



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.



Training Slides

[Operational Considerations for Personal Protective Equipment in the Context of Global Shortages for COVID-19 Pandemic](#)  [2 MB, 34 slides] | [PDF](#)  [420 KB, 34 pages]

Summary of Recent Changes



Updates as of October 12, 2021 

- Deleted the strategy of reprocessing and reuse of medical masks
- Deleted the use of face shield only as an emergency strategy when no medical masks are available
- Added language to the section on extended use of gowns
- Deleted the reuse strategy of dedicating a supply of goggles/face shields to an isolation area when supplies are limited
- Deleted the strategy of reprocessing and reuse of filtering facepiece respirators (FFR)
- Added the use of potential respirator alternatives when no N95, FFP2, P2 or equivalent standard particulate respirator available

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](#) and includes potential strategies that may be applicable 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 \(COVID-19\)](#)  [762 KB, 28 Pages]  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.

Key Points:

- 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, and allow adherence to infection prevention and control (IPC) standard practice.
- The emergency PPE strategies discussed in this document are not consistent with standard practice and therefore not recommended when avoidable. When needed, they should be implemented for the most limited time possible.
- Whenever possible, emergency PPE strategies should not be used in hospital wards housing severe or critically ill patients with COVID-19, and 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 healthcare facility operators and administrators

- Communicate with local public health partners, such as public health emergency preparedness and response staff and sub-national and national authorities, to identify additional PPE supplies.
- Know their inventory and utilization rate – see: [Personal Protective Equipment \(PPE\) Burn Rate Calculator](#)
- Implement other engineering and administrative control measures for patients with COVID-19, including:
 - Using physical barriers and other engineering controls
 - Reducing face-to-face healthcare worker (HCW) encounters with patients, such as through telemedicine
 - Limiting the number of visitors to healthcare facilities
 - Cohorting patients and HCWs
 - Reducing or cancelling elective surgical procedures and non-critical/non-urgent outpatient visits
- Provide education and training, including having them demonstrate competency in donning (putting on) and doffing (taking off) with all PPE required for direct care of patients with COVID-19 and other job functions – see: [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. The strategy under this scenario is to use **alternative protection** to recommended PPE **as a last resort** during a crisis.

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

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:
 - Support staff should ensure that equipment is reprocessed after each use, following manufacturer's instructions for cleaning and disinfecting.
 - Support staff should be augmented as needed to ensure that equipment is reprocessed after each use.
 - Systems should be established to 1) routinely inspect, 2) maintain (e.g., replace missing fastening ties), and 3) replace reusable PPE when they are damaged (e.g., when gowns become thin or ripped, they should be disposed).

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

- If this strategy is 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.*

- If this strategy is 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.

2) No Medical Masks Available

Use of alternative protection: *Using a combination of a non-medical, validated fabric mask and face shield.*

- If this strategy is adopted:
 - Consult published guidance on essential parameters (minimum and preferred thresholds) for manufactured non-medical fabric masks:
 - [Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus \(COVID-19\) outbreak \(who.int\)](#) 
 - [ASTM Standards & COVID-19](#) 
 - Given the uncertain effect of reprocessing on the integrity of a non-medical fabric mask, the masks should be disposed following local protocols whenever needed, such as when they become moist, visibly soiled, or damaged, and when the HCW exits the isolation area.
- **Note: Non-medical fabric masks are not considered PPE and are not regulated.** 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.*

- If this strategy is 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 strategy can be considered only if there are no additional co-infectious diagnoses transmitted by contact (such as *Clostridioides difficile*, *Candida auris*) among patients.

Reprocessing Guidance for Gowns

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	1. Clean by immersing in detergent and hot water solution and use mechanical action	Laundry staff should wear reusable rubber gloves

laundrying	detergent Hospital disinfectant	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.	reusable rubber gloves, gowns or aprons and face protection (face shield and goggles) when manually laundrying gowns.
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For additional reprocessing guidance for reusable gowns, see: [Environmental Cleaning in Resource-Limited Settings](#)

2) No Gowns Available

Use of alternative protection (in order of priority):

- Disposable laboratory coats
- Reusable (washable) patient gowns, reusable (washable) laboratory coats
- Disposable aprons
- Combinations of clothing such as sleeve covers in combination with aprons and long sleeve patient gowns or laboratory coats
- If this strategy is 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 for either reprocessing or disposal following local protocols whenever needed, such as when they become when moist, visibly soiled, or damaged and when the HCW exists the isolation area.
- **Note:** Augment laundry operations and increase personnel as needed to accommodate additional washing loads and cycles. Additionally, systems should be established to routinely inspect, maintain (e.g., mend a small hole in a gown, replace missing fastening ties) and replace reusable gown alternatives when needed (e.g., when they are thin or ripped)


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 reusable and therefore it is standard practice to reprocess and reuse them.**

Face shields: 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). 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.*


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

- If this strategy is 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 the HCW leaves the isolation area, and at least daily (after every shift) prior to putting them back on (See *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.

Reprocessing Guidance for Eye Protection

Type of equipment	Reprocessing steps	Disinfectant Product Options	Considerations / Additional Guidance
Disposable face shield	<ol style="list-style-type: none"> 1. Carefully wipe the <i>inside</i> and then the <i>outside</i> of the visor using a clean cloth saturated with neutral detergent solution, rinse if needed. 2. Carefully wipe the <i>outside</i> 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). 	<p>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.</p> <p>See guidance on how to prepare 0.1% chlorine solution  [412 KB, 1 Page].</p>	<p>The emphasis of reprocessing should be on the outside of the visor.</p> <p>Carefully avoid the foam cushion and elastic strap as they may not be tolerant to disinfectants.</p> <p>Note: If reprocessing disposable face shields on a time-limited basis, they should be dedicated to one HCW.</p>
Reusable goggles or face shield	<ol style="list-style-type: none"> 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). 	<p>Manufacturers should be consulted for their guidance and experience in disinfecting their respective products.</p>	<p>Chlorine-based disinfectant (0.1% chlorine solution) recommended over alcohol as alcohol may damage and discolor plastic and deteriorate glue over time; note that it may also remove anti-glare and anti-fogging properties of the eye protection.</p> <p>Note: Solutions must be regularly replaced as they will quickly become contaminated.</p>

See guidance on how to prepare 0.1% chlorine solution.

2) No Goggles or Face Shields Available

Use of alternative protection: *Using safety glasses such as trauma glasses.*

- If this strategy is adopted:
 - The selection of potential alternatives should include those that have extensions to cover the side of the eyes.



Procedure-specific PPE:

Respirators

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 (when seen in succession) 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:
 - Strategies for Optimizing the Supply of N95 Respirators
 - Pandemic Planning
 - Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19)
 - 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.
- If this strategy is adopted:
 - Consult published documents on this strategy:
 - [Strategies for Optimizing the Supply of N95 Respirators](#)
 - [Rational use of personal protective equipment for coronavirus disease 2019 \(COVID-19\)](#)  
 - 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.

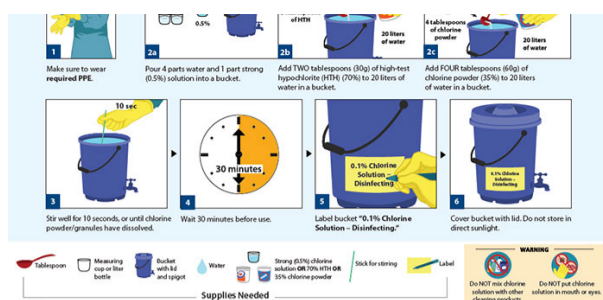
2) No N95, FFP2, P2 or equivalent standard particulate respirators available

Use of alternative protection: *Using elastomeric half-mask and full facepiece air purifying respirators, and powered air purifying respirators (PAPRs).*

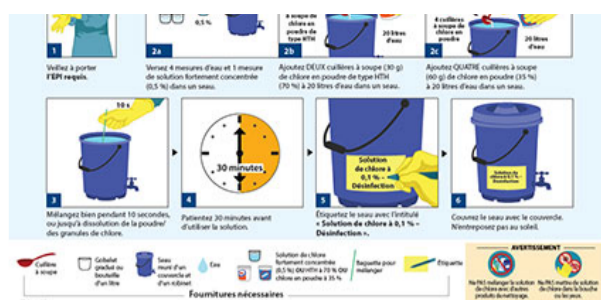
- If this strategy is adopted:
 - Consult published guidance on this strategy:
 - [Strategies for Optimizing the Supply of N95 Respirators](#)
 - [Rational use of personal protective equipment for coronavirus disease 2019 \(COVID-19\)](#)  

How to Make Chlorine Solution

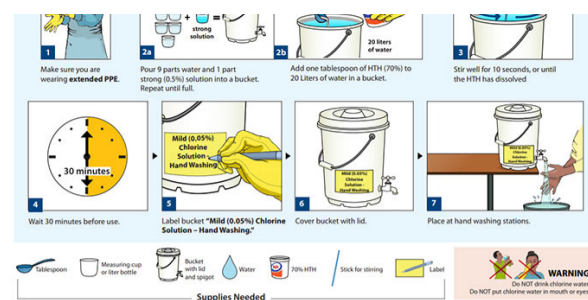




How to Make 0.1% (1,000ppm) Chlorine Solution (English) [412 KB, 1 page]



How to Make 0.1% (1,000ppm) Chlorine Solution (French) [412 KB, 1 page]



How to Make Mild (0.05%) Chlorine Solution [994 KB, 1 page]

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