontamination of FFRs before reuse. Whether and how a facility decides to implement specific crisis strategies is at the discretion of its administrators and should be based on present and projected risk mitigation needs and local, regional, and national availability of N95s.**

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

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

# Strategies for Optimizing the Supply of N95 Respirators

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

**Updated:** April 2, 2020

Summary of Updates as of April 2, 2020:

* Conventional capacity strategies
  + Edited the section on use of airborne infection isolation rooms (AIIRs) for aerosol-generating procedures performed on patients with confirmed or suspected COVID-19 patients.
  + Added language on FDA’s Emergency Use Authorization (EUA) authorizing the use of certain NIOSH-approved respirator models in healthcare settings to the section on N95 alternatives.
* Contingency capacity strategies
  + Added a section on temporarily suspending annual fit testing following updated guidance from OSHA
  + Added more details in the extended use section.
* Crisis capacity strategies
  + Added language on the use of respirators approved under international standards and updated the tables.
  + Combined sections on limited re-use of N95 respirators for tuberculosis and then COVID-19 patients. Added more details surrounding limited re-use.

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

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

1. **Standard Respirator Testing Procedures**

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

**Page last reviewed:** April 10, 2020

**Content source:** National Institute for Occupational Safety and Health

**Extract:** Title 42 Code of Federal Regulations, Part 84 requires that respirators submitted for evaluation against the terms of the Standard must be accompanied by data that demonstrate the respirator under evaluation meets or exceeds the performance requirements set forth therein. Once approved, the quality assurance requirements specified in Subpart E of the Standard require an ongoing effort by the approval holder for the purpose of assuring not only the material aspects, but the performance level of the approved product.

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

<https://www.cdc.gov/niosh/npptl/stps/respirator_testing.html>

1. **Coronavirus: Belgian directive for the reuse of surgical masks and FFP2/FFP3 masks in the context of the COVID-19 epidemic**

**Authors:** Federal Agency for Medicines and Health Products (FAMHP), Belgium

**Date:**  7 April 2020

A national guideline is available for the reprocessing of surgical masks and FFP2/FFP3 masks which allows reuse by cleaning, disinfecting or sterilising.

Because of the COVID-19 epidemic, maintaining supplies of various healthcare materials are running is difficult, including medical devices such as surgical masks and personal protective equipment such as FFP2/FFP3 masks. Under the supervision of the Task Force Shortages, a working group on the reuse of single-use products has been set up in collaboration with various external partners. This collaboration has allowed the development of a national guideline. This guideline aims to guide the validation of the various initiatives that are being put in place in the context of the reuse of surgical masks and personal facial protection.

<https://www.famhp.be/en/news/coronavirus_belgian_directive_for_the_reuse_of_surgical_masks_and_ffp2ffp3_masks_in_the_context>

1. **Guidance for the reprocessing of surgical masks and filtering facepiece respirators (FFP2, FFP3) during the Coronavirus disease (COVID-19) Public Health Emergency**

**Authors:** Federal Agency for Medicines and Health Products (FAMHP), Belgium

**Date:**  6 April 2020

In the context of the coronavirus (COVID-19) public health emergency, the risk of shortage of surgical masks and filtering facepiece respirators (FFP2, FFP3) is a major public health risk. To face this situation, a general Task Force on shortages has been set up in which FAMHP is taking part with stakeholders.

<https://www.fagg.be/sites/default/files/content/national_guidance_mask_reprocessing_finalversion1_0_0.pdf>

1. **Enforcement Policy for Face Masks and Respirators During the Coronavirus Disease (COVID-19) Public Health Emergency (Revised): Guidance for Industry and Food and Drug Administration Staff**

**Authors:** US Food and Drug Administration

**Date:** April 2020

**Docket Number:** FDA-2020-D-1138

**Issued by:** Center for Devices and Radiological Health

The Food and Drug Administration (FDA or the Agency) plays a critical role in protecting the United States from threats such as emerging infectious diseases, including the Coronavirus Disease 2019 (COVID-19) pandemic. FDA is committed to providing timely guidance to support response efforts to this pandemic.

FDA is issuing this guidance to provide a policy to help expand the availability of general use face masks for the general public and particulate filtering facepiece respirators (including N95 respirators) for health care professionals during this pandemic.

This policy is intended to remain in effect only for the duration of the public health emergency related to COVID-19 declared by the Department of Health and Human Services (HHS), including any renewals made by the Secretary in accordance with section 319(a)(2) of the Public Health Services (PHS) Act.

Given this public health emergency, this guidance is being implemented without prior public comment because the FDA has determined that prior public participation for this guidance is not feasible or appropriate (see section 701(h)(1)(C)(i) of the Federal Food, Drug, and Cosmetic Act (FD&C Act) and 21 CFR 10.115(g)(2)). This guidance document is being implemented immediately, but it remains subject to comment in accordance with the Agency's good guidance practices.

<https://www.fda.gov/regulatory-information/search-fda-guidance-documents/enforcement-policy-face-masks-and-respirators-during-coronavirus-disease-covid-19-public-health>

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

**Publication Type:** Technical Report

**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.

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

# Strategies for Optimizing the Supply of Facemasks

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

**Page last reviewed:** March 17, 2020

**Content source:** National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases.

**Audience:** These considerations are intended for use by federal, state, and local public health officials; leaders in occupational health services and infection prevention and control programs; and other leaders in healthcare settings who are responsible for developing and implementing policies and procedures for preventing pathogen transmission in healthcare settings.

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

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

# N95 Filtering Facepiece Respirator Ultraviolet Germicidal Irradiation (UVGI) Process for Decontamination and Reuse

**Authors:** John J Lowe, Katie D Paladino, Jerald D Farke, Kathleen Boulter, Kelly Cawcutt, Mark Emodi, Shawn Gibbs, Richard Hankins, Lauren Hinkle, Terry Micheels, Shelly Schwedhelm, Angela Vasa, Michael Wadman, Suzanne Watson, and Mark E Rupp

**Date:** 10 April 2020

<https://www.nebraskamed.com/sites/default/files/documents/covid-19/n-95-decon-process.pdf>

# ARA Research to Mitigate a Shortage of Respiratory Protection Devices During Public Health Emergencies

**Authors:** Heimbuch, B.K. and D. Harnish. R. Applied Research Associates

**Date:** 22 March 2020

One of the greatest concerns facing health care workers on the front lines of infectious disease outbreaks such as COVID-19, the novel coronavirus, is a shortage of personal protective equipment, including respiratory protection devices.

Applied Research Associates, Inc. (ARA), recently completed a Study for the Food and Drug Administration (FDA), where we developed and evaluated methods for decontamination and reuse of respiratory protection devices (RPDs) in an effort to mitigate a shortage during a public health emergency. A two-phase approach was implemented:

1. Optimize UV decontamination of single-use N95 Filtering Facepiece Respirators
2. Optimize reprocessing of reusable respirators – Half-Mask Elastomeric Respirators (HMERs) and Powered Air-Purifying Respirators (PAPRs)

Overall, the research performed as part of this effort generated significant data pertaining to the feasibility of reprocessing existing RPDs for reuse as a means to mitigate a potential shortage resulting from a public health emergency.

<https://www.ara.com/news/ara-research-mitigate-shortage-respiratory-protection-devices-during-public-health-emergencies>

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**Journal Articles**

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1. **Transmission of aerosols through pristine and 1 reprocessed N95 respirators**

**Authors: Paul Z Chen, Aldrich Ngan, Niclas Manson, Jason T Maynes, Gregory H Borschel, Ori D Rotstein, Frank X Gu**

**Posted:** May 18, 2020.

**Doi:** <https://www.medrxiv.org/content/10.1101/2020.05.14.20094821v1>

**This article is a preprint and has not been certified by peer review. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.**

**Abstract: During the Covid-19 pandemic, pristine and reprocessed N95 respirators are crucial equipment towards limiting nosocomial infections. The NIOSH test certifying the N95 rating, however, poorly simulates aerosols in healthcare settings, limiting our understanding of the exposure risk for healthcare workers wearing these masks, especially reprocessed ones. We used experimental conditions that simulated the sizes, densities and airflow properties of infectious aerosols in healthcare settings. We analyzed the penetration and leakage of aerosols through pristine and reprocessed N95 respirators. Seven reprocessing methods were investigated. Our findings suggest that pristine and properly reprocessed N95 respirators effectively limit exposure to infectious aerosols, but that care must be taken to avoid the elucidated degradation mechanisms and limit noncompliant wear.**

**Database: medRxiv**

* **Aerosol transmission through new vs. reused N95 masks**

**Author:** Dr. Liji Thomas, MD

**Date:** May 19, 2020

**Source:** NewsMedical

<https://www.news-medical.net/news/20200519/Aerosol-transmission-through-new-vs-reused-N95-masks.aspx>

1. **Preparing** **for an Influenza Pandemic: Hospital Acceptance Study of Filtering Facepiece Respirator Decontamination Using Ultraviolet Germicidal Irradiation**

**Author(s):** Nemeth, Christopher; Laufersweiler, Dawn; Polander, Emily; Orvis, Christianna; Harnish, Del; Morgan, Sherwin E; O'Connor, Michael; Hymes, Saul; Nachman, Sharon; Heimbuch, Brian

**Source:** Journal of Patient Safety; Jun 2020; vol. 16 (no. 2); p. 117-122

**Publication Date:** Jun 2020

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

**PubMedID:** 32175970

**Abstract:** OBJECTIVES: Predictions estimate supplies of filtering facepiece respirators (FFRs) would be limited in the event of a severe influenza pandemic. Ultraviolet decontamination and reuse (UVDR) is a potential approach to mitigate an FFR shortage. A field study sought to understand healthcare workers' perspectives and potential logistics issues related to implementation of UVDR methods for FFRs in hospitals. METHODS: Data were collected at three hospitals using a structured guide to conduct 19 individual interviews, 103 focus group interviews, and 285 individual surveys. Data were then evaluated using thematic analysis to reveal key themes. RESULTS: Data revealed noteworthy variation in FFR use across the sample, along with preferences and requirements for the use of UVDR, unit design, and FFR reuse. Based on a scale of 1 (low) to 10 (high), the mean perception of safety in a high mortality pandemic wearing no FFR was 1.25 of 10, wearing an FFR for an extended period without decontamination was 4.20 of 10, and using UVDR was 7.72 of 10. CONCLUSIONS: In addition to technical design and development, preparation and training will be essential to successful implementation of a UVDR program. Ultraviolet decontamination and reuse program design and implementation must account for actual clinical practice, compliance with regulations, and practical financial considerations to be successfully adopted so that it can mitigate potential FFR shortages in a pandemic.

**Database:** Medline

1. **Sterilization of disposable face masks by means of standardized dry and steam sterilization processes; an alternative in the fight against mask shortages due to COVID-19**

**Author(s):**de Man P.; Koeleman H.; van Straten B.; van den Dobbelsteen J.; Horeman T.; van der Eijk A.

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

**Publication Date:**2020

**Publication Type(s):**Letter

**PubMedID:**32277964

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.2020.04.001) - from ClinicalKey

Available at [The Journal of hospital infection](https://doi.org/10.1016/j.jhin.2020.04.001) - from Unpaywall

**Extract:** The Covid-19 pandemic causes imminent shortages of face masks in hospitals globally. In preparation for that scarcity we performed a study to investigate the possibility of reprocessing disposable FFP2 face masks in order to verify their re-usability…

**Database:**EMBASE

1. **Immediate Use Steam Sterilization (IUSS) Sterilizes N95 Masks without Mask Damage**

**Author(s):** Carrillo I.; Floyd A.; Valverde C.; Tingle T.; Zabaneh F.

**Source:** Infection Control and Hospital Epidemiology; 2020

**Publication Date:** 2020

**Publication Type(s):** Letter

**PubMedID:** 32299520

Available at [Infection control and hospital epidemiology](https://www.cambridge.org/core/services/aop-cambridge-core/content/view/4BDC5CF0BBC9CFB44C0E837B3B37CC83/S0899823X20001452a.pdf/div-class-title-immediate-use-steam-sterilization-iuss-sterilizes-n95-masks-without-mask-damage-div.pdf) - from Unpaywall

**Extract:** To the Editor—As coronavirus disease 2019 (COVID-19) cases increase around the world, severe shortages of essential healthcare supplies are hampering the efforts to provide life-saving medical care without compromising the safety of healthcare workers. COVID-19 is transmitted by droplets, meaning that clinicians can be protected by gloves, gowns, eye shields, and masks. Disposable N95 masks seal tightly to the face and provide significantly better protection than surgical masks.

**Database:** EMBASE

1. **N95 Respirator Cleaning and Reuse Methods Proposed by the Inventor of the N95 Mask Material**

**Author(s):** Juang P.S.C.; Tsai P.

**Source:** Journal of Emergency Medicine; 2020

**Publication Date:** 2020

**Publication Type(s):** Article

**PubMedID:** 32389433

Available at [Journal of Emergency Medicine](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.jemermed.2020.04.036) - from ClinicalKey

Available at [Journal of Emergency Medicine](https://doi.org/10.1016/j.jemermed.2020.04.036) - from Unpaywall

**Extract:** *Editorial Comment—*This article is timely and we thank Dr. Juang for his diligence and desire to protect frontline health care providers. These appear to be simple methods for conserving N95 masks that are supported by some evidence as well as supported by the developer of the mask. We are publishing this in an expedited manner and readers should be aware that for obvious reasons this article has not gone through our regular peer-review process. Readers should also be aware that as of this writing, these methods are not officially approved by regulatory agencies. Nonetheless, even the Centers for Disease Control and Prevention notes that in times of crisis, alternative recommendations for the use of respirators like the ones in Dr. Juang's article may need to be considered when there are shortages of personal protective equipment that could put health care providers at risk. We will leave it to readers of the *Journal*to decide if the recommendations in this article are applicable to their situation. Stephen Hayden, MD, Editor-in-Chief

**Database:** EMBASE

1. **Steam treatment for rapid decontamination of N95 respirators and medical face masks**

**Author(s):** Li, Daniel F; Cadnum, Jennifer L; Redmond, Sarah N; Jones, Lucas D; Pearlmutter, Basya; Haq, Muhammed F; Donskey, Curtis J

**Source:** American Journal of Infection Control; May 2020

**Publication Date:** May 2020

**Publication Type(s):** Letter

**PubMedID:** 32417321

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.2020.05.009) - from ClinicalKey

**Database:** Medline

1. **Reusable and Recyclable Graphene Masks with Outstanding Superhydrophobic and Photothermal Performances**

**Author(s):**Zhong H.; Zhu Z.; Lin J.; Cheung C.F.; Chan C.-Y.; Li G.; Lu V.L.; Yan F.

**Source:**ACS Nano; Apr 2020

**Publication Date:**Apr 2020

**Publication Type(s):**Article

**PubMedID:**32329600

**Abstract:** The 2019 coronavirus outbreak (COVID-19) is affecting over 210 countries and territories, and it is spreading mainly by respiratory droplets. The use of disposable surgical masks is common for patients, doctors, and even the general public in highly risky areas. However, the current surgical masks cannot self-sterilize in order to reuse or be recycled for other applications. The resulting high economic and environmental costs are further damaging societies worldwide. Herein, we reported a unique method for functionalizing commercially available surgical masks with outstanding self-cleaning and photothermal properties. A dual-mode laser-induced forward transfer method was developed for depositing few-layer graphene onto low-melting temperature nonwoven masks. Superhydrophobic states were observed on the treated masks' surfaces, which can cause the incoming aqueous droplets to bounce off. Under sunlight illumination, the surface temperature of the functional mask can quickly increase to over 80 degree C, making the masks reusable after sunlight sterilization. In addition, this graphene-coated mask can be recycled directly for use in solar-driven desalination with outstanding salt-rejection performance for long-term use. These roll-to-roll production-line-compatible masks can provide us with better protection against this severe virus. The environment can also benefit from the direct recycling of these masks, which can be used for desalinating seawater.

**Database:**EMBASE

1. **Disposable masks: Disinfection and sterilization for reuse, and non-certified manufacturing, in the face of shortages during the COVID-19 pandemic.**

**Author(s):** Carlos Rubio-Romero, Juan; Del Carmen Pardo-Ferreira, María; Antonio Torrecilla García, Juan; Calero-Castro, Santiago

**Source:** Safety Science; May 2020; p. 104830

**Publication Date:** May 2020

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

**PubMedID:** 32406406

Available at [Safety science](https://doi.org/10.1016/j.ssci.2020.104830) - from Unpaywall

**Abstract:** The COVID-19 pandemic is posing a huge global health threat. To deal with this problem, in addition to research and work in the medical field, the main health measures being taken in the workplace and at home involve the establishment of safety protocols, which include distance measures, hygiene and the use of personal protective equipment, such as masks, etc. The WHO still does not recommend the use of masks for the general population. However, their successful use in China, South Korea and the Czech Republic has encouraged their widespread use, and the shortage that already existed. This has caused that companies and individuals are looking at the best way to reuse them, and to manufacture, homemade or not, of non-certified masks. This paper is based on two objectives: to consult the scientific literature to identify the main strategies for disinfecting them, and to determine the effectiveness of non-certified disposable masks. A rapid review has been conducted in which the main publications and other information available online have been analyzed. Results showed that the most promising methods are those that use hydrogen peroxide vapor, ultraviolet radiation, moist heat, dry heat and ozone gas. Soapy water, alcohol, bleach immersion, ethylene oxide, ionizing radiation, microwave, high temperature, autoclave or steam are not fully recommended. Regarding the effectiveness of surgical masks compared to PPE, the former have been seen to be slightly less effective than PPE. As for other types of masks the effectiveness of homemade or non-certified masks is very low.

**Database:** Medline

1. **Stockpiling of Used Personal Protective Equipment Now for Future Decontamination and Reuse in the COVID-19 Pandemic.**

**Author(s):** Gibney, Brian

**Source:** Journal of Patient Safety; May 2020

**Publication Date:** May 2020

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

**PubMedID:** 32404851

**Database:** Medline

1. **COVID-19 global pandemic planning: Decontamination and reuse processes for N95 respirators.**

**Author(s):** Perkins, Douglas J; Villescas, Steven; Wu, Terry H; Muller, Timothy; Bradfute, Steven; Hurwitz, Ivy; Cheng, Qiuying; Wilcox, Hannah; Weiss, Myissa; Bartlett, Chris; Langsjoen, Jens; Seidenberg, Phil

**Source:** Experimental Biology and Medicine (Maywood, N.J.); May 2020; p. 1535370220925768

**Publication Date:** May 2020

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

**PubMedID:** 32397762

Available at [Experimental biology and medicine (Maywood, N.J.)](https://doi.org/10.1101/2020.04.09.20060129) - from Unpaywall

**Abstract:** IMPACT STATEMENT: There is a critical shortage of personal protective equipment (PPE) around the globe. This article describes the safe collection, storage, and decontamination of N95 respirators using hydrogen peroxide vapor (HPV). This article is unique because it describes the HPV process in an operating room, and is therefore, a deployable method for many healthcare settings. Results presented here offer creative solutions to the current PPE shortage.

**Database:** Medline

1. **Ozone disinfectants like soclean CPAP sanitizer can be used to sterilize cloth and n95 masks in the protection against COVID-19**

**Author(s):** Burkhart C.G.

**Source:** Open Dermatology Journal; 2020; vol. 14 (no. 1); p. 14-15

**Publication Date:** 2020

**Publication Type(s):** Editorial

Available at [The Open Dermatology Journal](https://opendermatologyjournal.com/VOLUME/14/PAGE/14/PDF/) - from Unpaywall

**Database:** EMBASE

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

**Author(s):** Hamzavi I.H.; Lyons A.B.; Kohli I.; Narla S.; Parks-Miller A.; Lim H.W.; Ozog D.M.; Gelfand J.M.

**Source:** Journal of the American Academy of Dermatology; Jun 2020; vol. 82 (no. 6); p. 1511-1512

**Publication Date:** Jun 2020

**Publication Type(s):** Article

**PubMedID:** 32246972

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

Available at [Journal of the American Academy of Dermatology](https://doi.org/10.1016/j.jaad.2020.03.085) - from Unpaywall

**Extract:** *To the Editor:* The ability to disinfect and reuse disposable N95 filtering facepiece respirators is urgently needed during the current COVID-19 pandemic because supplies are running low in hospitals throughout the United States and abroad. Ultraviolet (UV) germicidal irradiation (UVGI) is one possible method for respirator disinfection to facilitate the reuse of dwindling supplies. Dermatology offices often use narrow-band 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 UVC germicidal disinfection.

**Database:** EMBASE

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

**Author(s):** Verbeek J.H.; Rajamaki B.; Ijaz S.; Sauni R.; Toomey E.; Blackwood B.; Tikka C.; Ruotsalainen J.H.; Kilinc Balci F.S.

**Source:** Cochrane Database of Systematic Reviews; May 2020; vol. 2020 (no. 5)

**Publication Date:** May 2020

**Publication Type(s):** Review

**PubMedID:** 32412096

Available at [The Cochrane database of systematic reviews](https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD011621.pub5/full) - from Cochrane Collaboration (Wiley)

**Abstract:** BACKGROUND: In epidemics of highly infectious diseases, such as Ebola, severe acute respiratory syndrome (SARS), or coronavirus (COVID-19), healthcare workers (HCW) are at much greater risk of infection than the general population, due to their contact with patients' contaminated body fluids. Personal protective equipment (PPE) can reduce the risk by covering exposed body parts. It is unclear which type of PPE protects best, what is the best way to put PPE on (i.e. donning) or to remove PPE (i.e. doffing), and how to train HCWs to 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 contamination or infection for HCW, and which training methods increase compliance with PPE protocols. SEARCH METHODS: We searched CENTRAL, MEDLINE, Embase and CINAHL to 20 March 2020. SELECTION CRITERIA: We included all controlled studies that evaluated the effect of full-body PPE used by HCW exposed to highly infectious diseases, on the risk of infection, contamination, or noncompliance with protocols. We also included studies that compared the effect of various ways of donning or doffing PPE, and the effects of training on the same outcomes. DATA COLLECTION AND ANALYSIS: Two review authors independently selected studies, extracted data and assessed the risk of bias in included trials. We conducted random-effects meta-analyses were appropriate. MAIN RESULTS: Earlier versions of this review were published in 2016 and 2019. In this update, we included 24 studies with 2278 participants, of which 14 were randomised controlled trials (RCT), one was a quasi-RCT and nine had a non-randomised design. Eight studies compared types of PPE. Six studies evaluated adapted PPE. Eight studies compared donning and doffing processes and three studies evaluated types of training. Eighteen studies used simulated exposure with fluorescent markers or harmless microbes. In simulation studies, median contamination rates were 25% for the intervention and 67% for the control groups. Evidence for all outcomes is of very low certainty unless otherwise stated because it is based on one or two studies, the indirectness of the evidence in simulation studies and because of risk of bias. Types of PPE. The use of a powered, air-purifying respirator with coverall may protect against the risk of contamination better than a N95 mask and gown (risk ratio (RR) 0.27, 95% confidence interval (CI) 0.17 to 0.43) but was more difficult to don (non-compliance: RR 7.5, 95% CI 1.81 to 31.1). In one RCT (59 participants), people with a long gown had less contamination than those with a coverall, and coveralls were more difficult to doff (low-certainty evidence). Gowns may protect better against contamination than aprons (small patches: mean difference (MD) -10.28, 95% CI -14.77 to -5.79). PPE made of more breathable material may lead to a similar number of spots on the trunk (MD 1.60, 95% CI -0.15 to 3.35) compared to 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). Modified PPE versus standard PPE. The following modifications to PPE design may lead to less contamination compared to standard PPE: sealed gown and glove combination (RR 0.27, 95% CI 0.09 to 0.78), a better fitting gown around the neck, wrists and hands (RR 0.08, 95% CI 0.01 to 0.55), a better cover of the gown-wrist interface (RR 0.45, 95% CI 0.26 to 0.78, low-certainty evidence), added tabs to grab to facilitate doffing of masks (RR 0.33, 95% CI 0.14 to 0.80) or gloves (RR 0.22, 95% CI 0.15 to 0.31). Donning and doffing. Using Centers for Disease Control and Prevention (CDC) recommendations for doffing may lead to less contamination compared to no guidance (small patches: MD -5.44, 95% CI -7.43 to -3.45). One-step removal of gloves and gown may lead to less bacterial contamination (RR 0.20, 95% CI 0.05 to 0.77) but not to less fluorescent contamination (RR 0.98, 95% CI 0.75 to 1.28) than separate removal. Double-gloving may lead to less viral or bacterial contamination compared to single gloving (RR 0.34, 95% CI 0.17 to 0.66) but not to less fluorescent contamination (RR 0.98, 95% CI 0.75 to 1.28). Additional spoken instruction may lead to fewer errors in doffing (MD -0.9, 95% CI -1.4 to -0.4) and to fewer contamination spots (MD -5, 95% CI -8.08 to -1.92). Extra sanitation of gloves before doffing with quaternary ammonium or bleach may decrease contamination, but not alcohol-based hand rub. 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 to 41.26) than a traditional lecture. Face-to-face instruction may reduce noncompliance with doffing guidance more (odds ratio 0.45, 95% CI 0.21 to 0.98) than providing folders or videos only. AUTHORS' CONCLUSIONS: We found low- to very low-certainty evidence that covering more parts of the body leads to better protection but usually comes at the cost of more difficult donning or doffing and less user comfort, and may therefore even lead to more contamination. More breathable types of PPE may lead to similar contamination but may have greater user satisfaction. Modifications to PPE design, such as tabs to grab, may decrease the risk of contamination. For donning and doffing procedures, following CDC doffing guidance, a one-step glove and gown removal, double-gloving, spoken instructions during doffing, and using glove disinfection may reduce contamination and increase compliance. Face-to-face training in PPE use may reduce errors more than folder-based training. We still need RCTs of training with long-term follow-up. We need simulation studies with more participants to find out which combinations of PPE and which doffing procedure protects best. Consensus on simulation of exposure and assessment of outcome is urgently needed. We also need more real-life evidence. Therefore, the use of PPE of HCW exposed to highly infectious diseases should be registered and the HCW should be prospectively followed for their risk of infection. Copyright © 2020 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

**Database:** EMBASE

1. **Can N95 Respirators Be Reused after Disinfection? How Many Times?**

**Author(s):** Liao L.; Xiao W.; Zhao M.; Yu X.; Wang H.; Wang Q.; Chu S.; Cui Y.

**Source:** ACS Nano; May 2020

**Publication Date:** May 2020

**Publication Type(s):** Article

**PubMedID:** 32368894

Available at [ACS nano](https://pubs.acs.org/doi/pdf/10.1021/acsnano.0c03597) - from Unpaywall

**Abstract:** The coronavirus disease 2019 (COVID-19) pandemic has led to a major shortage of N95 respirators, which are essential for protecting healthcare professionals and the general public who may come into contact with the virus. Thus, it is essential to determine how we can reuse respirators and other personal protective equipment in these urgent times. We investigated multiple commonly used disinfection schemes on media with particle filtration efficiency of 95%. Heating was recently found to inactivate the virus in solution within 5 min at 70 degree C and is among the most scalable, user-friendly methods for viral disinfection. We found that heat (<=85 degree C) under various humidities (<=100% relative humidity, RH) was the most promising, nondestructive method for the preservation of filtration properties in meltblown fabrics as well as N95-grade respirators. At 85 degree C, 30% RH, we were able to perform 50 cycles of heat treatment without significant changes in the filtration efficiency. At low humidity or dry conditions, temperatures up to 100 degree C were not found to alter the filtration efficiency significantly within 20 cycles of treatment. Ultraviolet (UV) irradiation was a secondary choice, which was able to withstand 10 cycles of treatment and showed small degradation by 20 cycles. However, UV can potentially impact the material strength and subsequent sealing of respirators. Finally, treatments involving liquids and vapors require caution, as steam, alcohol, and household bleach all may lead to degradation of the filtration efficiency, leaving the user vulnerable to the viral aerosols.

**Database:** EMBASE

1. **Are Powered Air Purifying Respirators a Solution for Protecting Healthcare Workers from Emerging Aerosol-Transmissible Diseases?**

**Author(s):** Brosseau, Lisa M

**Source:** Annals of Work Exposures & Health; May 2020; vol. 64 (no. 4); p. 339-341

**Publication Date:** May 2020

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

Available at [Annals of work exposures and health](https://academic.oup.com/annweh/advance-article-pdf/doi/10.1093/annweh/wxaa024/32885394/wxaa024.pdf) - from Unpaywall

**Abstract:** An editorial is presented regarding Powered Air Purifying Respirators a Solution for Protecting Healthcare Workers from Emerging Aerosol-Transmissible Diseases. It mentions risk factors for nosocomial transmission of SARS included exposure during aerosol-generating medical procedures, failure to isolate infectious patients, and the lack or uneven use of personal protective equipment.

**Database:** CINAHL

1. **Surgery during the COVID-19 pandemic: operating room suggestions from an international Delphi process**

**Author(s):** Abdelrahman T.; Beamish A.J.; Brown C.; Egan R.J.; Evans T.; Ryan Harper E.; Harries R.L.; Hopkins L.; James O.; Lewis S.; Lewis W.G.; Luton O.; Mellor K.; Robinson D.; Thomas R.; Williams A.

**Source:** The British Journal of Surgery; May 2020

**Publication Date:** May 2020

**Publication Type(s):** Article

**PubMedID:** 32395829

Available at [The British journal of surgery](https://go.openathens.net/redirector/nhs?url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Ffull%2F10.1002%2Fbjs.11747) - from Wiley Online Library Medicine and Nursing Collection 2019 - NHS

Available at [The British journal of surgery](https://bjssjournals.onlinelibrary.wiley.com/doi/pdfdirect/10.1002/bjs.11747) - from Unpaywall

**Abstract:** INTRODUCTION: Operating room (OR) practice during the COVID-19 pandemic is driven by basic principles, shared experience, and nascent literature. This study aimed to identify the knowledge needs of the global OR workforce, and characterise supportive evidence to establish consensus. METHOD(S): A rapid, modified Delphi exercise was performed, open to all stakeholders, informed via an online international collaborative evaluation. RESULT(S): The consensus exercise was completed by 339 individuals from 41 countries (64% UK). Consensus was reached on 71/100 statements, predominantly standardisation of OR pathways, OR staffing, and pre-operative screening or diagnosis. The highest levels of consensus were observed in statements relating to appropriate personal and protective equipment (PPE) and risk distribution (96-99%), clear consent processes (96%), multidisciplinary decision-making and working (97%). Statements yielding equivocal responses predominantly related to technical and procedure choices, including: decontamination (40-68%), laminar flow systems (13-61%), PPE reuse (58%), risk stratification of patients (21-48%), open vs. laparoscopic surgery (63%), preferential cholecystostomy in biliary disease (48%), and definition of aerosol generating procedures (19%). DISCUSSION: High levels of consensus existed for many statements within each domain, supporting much of the initial guidance issued by professional bodies, yet several contentious areas arose, which represent urgent targets for investigation to delineate safe COVID-19 related OR practice. This article is protected by copyright. All rights reserved.

**Database:** EMBASE

1. **Intensive care management of coronavirus disease 2019 (COVID-19): challenges and recommendations**

**Author(s):** Phua J.; Weng L.; Du B.; Ling L.; Gomersall C.D.; Egi M.; Lim C.-M.; Koh Y.; Divatia J.V.; Shrestha B.R.; Arabi Y.M.; Ng J.; Nishimura M.

**Source:** The Lancet Respiratory Medicine; May 2020; vol. 8 (no. 5); p. 506-517

**Publication Date:** May 2020

**Publication Type(s):** Review

**PubMedID:** 32272080

Available at [The Lancet. Respiratory medicine](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%2FS2213-2600(20)30161-2) - from ClinicalKey

Available at [The Lancet. Respiratory medicine](https://doi.org/10.1016/s2213-2600(20)30161-2) - from Unpaywall

**Abstract:** As coronavirus disease 2019 (COVID-19) spreads across the world, the intensive care unit (ICU) community must prepare for the challenges associated with this pandemic. Streamlining of workflows for rapid diagnosis and isolation, clinical management, and infection prevention will matter not only to patients with COVID-19, but also to health-care workers and other patients who are at risk from nosocomial transmission. Management of acute respiratory failure and haemodynamics is key. ICU practitioners, hospital administrators, governments, and policy makers must prepare for a substantial increase in critical care bed capacity, with a focus not just on infrastructure and supplies, but also on staff management. Critical care triage to allow the rationing of scarce ICU resources might be needed. Researchers must address unanswered questions, including the role of repurposed and experimental therapies. Collaboration at the local, regional, national, and international level offers the best chance of survival for the critically ill. Copyright © 2020 Elsevier Ltd

**Database:** EMBASE

1. **Emergency Medical Services resource capacity and competency amid COVID-19 in the United States: Preliminary findings from a national survey.**

**Author(s):** Gibson, Cody V; Ventura, Christian A; Collier, George D

**Source:** Heliyon; May 2020; p. e03900

**Publication Date:** May 2020

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

**PubMedID:** 32368629

Available at [Heliyon](http://europepmc.org/search?query=(DOI:10.1016/j.heliyon.2020.e03900)) - from Europe PubMed Central - Open Access

Available at [Heliyon](https://doi.org/10.1016/j.heliyon.2020.e03900) - from Unpaywall

**Abstract:** OBJECTIVE: This study aimed to investigate available resources, Personal Protective Equipment (PPE) availability, sanitation practices, institutional policies, and opinions among EMS professionals in the United States amid the COVID-19 pandemic using a self-report survey questionnaire. METHODS: An online 42-question multiple choice survey was randomly distributed between April 1, 2020, and April 16, 2020 to various active Emergency Medical Services (EMS) paid personnel in all 50 U.S. states including the District of Columbia (n=192). We approximate a 95% confidence interval (± 0.07). RESULTS: An overwhelming number of EMS providers report having limited access to N95 respirators, receiving little or no benefits from COVID-19 related work, and report no institutional policy on social distancing practices despite CDC recommendations. For providers who do have access to N95 respirators, 31% report having to use the same mask for 1 week or longer. Approximately ⅓ of the surveyed participants were unsure of when a COVID-19 patient is infectious. The data suggests regular decontamination of EMS equipment after each patient contact is not a regular practice. DISCUSSION: Current practices to educate EMS providers on appropriate response to the novel coronavirus may not be sufficient, and future patients may benefit from a nationally established COVID-19 EMS response protocol. Further investigation on whether current EMS practices are contributing to the spread of infection is warranted. The data reveals concerning deficits in COVID-19 related education and administrative protocols which pose as a serious public health concern that should be urgently addressed.

**Database:** Medline

1. **Facial protection for healthcare workers during pandemics: a scoping review.**

**Author(s):** Garcia Godoy, Laura R; Jones, Amy E; Anderson, Taylor N; Fisher, Cameron L; Seeley, Kylie M L; Beeson, Erynn A; Zane, Hannah K; Peterson, Jaime W; Sullivan, Peter D

**Source:** BMJ Global Health; May 2020; vol. 5 (no. 5)

**Publication Date:** May 2020

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

**PubMedID:** 32371574

Available at [BMJ global health](http://europepmc.org/search?query=(DOI:10.1136/bmjgh-2020-002553)) - from Europe PubMed Central - Open Access

Available at [BMJ global health](https://gh.bmj.com/content/bmjgh/5/5/e002553.full.pdf) - from Unpaywall

**Abstract:** BACKGROUND: The coronavirus disease 2019 (COVID-19) pandemic has led to personal protective equipment (PPE) shortages, requiring mask reuse or improvisation. We provide a review of medical-grade facial protection (surgical masks, N95 respirators and face shields) for healthcare workers, the safety and efficacy of decontamination methods, and the utility of alternative strategies in emergency shortages or resource-scarce settings. METHODS: We conducted a scoping review of PubMed and grey literature related to facial protection and potential adaptation strategies in the setting of PPE shortages (January 2000 to March 2020). Limitations included few COVID-19-specific studies and exclusion of non-English language articles. We conducted a narrative synthesis of the evidence based on relevant healthcare settings to increase practical utility in decision-making. RESULTS: We retrieved 5462 peer-reviewed articles and 41 grey literature records. In total, we included 67 records which met inclusion criteria. Compared with surgical masks, N95 respirators perform better in laboratory testing, may provide superior protection in inpatient settings and perform equivalently in outpatient settings. Surgical mask and N95 respirator conservation strategies include extended use, reuse or decontamination, but these strategies may result in inferior protection. Limited evidence suggests that reused and improvised masks should be used when medical-grade protection is unavailable. CONCLUSION: The COVID-19 pandemic has led to critical shortages of medical-grade PPE. Alternative forms of facial protection offer inferior protection. More robust evidence is required on different types of medical-grade facial protection. As research on COVID-19 advances, investigators should continue to examine the impact on alternatives of medical-grade facial protection.

**Database:** Medline

1. **Disposable masks: Disinfection and sterilization for reuse, and non-certified manufacturing, in the face of shortages during the COVID-19 pandemic.**

**Author(s):** Carlos Rubio-Romero, Juan; Del Carmen Pardo-Ferreira, María; Antonio Torrecilla García, Juan; Calero-Castro, Santiago

**Source:** Safety Science; May 2020; p. 104830

**Publication Date:** May 2020

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

**PubMedID:** 32406406

Available at [Safety science](https://doi.org/10.1016/j.ssci.2020.104830) - from Unpaywall

**Abstract:** The COVID-19 pandemic is posing a huge global health threat. To deal with this problem, in addition to research and work in the medical field, the main health measures being taken in the workplace and at home involve the establishment of safety protocols, which include distance measures, hygiene and the use of personal protective equipment, such as masks, etc. The WHO still does not recommend the use of masks for the general population. However, their successful use in China, South Korea and the Czech Republic has encouraged their widespread use, and the shortage that already existed. This has caused that companies and individuals are looking at the best way to reuse them, and to manufacture, homemade or not, of non-certified masks. This paper is based on two objectives: to consult the scientific literature to identify the main strategies for disinfecting them, and to determine the effectiveness of non-certified disposable masks. A rapid review has been conducted in which the main publications and other information available online have been analyzed. Results showed that the most promising methods are those that use hydrogen peroxide vapor, ultraviolet radiation, moist heat, dry heat and ozone gas. Soapy water, alcohol, bleach immersion, ethylene oxide, ionizing radiation, microwave, high temperature, autoclave or steam are not fully recommended. Regarding the effectiveness of surgical masks compared to PPE, the former have been seen to be slightly less effective than PPE. As for other types of masks the effectiveness of homemade or non-certified masks is very low.

**Database:** Medline

1. **COVID-19 pandemic and personal protective equipment shortage: protective efficacy comparing masks and scientific methods for respirator reuse**

**Author(s):** Boskoski I.; Gallo C.; Costamagna G.; Wallace M.B.

**Source:** Gastrointestinal Endoscopy; Apr 2020

**Publication Date:** Apr 2020

**Publication Type(s):** Article

**PubMedID:** 32353457

Available at [Gastrointestinal endoscopy](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.gie.2020.04.048) - from ClinicalKey

Available at [Gastrointestinal endoscopy](https://doi.org/10.1016/j.gie.2020.04.048) - from Unpaywall

**Abstract:** BACKGROUND AND AIMS: The abrupt outbreak of COVID-19 and its rapid spread over many health care systems in the world led to personal protective equipment (PPE) shortening, which cannot be faced only by the reduction in their consumption nor by the expensive and time-requiring implementation of their production. It is thus necessary to promote PPE rational use, highlighting possible differences in terms of efficacy among them and promoting an effective technique to reuse them. METHOD(S): A literature search was performed on PubMed, Scopus, Cochrane database, and Google Scholar and from 25 top cited papers, 15 were selected for relevance and impact. RESULT(S): Most studies on prior respiratory virus epidemic to date suggest surgical masks not to be inferior compared with N95 respirators in terms of protective efficacy among health care workers. The use of N95 respirators should be then limited in favor of high-risk situations. Concerning respirators reuse, highly energetic short-wave ultraviolet germicidal irradiation (UVGI) at 254 nm was proficiently applied to determine N95 respirators decontamination from viral respiratory agents, but it requires careful consideration of the type of respirator and of the biological target. CONCLUSION(S): Rational use and successful reuse of respirators can help facing PPE shortening during a pandemic. Further evidences testing UVGI and other decontamination techniques are an unmet need. The definitive answer to pandemic issues can be found in artificial intelligence and deep learning: these groundbreaking modalities could help in identifying high-risk patients and in suggesting appropriate types and use of PPE. Copyright © 2020 American Society for Gastrointestinal Endoscopy. Published by Elsevier Inc. All rights reserved.

**Database:** EMBASE

1. **It's Not the Heat, It's the Humidity: Effectiveness of a Rice Cooker-Steamer for Decontamination of Cloth and Surgical Face Masks and N95 Respirators**

**Author(s):** Li D.F.; Cadnum J.L.; Redmond S.N.; Jones L.D.; Donskey C.J.

**Source:** American Journal of Infection Control; Apr 2020

**Publication Date:** Apr 2020

**Publication Type(s):** Letter

**PubMedID:** 32334003

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.2020.04.012) - from ClinicalKey

Available at [American journal of infection control](https://doi.org/10.1016/j.ajic.2020.04.012) - from Unpaywall

**Database:** EMBASE

1. **Decontamination of face masks with steam for mask reuse in fighting the pandemic COVID-19: experimental supports**

**Author(s):** Ma Q.-X.; Shan H.; Zhang C.-M.; Zhang H.-L.; Li G.-M.; Yang R.-M.; Chen J.-M.

**Source:** Journal of Medical Virology; Apr 2020

**Publication Date:** Apr 2020

**Publication Type(s):** Article

**PubMedID:** 32320083

Available at [Journal of medical virology](https://go.openathens.net/redirector/nhs?url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Ffull%2F10.1002%2Fjmv.25921) - from Wiley Online Library Medicine and Nursing Collection 2019 - NHS

Available at [Journal of medical virology](https://onlinelibrary.wiley.com/doi/pdfdirect/10.1002/jmv.25921) - from Unpaywall

**Abstract:** The COVID-19 pandemic caused by the novel coronavirus SARS-CoV-2 has claimed many lives worldwide. Wearing medical masks or N95 masks (namely N95 respirators) can slow the virus spread and reduce the infection risk. Reuse of these masks can minimize waste, protect the environment, and help to solve the current imminent shortage of masks. Disinfection of used masks is needed for reuse of them with safety, but improper decontamination can damage the blocking structure of masks. In this study, we demonstrated, using avian coronavirus of infectious bronchitis virus to mimic SARS-CoV-2, that medical masks and N95 masks remained their blocking efficacy after being steamed on boiling water even for 2 hours. We also demonstrated that three brands of medical masks blocked over 99% viruses in aerosols. The avian coronavirus was completely inactivated after being steamed for 5 minutes. Together, this study suggested that medical masks are adequate for use on most social occasions, and both medical masks and N95 masks can be reused for a few days with steam decontamination between use. This article is protected by copyright. All rights reserved.

**Database:** EMBASE

1. **Respiratory Protection Considerations for Healthcare Workers During the COVID-19 Pandemic**

**Author(s):** Friese C.R.; Veenema T.G.; Johnson J.S.; Jayaraman S.; Chang J.C.; Clever L.H.

**Source:** Health Security; Apr 2020

**Publication Date:** Apr 2020

**Publication Type(s):** Article

**PubMedID:** 32320327

Available at [Health security](https://www.liebertpub.com/doi/pdf/10.1089/hs.2020.0036) - from Unpaywall

**Abstract:** The COVID-19 pandemic has resulted in a surge of patients that exceeds available human and physical resources in many settings, triggering the implementation of crisis standards of care. High-quality respiratory protection is essential to reduce exposure among healthcare workers, yet dire shortages of personal protective equipment in the United States threaten the health and safety of this essential workforce. In the context of rapidly changing conditions and incomplete data, this article outlines 3 important strategies to improve healthcare workers' respiratory protection. At a minimum, healthcare workers delivering care to patients with confirmed or suspected COVID-19 should wear N95 respirators and full-face shields. Several mechanisms exist to boost and protect the supply of N95 respirators, including rigorous decontamination protocols, invoking the Defense Production Act, expanded use of reusable elastomeric respirators, and repurposing industrial N95 respirators. Finally, homemade facial coverings do not protect healthcare workers and should be avoided. These strategies, coupled with longer-term strategies of investments in protective equipment research, infrastructure, and data systems, provide a framework to protect healthcare workers immediately and enhance preparedness efforts for future pandemics.

**Database:** EMBASE

1. **Reuse of N95 Masks.**

**Author(s):** Mackenzie, Dana

**Source:** Engineering (Beijing, China); Apr 2020

**Publication Date:** Apr 2020

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

**PubMedID:** 32292629

Available at [Engineering (Beijing, China)](https://doi.org/10.1016/j.eng.2020.04.003) - from Unpaywall

**Abstract:** As the COVID-19 pandemic enters its second month (April 2020) in the United States, one of the simplest pieces of medical equipment is in desperately short supply: medical-grade protective facemasks, typically engineered and specified for a single use only. Now, to meet the critical and quickly intensifying need, Chinese and American engineers are devising new procedures for decontaminating and reusing masks that hospitals already have on hand (Fig. 1) [1]. Although some of these procedures require specialized equipment, others are simple enough to use at home (Fig. 2) [2], [3].

**Database:** Medline

1. **Covid-19 and the N95 respirator shortage: Closing the gap.**

**Author(s):** Nogee, Daniel; Tomassoni, Anthony J

**Source:** Infection Control and Hospital Epidemiology; Apr 2020; p. 1

**Publication Date:** Apr 2020

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

**PubMedID:** 32279694

Available at [Infection control and hospital epidemiology](https://www.cambridge.org/core/services/aop-cambridge-core/content/view/00C6F711245BED3BC1E791E12F724C4D/S0899823X20001245a.pdf/div-class-title-covid-19-and-the-n95-respirator-shortage-closing-the-gap-div.pdf) - from Unpaywall

**Abstract:** Due to extreme shortages of personal protective equipment caused by the COVID-19 pandemic, many healthcare workers will be forced to recycle protective masks intended for disposal after a single use. We propose investigating the use of ultraviolet germicidal irradiation to sterilize masks of SARS-CoV-2 for safer reuse.

**Database:** Medline

1. **Reuse of N95 masks grows, though experts raise safety concerns.**

**Author(s):** Castellucci, Maria

**Source:** Modern Healthcare; Apr 2020; vol. 50 (no. 16); p. 16-16

**Publication Date:** Apr 2020

**Publication Type(s):** Trade Publication

Available at [Modern Healthcare](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=0160-7480&volume=50&issue=16&spage=16) - from ProQuest (Health Research Premium) - NHS Version

**Abstract:** The article discusses the hazardous decontamination and reuse of N95 respirator masks in the handling coronavirus 2019 (COVID-19) cases in some U.S. health systems due to their projected shortages as of April 20, 2020. Topics covered include the processes for mask reuse, medical experts' concerns on the move and the considered use of one ventilator for two patients, and the alternative of using reusable battery-operated and air powered purifying respirators.

**Database:** CINAHL

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

**Author(s):** Dargaville, Tim; Spann, Kirsten; Celina, Mathew

**Source:** Polymer degradation and stability; Apr 2020; p. 109162

**Publication Date:** Apr 2020

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

**PubMedID:** 32292217

Available at [Polymer degradation and stability](https://doi.org/10.1016/j.polymdegradstab.2020.109162) - from Unpaywall

**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:** Medline

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/9000/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

1. **Use of personal protective equipment to protect against respiratory infections in Pakistan: A systematic review**

**Author(s):** Chughtai A.A.; Khan W.

**Source:** Journal of Infection and Public Health; Mar 2020; vol. 13 (no. 3); p. 385-390

**Publication Date:** Mar 2020

**Publication Type(s):** Article

**PubMedID:** 32146139

Available at [Journal of infection and public health](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.jiph.2020.02.032) - from ClinicalKey

Available at [Journal of infection and public health](https://doi.org/10.1016/j.jiph.2020.02.032) - from Unpaywall

**Abstract:** Like other low-income countries, limited data are available on the use of personal protective equipment (PPE) in Pakistan. We conducted a systematic review of studies on PPE use for respiratory infections in healthcare settings in Pakistan. MEDLINE, Embase and Goggle Scholar were searched for clinical, epidemiological and laboratory-based studies in English, and 13 studies were included; all were observational/cross-sectional studies. The studies examined PPE use in hospital (n = 7), dental (n = 4) or laboratory (n = 2) settings. Policies and practices on PPE use were inconsistent. Face masks and gloves were the most commonly used PPE to protect from respiratory and other infections. PPE was not available in many facilities and its use was limited to high-risk situations. Compliance with PPE use was low among healthcare workers, and reuse of PPE was reported. Clear policies on the use of PPE and available PPE are needed to avoid inappropriate practices that could result in the spread of infection. Large, multimethod studies are recommended on PPE use to inform national infection-control guidelines. Copyright © 2019 The Author(s)

**Database:** EMBASE

1. **In The News.**

**Author(s):**

**Source:** New York Nurse; Mar 2020; p. 15-15

**Publication Date:** Mar 2020

**Publication Type(s):** Periodical

**Abstract:** The article presents several news briefs from March to April 2020 on topics finding beds for hospital patients in the midst of a Covid-19 crisis, shortage of personal protective equipment specifically the risky reuse of N-95 masks at New York's Jacobi Medical Center, and suggestions from President Donald Trump to healthcare workers in New York City.

**Database:** CINAHL

1. **COVID-19 and Face Masks -- To Use or Not to Use!**

**Author(s):** Ramakrishnan, Devraj

**Source:** Indian Journal of Community Health; Jan 2020; vol. 32 (no. 2); p. 240-243

**Publication Date:** Jan 2020

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

**Abstract:** COVID-19 has evolved into a pandemic in quick time and being a droplet infection, it was quickly understood that prevention is the key. People started to use all types of masks and there was a panic as stocks started running out. Health care workers must use a triple layered surgical mask and those exposed to aerosol generating procedures must use an N 95 mask and these should be kept reserved for them, especially in a resource limited setting. Though initial advice from experts to the general public was not to use a mask in community settings unless they are sick or taking care of someone sick, the advice had to be later modified. Though CDC Atlanta currently advices everyone with no symptoms to wear cloth masks in the community, WHO opines there is no clear evidence to advise for or against mask use in the community. However, WHO encourages countries advising community mask use as it can generate useful evidence. Along with mask use, practicing all other preventive measures such as handwashing, cough etiquette, social distancing, quarantine and isolation are of utmost importance, without which, using surgical masks or even N95 masks, will not be much effective in the community setting.

**Database:** CINAHL

1. **Effects of Ultraviolet Germicidal Irradiation (UVGI) on N95 Respirator Filtration Performance and Structural Integrity.**

**Author(s):** Lindsley, William G; Martin, Stephen B; Thewlis, Robert E; Sarkisian, Khachatur; Nwoko, Julian O; Mead, Kenneth R; Noti, John D

**Source:** Journal of Occupational and Environmental Hygiene; 2015; vol. 12 (no. 8); p. 509-517

**Publication Date:** 2015

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

**PubMedID:** 25806411

Available at [Journal of occupational and environmental hygiene](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4699414) - from Unpaywall

**Abstract:** The ability to disinfect and reuse disposable N95 filtering facepiece respirators (FFRs) may be needed during a pandemic of an infectious respiratory disease such as influenza. Ultraviolet germicidal irradiation (UVGI) is one possible method for respirator disinfection. However, UV radiation degrades polymers, which presents the possibility that UVGI exposure could degrade the ability of a disposable respirator to protect the worker. To study this, we exposed both sides of material coupons and respirator straps from four models of N95 FFRs to UVGI doses from 120-950 J/cm(2). We then tested the particle penetration, flow resistance, and bursting strengths of the individual respirator coupon layers, and the breaking strength of the respirator straps. We found that UVGI exposure led to a small increase in particle penetration (up to 1.25%) and had little effect on the flow resistance. UVGI exposure had a more pronounced effect on the strengths of the respirator materials. At the higher UVGI doses, the strength of the layers of respirator material was substantially reduced (in some cases, by >90%). The changes in the strengths of the respirator materials varied considerably among the different models of respirators. UVGI had less of an effect on the respirator straps; a dose of 2360 J/cm(2) reduced the breaking strength of the straps by 20-51%. Our results suggest that UVGI could be used to effectively disinfect disposable respirators for reuse, but the maximum number of disinfection cycles will be limited by the respirator model and the UVGI dose required to inactivate the pathogen.

**Database:** Medline

1. **Evaluation of five decontamination methods for filtering facepiece respirators.**

**Author(s):** Viscusi, Dennis J; Bergman, Michael S; Eimer, Benjamin C; Shaffer, Ronald E

**Source:** The Annals of Occupational Hygiene; Nov 2009; vol. 53 (no. 8); p. 815-827

**Publication Date:** Nov 2009

**Publication Type(s):** Research Support, N.I.H., Extramural Evaluation Study Journal Article

**PubMedID:** 19805391

Available at [The Annals of occupational hygiene](https://academic.oup.com/annweh/article/53/8/815/154763/Evaluation-of-Five-Decontamination-Methods-for) - from HighWire - Free Full Text

Available at [The Annals of occupational hygiene](https://academic.oup.com/annweh/article-pdf/53/8/815/363130/mep070.pdf) - from Unpaywall

**Abstract:** Concerns have been raised regarding the availability of National Institute for Occupational Safety and Health (NIOSH)-certified N95 filtering facepiece respirators (FFRs) during an influenza pandemic. One possible strategy to mitigate a respirator shortage is to reuse FFRs following a biological decontamination process to render infectious material on the FFR inactive. However, little data exist on the effects of decontamination methods on respirator integrity and performance. This study evaluated five decontamination methods [ultraviolet germicidal irradiation (UVGI), ethylene oxide, vaporized hydrogen peroxide (VHP), microwave oven irradiation, and bleach] using nine models of NIOSH-certified respirators (three models each of N95 FFRs, surgical N95 respirators, and P100 FFRs) to determine which methods should be considered for future research studies. Following treatment by each decontamination method, the FFRs were evaluated for changes in physical appearance, odor, and laboratory performance (filter aerosol penetration and filter airflow resistance). Additional experiments (dry heat laboratory oven exposures, off-gassing, and FFR hydrophobicity) were subsequently conducted to better understand material properties and possible health risks to the respirator user following decontamination. However, this study did not assess the efficiency of the decontamination methods to inactivate viable microorganisms. Microwave oven irradiation melted samples from two FFR models. The remainder of the FFR samples that had been decontaminated had expected levels of filter aerosol penetration and filter airflow resistance. The scent of bleach remained noticeable following overnight drying and low levels of chlorine gas were found to off-gas from bleach-decontaminated FFRs when rehydrated with deionized water. UVGI, ethylene oxide (EtO), and VHP were found to be the most promising decontamination methods; however, concerns remain about the throughput capabilities for EtO and VHP. Further research is needed before any specific decontamination methods can be recommended.

**Database:** Medline

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**Non-English Language**

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1. **Rationeel gebruik van ademhalingsbeschermingsmaskers: Adviezen voor zorgverleners in tijden van COVID-19 *[Rational use of respiratory protective equipment: Advice for health care professionals in time of COVID-19]***

**Author(s):** Voss A.; Martens L.; Hopman J.; Wertheim H.; van Mansfeld R.; Veldkamp K.E.; Kluytmans J.

**Source:** Nederlands Tijdschrift voor Geneeskunde; Apr 2020; vol. 164 (no. 17)

**Publication Date:** Apr 2020

**Publication Type(s):** Article

**PubMedID:** 32395962

**Language:** Dutch

**Abstract:** The current COVID-19 pandemic has led to a worldwide shortage of respiratory protective equipment. In order to offer maximum protection against infection for all healthcare workers, we need to optimise our use of the available equipment. This article provides practical advice on which type of mask is indicated in what specific situation, what requirements the mask should meet and how to optimise the local workflow, including the re-use of masks after decontamination.

**Database:** EMBASE

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**Databases searched:**

* + **Evidence-Based Reviews:** The Cochrane Library.
  + **Guidance:** Selected International Guidelines
  + **Healthcare Databases:** MEDLINE, EMBASE, CINAHL, EMCARE, PubMed.
  + **Other:** Google, medRxiv, Public Health England.

**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*** |
| \*CLEANING/ | clean\* |
| "CLEANING COMPOUNDS"/ | decontamin\* |
| DECONTAMINATION/ | decontamination |
| "DECONTAMINATION, HAZARDOUS MATERIALS"/ | FFP3 mask\* |
| exp DETERGENTS/ | mask\* |
| "EQUIPMENT REUSE"/ | reprocess\* |
| exp MASKS/ | reprocessing |
| exp "PERSONAL PROTECTIVE EQUIPMENT"/ | reuse |
| exp STERILIZATION/ |  |
| exp "STERILIZATION AND DISINFECTION"/ |  |

**Search Limits:** English Language

**Search Date:** 20/05/2020

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