Coronavirus Disease 2019 (COVID-19)

Operational Considerations for Personal Protective Equipment in the Context of Global Supply Shortages for Coronavirus Disease 2019 (COVID-19) Pandemic: non-US Healthcare Settings

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The Centers for Disease Control and Prevention (CDC) is working closely with international partners to respond to the coronavirus (COVID-19) pandemic. CDC provides technical assistance to help other countries increase their ability to prevent, detect, and respond to health threats, including COVID-19.

This document is provided by CDC and is intended for use in non-US healthcare settings.

Alert: CDC does not recommend or endorse any strategies for personal protective equipment (PPE) use that differ from standard infection prevention and control (IPC) practice.

In times of crisis and global supply shortages, emergency strategies are temporary approaches for consideration. However, efforts to scale up rapid production of PPE should be prioritized.

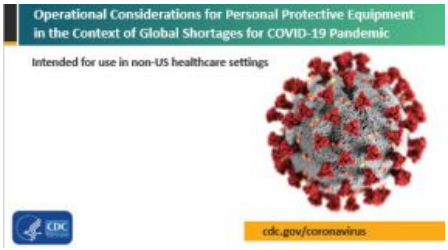
Purpose and scope of this document:

This document provides specific operational considerations that healthcare settings and healthcare authorities can review in the context of global supply shortages of personal protective equipment (PPE), to help with decision making in order to provide needed surge capacity during the COVID-19 response.

This document draws from CDC strategies for US-healthcare settings on COVID-19: Strategies for Optimizing the Supply of PPE | CDC and includes potential strategies that

Training Slides

This slide deck is a reference for content on this page and can be used for training.



may be considered in non-US contexts.

This document should be reviewed alongside WHO's guidance on the Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19) which defines strategies to optimize the availability of PPE and options for temporary measures during severe shortage of PPE.

High-level and continued efforts will be needed to maintain and scale-up the PPE supply chain to ensure availability of PPE in healthcare settings where it is needed, to avoid supply shortages, and allow adherence to IPC standard practice.

> *Wherever possible*, emergency PPE strategies should not be used in hospital wards housing severe or critically ill patients with COVID-19, as well as those with known co-infections of multi-drug resistant or other organisms transmitted by contact (e.g., *Klebsiella pneumoniae*) or droplet (e.g., influenza virus).

Consideration of these strategies assumes that:

- Facilities are in communication with local public health partners such as public health emergency preparedness and response staff and sub-national and national authorities regarding identification of additional supplies.
- Facilities understand their inventory and utilization rate – see: Personal Protective Equipment (PPE) Burn Rate Calculator | CDC
- Facilities have already implemented other engineering and administrative control measures for patients with COVID-19, including:
  - Reducing or cancelling elective surgical procedures and non-critical/ non-urgent outpatient visits
  - Reducing face-to-face healthcare worker (HCW) encounters with patients
  - Limiting the number of visitors to healthcare facilities
  - Cohorting patients and HCWs
- Facilities have provided HCWs with required education and training, including having them demonstrate competency in donning and doffing with all PPE required for direct care of patients with COVID-19 and other job functions – see: WHO | HOW TO

PUT ON AND TAKE OFF Personal Protective Equipment (PPE)

Structure of the document:

This document is organized by the type of PPE indicated for use in direct clinical care of suspected or confirmed patients with COVID-19. Medical masks, gowns and eye protection are addressed within this document, due to widespread supply shortages. Respirators are only described briefly, with references to other sources of information where available. Finally, examination gloves are not addressed within this document; the use of examination gloves should always adhere to standard IPC practice.

For each type of PPE, a brief description is provided as well as **operational considerations** under each of several potential strategies for scenarios of:

1. **Limited supplies:** where recommended PPE for direct clinical care is still available, but the supply is insufficient to enable full adherence to standard IPC practice. Strategies to *conserve supplies* under this scenario include:
    - **Extended use:** by one HCW among multiple patients with COVID-19 (one donning and doffing)
    - **Reuse:** by one HCW among multiple patients with COVID-19 (multiple donning and doffing)

2. **No PPE available:** where recommended PPE for direct clinical care is NOT available, in the context of acute supply shortages. Strategies under this scenario include **potential alternatives** to recommended PPE **as a last resort** during a crisis where standard PPE is not available.

These strategies are generally listed according to priority for consideration; for example, extended use strategies should generally be considered prior to reuse strategies.

These strategies largely mirror the temporary measures laid out in Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19) **, as well as additional strategies that may be utilized in some contexts.**

This is an interim document and information provided will be updated as new data sources become available.

General Strategies:

Considerations in the context of limited supplies:

Using reusable PPE where options exist such as cloth gowns and reusable goggles.

- If this strategy is adopted:
    - Manufacturer's instructions for reprocessing including cleaning and disinfecting should be followed and support staff augmented as needed to ensure that

equipment is reprocessed after each use.

- Systems should be established to 1) routinely inspect, 2) maintain by such means as replacing missing fastening ties, and 3) replace reusable PPE when they are damaged, such as when gowns become thin or ripped (upon which time they should be disposed).

Using PPE beyond the manufacturer-designated shelf life or expiration date for a limited time.

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - The items should be inspected prior to use to be sure they are in good condition with no degradation, tears, or wear that could affect performance.

PPE-Specific Strategies:

Medical Masks

Medical masks (also known as surgical masks or medical facemasks): *Medical masks reduce the transfer of saliva and respiratory droplets to others and help block blood and other potentially infectious materials from the skin, mouth, or nose of the wearer. Medical masks may or may not have some level of fluid-resistance and do not seal tightly to the wearer's face. They have multiple layers of different nonwoven fabric materials, which are fused together. They are available in different thicknesses and with different ability to protect from contact with splashes and droplets. They are designed for single-use and will deteriorate with prolonged use, exposure to moisture and exposure to standard levels of disinfection such as chemicals, heat, and radiation. EU MDD Directive 93/42/EEC Category III or equivalent, EN 14683 Type II, IIR, ASTM F2100 minimum Level 1 or equivalent are indicated for use for direct clinical care of patients with COVID-19.*

1) Limited Supplies

Extended use: *Extending use of medical masks for one HCW to use on multiple patients with COVID-19 (multiple single-rooms when seen in succession or cohort of patients) during a single shift.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - If the mask becomes moist, damaged, visibly soiled, or difficult to breathe through it should be removed using appropriate technique and disposed following local protocols.
  - If the mask is removed for any other reason such as taking a break or completing a shift, it should be disposed of following local protocols.
  - The potential number of hours of extended use would be dependent on local and individual factors such as humidity and shift length. In practice, this would likely be a maximum of six hours.

    - **This emergency strategy (extended use) should be prioritized over reuse or any other approaches.**

Reuse: *Reprocessing and reusing medical masks for one HCW to use on multiple patients with COVID-19 for a limited time-period (multiple shifts).*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
    - It would be important to establish standardized methods and protocols for ensuring the effectiveness of the process and that the integrity of the medical mask is maintained after reprocessing.
    - It would be important to closely inspect the mask prior to each reuse, given that the number of times a medical mask could potentially be reprocessed is unknown, and it is expected that the masks would quickly deteriorate. Some medical masks may not be able to be reused such as those that fasten to the provider via ties (and may not be able to be undone without tearing).
    - If the mask becomes damaged, soiled or difficult to breathe through, it should be removed from circulation and disposed following local protocols.
- **Note: The effectiveness of reprocessing methods to inactivate coronavirus (or other enveloped virus) on a medical mask and on preserving the integrity of the mask has not been established to date.**
- **Note:** Many potential reprocessing methods are resource-intensive and may not be feasible in many low- and middle-income countries nor at a facility-level (Darnell et al, 2004; Feldmann et al, 2019).
- **Note:** See respirator section below for additional data on potential reprocessing methods for respirators.

2) No Medical Masks Available

Potential alternatives: *Using 1) a face shield only or 2) a combination of a non-medical, approved fabric mask and face shield.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
    - It would be important to take into consideration the limited ability of face shields to fully protect against droplets and the lack of evidence on effectiveness of non-medical fabric masks against respiratory viruses (Institute of Medicine, 2006).
    - Efforts should be made to obtain standardized masks made of fabrics that are approved by national or sub-national authorities and offer some level of filtration as well as a hydrophobic outer layer to allow some level of fluid resistance.
    - Given the uncertain effect of reprocessing on the integrity of a non-medical fabric mask, the masks should be removed using appropriate technique for disposal following local protocols whenever needed such as when they become moist, visibly soiled, or damaged and upon exiting the isolation area per standard practice.
- **Note: Non-medical fabric masks are not considered PPE and their ability to**

protect HCWs is currently unknown; some studies suggest that it may lead to a false sense of protection and even increase influenza-like illness relative to wearing a medical mask (MacIntyre et al, 2015). Caution should be exercised when considering this option.

Gowns

Gowns: *Non-sterile, long-sleeved hospital gowns (isolation gowns or surgical gowns) are indicated for use for direct care of patients with COVID-19. These are available in both disposable and reusable options. Disposable gowns are generally made of a spun bound synthetic material. Reusable (washable) gowns are typically made of cotton or cotton-blend fabrics; gowns made of these fabrics can be safely laundered and reused if they are in good condition.*

1) Limited Supplies

Extended use: *Extending the use of gowns (disposable or reusable options) for one HCW to use on multiple patients with COVID-19 (multiple single-rooms when seen in succession or cohort of patients) during a single shift.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - If it becomes visibly soiled, the gown must be removed using appropriate technique for reprocessing (*See reprocessing guidance below*) or disposal following local protocols (followed by appropriate donning of a new gown).
  - If it is removed for any other reason such as taking a break or completing a shift, the gown should be sent for reprocessing or disposed of following local protocols
- **Note: this emergency strategy (extended use) should be prioritized over the use of alternatives.**

Method	Product(s)	Process	Additional considerations
Commercial/ industrial laundry machines	Laundry detergents	Follow instructions from the washer/dryer manufacturer. Use hot water (70–80°C X 10 min) [158–176°F]) and an approved laundry detergent. Dry linens completely in a commercial dryer.	Gowns with small holes, tears, or missing fastening ties need to be mended and those that are thin or ripped need to be discarded.

Manual laundering	Laundry detergent Hospital disinfectant	1. Clean by immersing in detergent and hot water solution and use mechanical action (scrubbing) to remove soil. 2. Soak in a 0.05% chlorine solution for approximately 30 minutes after cleaning with detergent and water. 3. Rinse with clean water to remove residue. 4. Allow to fully dry, ideally in the sun.	Laundry staff should wear reusable rubber gloves, gowns or aprons and face protection (face shield and goggles) when manually laundering gowns.

For additional reprocessing guidance for reusable gowns, see: Environmental Cleaning in Resource-Limited Settings | HAI | CDC

2) No Gowns Available

Potential alternatives:

- Disposable aprons
- Disposable laboratory coats
- Reusable (washable) patient gowns, reusable (washable) laboratory coats
- Combinations of clothing such as sleeve covers in combination with aprons and long sleeve patient gowns or laboratory coats

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - The selection of potential alternatives should take into consideration the availability of these alternatives and their attributes, such as impermeability and user comfort, and whether enough are available to allow frequent replacement.
  - The alternatives should be removed using appropriate technique for either reprocessing or disposal following local protocols whenever needed such as when they become (e.g., when moist, visibly soiled, or damaged) and upon exiting the isolation area following standard practice.

Eye Protection

Goggles: *Goggles provide barrier protection for the eyes. They should fit tightly over and around the eyes or personal prescription lenses, be indirectly vented (to prevent penetration of splashes or sprays) and have an anti-fog coating to help maintain clarity of vision. The lens is made of plastic, commonly polycarbonate, and there is an adjustable elastic strap to allow snug fit around the eyes. Goggles used for healthcare applications are typically reusable.*

***Face shields**: Provide barrier protection to the facial area and related mucous membranes (eyes, nose, lips) and are considered an alternative to goggles. Face shields are not meant to function as primary respiratory protection and should be used concurrently with a medical mask (for droplet precautions) or a respirator (for airborne precautions) if aerosol-generating procedure is performed. They should cover the forehead, extend below the chin, and wrap around the side of the face. Face shields are available in both disposable and reusable options.*

1) Limited Supplies

Extended use: *Extending the use of goggles or face shields (disposable or reusable) for one HCW to use on multiple patients with COVID-19 (multiple single-rooms when seen in succession or cohort of patients) during a single shift.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - If eye protection becomes visibly soiled, it should be removed using appropriate technique and sent for reprocessing or disposal following local protocols (followed by appropriate donning of a new set of eye protection) before moving to another patient.
  - If eye protection is removed for any other reason such as taking a break or completing a shift, it should be sent for reprocessing or disposed following local protocols.

Reuse:

A. *Reprocessing and reusing disposable face shields for one HCW to use on multiple patients with COVID-19 for a limited time-period (multiple shifts).*

- This strategy is not consistent with best practices and therefore not recommended, but if adopted:
  - A face shield should be **dedicated to one HCW.**
  - They should be immediately reprocessed when they are visibly soiled, whenever they are removed such as when leaving the isolation area, and at least daily (after every shift) prior to putting them back on (S*ee reprocessing guidance below*).
  - After reprocessing, a face shield should be stored in a transparent plastic container and **labeled with the HCW name** to prevent accidental sharing between HCW.
- **Note:** The number of times a disposable face shield could potentially be reprocessed is unknown; therefore, face shields should be closely examined prior to each reuse to ensure the integrity of the foam pad, elastic strap, and clarity of the visor.

B. *Dedicating a supply of reusable goggles or face shields to an isolation area (with one or more patients with COVID-19 in single-rooms or a cohort of patients) for multiple HCWs to use throughout one shift.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:

- Items should be **reprocessed after each use** and stored at the entry to the isolation area, in **a dedicated area equipped for reprocessing adjacent to the isolation area** (dirty and clean storage area) (S*ee reprocessing guidance below*).

Type of equipment	Reprocessing steps	Disinfectant Product Options	Considerations / Additional Guidance
Disposable face shield	1. Carefully wipe the *inside* and then the *outside* of the visor using a clean cloth saturated with neutral detergent solution, rinse if needed. 2. Carefully wipe the *outside* of the visor using a clean cloth or wipe saturated with hospital disinfectant solution; be sure it remains wet for the required contact time. 3. Wipe the outside of visor with clean water to remove residue. 4. Fully dry (air dry or use clean absorbent towels).	Chlorine-based disinfectant (0.1% chlorine solution) recommended over alcohol, as alcohol may damage and discolor plastic and deteriorate glues over time; note that it may also remove anti-glare and anti-fogging properties of the face shield. See guidance on how to prepare 0.1% chlorine solution .	The emphasis of reprocessing should be on the outside of the visor. Carefully avoid the foam cushion and elastic strap as they may not be tolerant to disinfectants. **Note:** If reprocessing disposable face shields on a time-limited basis, they should be **dedicated to one HCW.**

Reusable goggles or face shield	1. Immerse in or wipe with neutral detergent and warm water solution, use mechanical action to remove any visible soiling, then quickly rinse with clean water; rinse if needed. 2. Immerse in or wipe with hospital disinfectant solution for the required contact time. 3. Rinse with clean water (sink if available or by immersing in a bucket of clean water) to remove any residue. 4. Fully dry (air dry or use clean absorbent towels).	Manufacturers should be consulted for their guidance and experience in disinfecting their respective products.	Chlorine-based disinfectant (0.1% chlorine solution) recommended over alcohol as alcohol may damage and discolor plastic and deteriorate glues over time; note that it may also remove anti-glare and anti-fogging properties of the eye protection. **Note:** Solutions must be regularly replaced as they will quickly become contaminated. See guidance on how to prepare 0.1% chlorine solution.

2) No Goggles or Face Shields Available

Potential alternatives: *Using safety glasses such as trauma glasses*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - The selection of potential alternatives should include those that have extensions to cover the side of the eyes.

Procedure-specific PPE:

Respirators

Respirators: *Provide protection against inhalation of very small infectious airborne particulates using a filtering facepiece respirator (FFR). N95, FFP2, P2 or equivalent standard particulate respirators are indicated for use in patients with COVID-19.*

1) Limited Supplies

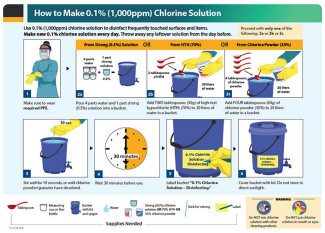
Extended use: *Extending use of FFRs for one HCW to use on multiple COVID-19 patients (multiple single-rooms when seen in succession or cohort of patients) during a single shift.*

- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - Consult published documents on this strategy:
    - https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy/contingency-capacity-strategies.html
    - https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
    - https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPPE_use-2020.1-eng.pdf
  - The potential number of hours of extended use would be dependent on local and individual factors such as humidity and shift length. In practice, this would likely be a maximum of six hours.

Reuse: *Reprocessing and reusing FFRs for one HCW to use for a limited time-period (multiple shifts).*

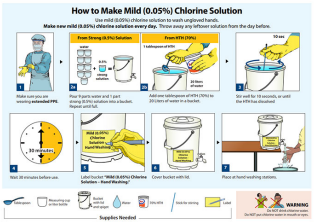
- This strategy is not consistent with standard practice and therefore not recommended, but if adopted:
  - Consult the published summary of the research on potential methods for this strategy (COVID-19 Decontamination and Reuse of Filtering Facepiece Respirators | CDC)
  - If the respirator becomes damaged, soiled or difficult to breathe through, it should be removed from circulation and disposed following local protocols.
- **Note:** At present, there are no CDC and/or NIOSH-approved methods for FFR decontamination prior to reuse.
- **Note:** Many of the most promising methods are resource-intensive and may not be feasible in many low- and middle-income countries.

How to Make Chlorine Solution



How to Make 0.1% (1,000ppm) Chlorine Solution (English) [1 page]

How to Make 0.1% (1,000ppm) Chlorine Solution (French) [1 page]



How to Make Mild (0.05%) Chlorine Solution [1 page]

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