Rational use of personal protective equipment for COVID-19 and considerations during severe shortages

Interim guidance

23 December 2020

World Health Organization

This fourth edition of the *Rational use of personal protective equipment for COVID-19 and considerations during severe shortages* interim guidance, which was last published on 6 April 2020, includes:

- Updated strategies for optimizing personal protective equipment (PPE) use by health workers caring for patients with suspected, probable, and confirmed COVID-19
- New options for gloves and respirators
- Updated advice regarding PPE reuse by health workers as a strategy that should be avoided
- Updated section describing PPE recommendations for health workers based on the transmission scenario, setting, and activity (Annex 1)
- Updated section describing PPE decontamination/ reprocessing considerations (Annex 2)

Key points

Recommendations:

- WHO recommends: contact and droplet precautions to be applied during care for patients with suspected, probable, and confirmed COVID-19. Additionally, airborne precautions are recommended to be applied during aerosol generating procedures.
- WHO does not recommend: PPE reuse (donning of a used PPE item without decontamination/ reprocessing), use of gloves in settings where they are not needed, wearing a medical mask over a respirator, or the use of non-medical masks as an alternative to medical masks or respirators.

Strategies during shortages:

- Where shortages in PPE supply are forecasted to impact the safety and sustainability of health care delivery, the use of PPE in health care settings where patients with COVID-19 are cared for must be optimized:
  - Optimize the use of PPE through care planning; bundling activities and using alternatives to face-to-face interactions where quality of care can be maintained.
  - Use PPE items according to the transmission risk; standard and transmission-based precautions should be accordingly applied when providing care to patients.
  - Expand PPE availability by evaluating PPE items tested to functionally equivalent international standards.

Temporary strategies during severe shortage:

- In situations where there is a severe PPE shortage or anticipated stockout and when strategies for optimizing available PPE use have been implemented, consider temporary stand-alone or combination measures to maximize the use of available supplies:
  - extended PPE use (using PPE items for longer than normal or for multiple patient encounters)
  - reprocessing PPE (using previously worn PPE after decontamination or reprocessing methods)
  - alternative PPE items (using non-standardized or repurposed products as PPE items).

Introduction

Ongoing worldwide efforts to increase the scale of manufacturing and distribution mechanisms in the global supply chain for PPE have improved since the onset of the COVID-19 public health emergency (1). However, global PPE shortages impacting health worker safety and the sustainability of essential health services remain (2-5).

This guidance is intended for public health authorities and organizations involved in decisions regarding PPE use and prioritization for health workers, such as Infection Prevention and Control and Occupational Health and Safety focal points, health care managers and individuals responsible for coordinating distribution and management of PPE.

The success of any modification to conventional PPE use strategies depends on the availability of adequate human resources (6), training (7-14), institutionally supported IPC and occupational health and safety measures (15-17) and consistent evaluation of the safety of a health service setting (18-20). Accompanying administrative and environmental/ engineering controls which reduce the risk of SARS-CoV-2 transmission in health settings, as well as setting-specific guidance are described in detail in other WHO technical resources.

This document includes operational advice for the use of PPE in the context of COVID-19 and is complimentary to other technical resources used for the selection and procurement of PPE items, including; WHO's *Technical specifications of personal protective equipment for COVID-19* (21), WHO's *COVID-19 Essential Supplies Forecasting Tool* (22), and for PPE items supplied through the UN COVID-19 Supply Chain System (CSCS) Supply Portal (23).

Methodology for developing this guidance

Recommendations included in this document are based on published WHO guidelines (24-26). Strategies and practical interim guidance included in this document have been developed through evaluation of emerging literature, country experiences, and expert opinions presented and discussed at the WHO ad hoc COVID-19 Infection Prevention and Control Guidance Development Group (COVID-19 IPC GDG), and the WHO Technical Advisory Group of Experts on PPE (see acknowledgement section).

During emergencies WHO publishes interim guidance, the development of which follows a transparent and robust process of evaluation of the available evidence on benefits and harms (specifically, outcomes of infection). This evidence is evaluated through expert consensus building through weekly consultations, and, when necessary, followed up by surveys. This process also considers potential resource implications, values and preferences, feasibility, equity, and ethics. Draft guidance documents are reviewed by the COVID-19 IPC GDG and an external panel of experts prior to publication.

Infection prevention and control practices

All health workers and caregivers must receive adequate training in infection prevention and control practices including risk assessment (7, 24), standard and transmission-based precautions (8-10, 25), WHO 5 Moments for Hand Hygiene (11, 26), donning and doffing of personal protective equipment (12) and waste management (13, 27) to ensure that PPE is utilized effectively where indicated and does not become a source of contamination to the wearer. Competencies among users of PPE in appropriate procedures for donning and doffing, and other occupational health and safety measures required when caring for patients with COVID-19 should be reviewed regularly (14).

The use of droplet and contact precautions (medical masks, gowns, gloves, eye protection) (24) are recommended for all health workers when caring for patients with suspected, probable, or confirmed COVID-19 (15). When performing aerosol generating procedures, WHO recommends airborne and contact precautions (15, 28). Universal masking and targeted continuous use of medical masks are recommended in specific transmission scenarios; WHO's current guidance is provided in *Mask use in the context of COVID-19* (29).

Where care is provided to patients isolated for suspected or confirmed infections, transmission-based precautions should be known to all health workers who will be providing care or interacting with the patient environment (25). Decision-making when planning which PPE items are worn in the patient environment must encompass appropriate risk assessment specific for tasks, their duration and the level of body fluid exposure that may be experienced (24, 25).

Appropriate storage of clean PPE and regular environmental cleaning of all areas in which PPE donning and doffing are performed is essential for effective use and reducing the risk of contaminating clean PPE and self-contamination during doffing procedures (30). PPE donning areas should be appropriately cleaned and have availability of hand hygiene supplies (34). Places where PPE is doffed should ideally be separate from donning areas, have hand hygiene accessibility and clearly posted instructions for disposal of PPE (19). Areas where PPE is doffed may become rapidly contaminated with SARS-CoV-2 (31) and should be prioritized for frequent cleaning and disinfection (32).

Hand hygiene should be performed prior to donning PPE and performed again whenever PPE is manipulated during care provision (36). Care should be taken so that proper PPE fit is achieved during the donning process for comfort and protection and to avoid manipulating PPE after donning. Gloves should be doffed and discarded in order to perform hand hygiene if worn during any of WHO's 5 moments for hand hygiene and replaced with new gloves if necessary to continue providing care (26).

Strategies during PPE shortages

PPE must be prioritized for health workers and caregivers at local, national, and international levels where shortages threaten health worker safety in the delivery of essential health services. In view of continued global PPE shortages, strategies that can facilitate optimizing PPE use in health care facilities include: minimizing the use and frequent changing of PPE, ensuring rational and appropriate use of PPE, and optimizing PPE supply chain management mechanisms to increase procurement options.

WHO strongly advises operational planning for strategies used during PPE shortages to be conducted well in advance of an anticipated impact to health care delivery. Health workers and patient advocacy groups should be provided opportunity to collaborate with decision makers when selecting strategies to be used locally (33, 34). Standard operating procedures are advised to incorporate inventory management and forecasting processes which define local/institutional escalation strategies to use during shortages, severe shortages, and stockouts.

Optimize PPE use

In areas experiencing PPE shortages, the following interventions introduced to a health setting (stand-alone or in combination), can optimize the availability of PPE for direct care of patients with COVID-19 while ensuring protection of health workers from exposure to SARS-CoV-2 (35).

- Wherever feasible and appropriate, consider alternatives to face-to-face outpatient visits using virtual consultations, such as through telemedicine, to provide clinical support without direct contact with the patient (36).
- Use physical barriers, including glass or plexiglass screens that extend above the head of all standing occupants when performing screening (37), observational windows or transparent curtains in critical care settings (38) and fluid-resistant privacy curtains separating patients on wards (39).
- Cohort patients with COVID-19 (who have no co-infection with other healthcare transmissible pathogens) in the same room and designate dedicated health workers/teams to care exclusively for these patients to streamline clinical workflow and facilitate extended use of PPE if needed (24).

- Restrict the number of health workers entering the rooms of patients with COVID-19 if they are not involved in providing essential care. For example, consider bundling care activities to minimize the number of times a room is entered by checking vital signs during medication administration or having food delivered by health workers while they are performing other care activities.
- Ensure health workers perform risk assessment for appropriate PPE selection according to whether physical distancing can be maintained or if there will be direct contact with the patient and their environment. For example, wearing a medical mask and not gloves, gowns, or eye protection when entering a patient's room briefly to ask a question or perform a visual check.
- In areas of known or suspected community or cluster SARS-CoV-2 transmission, traffic of visitors should be limited in inpatient health care settings, but when necessary, restrict the number of visitors and the time allowed. Provide clear instructions about what PPE is required during the visit, how to put on and remove PPE, enforce/audit the frequent performance of hand hygiene and consider escorting the visitor in and out of the health setting as appropriate.

Ensure rational and appropriate PPE use

The indications for PPE should be based on the setting, target audience, risk of exposure (e.g. type of activity) and the transmission dynamics of the pathogen (e.g. contact, droplet, or airborne).

- The type of PPE required when caring for patients with suspected or confirmed COVID-19 will vary according to the transmission setting, type of personnel and the activity performed (see Annex I for an expanded list of PPE by activity and transmission scenario).
- The use of transmission-based precautions (contact/droplet/airborne) and their associated isolation measures should be applied appropriately when patients are infectious (30) and can be stopped when no longer necessary in the care of a patient (40).
- Coveralls, double layering of gloves or gowns, shoe protection or head covers (hoods) that cover the head and neck used in the context of filovirus disease outbreaks (e.g. Ebola virus) are not required when caring for patients with COVID-19.

Coordinate PPE supply chain management mechanisms

The management of PPE should be coordinated through essential national and international supply chain management mechanisms that include:

- monitoring the end-to-end distribution of PPE to anticipate shortages at the facility and supplier level
- using PPE forecasting tools based on rational quantification models to ensure the volume of requested PPE items is proportional to the demand and use in the facility (21, 41)
- monitoring and controlling a centralized PPE procurement channel for countries and response efforts
- procuring supplies which have manufacturer and associated certification body approvals to withstand reprocessing where feasible
- promoting a centralized request management approach to avoid duplication of stock and ensuring strict adherence to essential stock management rules to limit waste, overstock, and stock ruptures
- monitoring and controlling the distribution of PPE from medical facilities stores
- monitoring and controlling waste management streams and appropriate processes for discarding used PPE (27, 42).

Stringent regulatory standards for PPE specifications and testing criteria used in local procurement processes may restrict available supply options. Given the global nature of current shortages of PPE, WHO's Technical Advisory Group of Experts on Personal Protective Equipment have evaluated regional and international standard specifications to facilitate the procurement of PPE that meets functional and protective criteria for use when caring for patients with COVID-19. International standards which meet functional equivalency for each type of PPE item are included in WHO's *Technical specifications of personal protective equipment for COVID-19: interim guidance* (22). A summary list by type and standard is outlined in WHO's *COVID-19 Disease Commodity Package* (43). These documents do not supersede local standards and regulations for the manufacturing and technical evaluation of PPE but may be consulted for procurement options from available global supply networks.

Temporary strategies during severe PPE shortages

Based on current evidence, in consultation with international experts and other agencies in the field of IPC, WHO and partners have carefully considered **last-resort temporary measures** in crisis situations to be adopted **only** when there is an anticipated PPE shortage that will adversely affect health worker safety and care delivery or in areas where access to the global supply chain of PPE remains limited despite attempts to use exceptional procurement processes.

The following temporary measures could be considered as stand-alone, or in combination, depending on the local situation:

1) Extended use of PPE

Extended use of PPE implies the use of any PPE item for a longer period than normal according to standards for conventional use and manufacturer recommendations (44). WHO advises that if this strategy is used to wear the same PPE for multiple patient encounters, this should be limited to scenarios where health workers are providing continuous care or assessment to a cohort of patients with confirmed COVID-19 who are not additionally suspected or confirmed of other healthcare transmissible infections (45).

In all instances where the same item of PPE is used for care activities beyond a single patient encounter, there is risk that contamination of the PPE item may facilitate the spread of pathogens within the healthcare environment to health workers (46) and other patients (47). An extended use

strategy depends on health workers ensuring that their PPE is not manipulated during or between patient encounters and that any PPE item that has been used in the provision of care is discarded when doffed. Implementing a strategy for extended use of PPE requires staff training to avoid self-contamination during prolonged use (7,12).

An additional consideration is the use of PPE beyond the manufacturer-designated shelf life or expiration date. All items used in this way should be inspected before use to be sure they are in good condition with no degradation, tears, or wear that could affect performance. Respirators that are past their designated shelf life are not considered approved in accordance with their associated regional/international standards. However, an expired respirator may still be effective for protecting health workers if it has been appropriately stored to avoid the effects of moisture or contamination, the straps have remained intact, there are no visible signs of damage and a self-fit test/seal check can be performed successfully by the wearer before use (42).

2) Decontamination or reprocessing of PPE

Many PPE items, such as cotton gowns and eye protection devices designed to be worn multiple times–are compatible with standard decontamination methods. This is not the case for many single-use PPE items. In some cases, manufacturers have developed operational instructions for PPE designed to withstand decontamination or reprocessing cycles for multiple usages (48, 49) or exceptional temporary measure guidance on the decontamination or reprocessing of single-use personal protective equipment (50, 51). However, methods for reprocessing PPE used in the care of patients with infectious diseases are not well established or standardized (52), and therefore reprocessing of single-use PPE items should be considered an extraordinary measure to be considered only when there would otherwise be a shortage of available PPE to perform tasks safely in the health care setting.

Wherever decontamination or reprocessing of PPE is performed, the process must be performed by trained staff under controlled and standardized conditions. When considering decontamination or reprocessing of single-use PPE, manufacturers' instructions for reprocessing and local regulatory approval processes (including, where applicable, emergency use authorizations) should be followed. Systems should be put in place locally to routinely inspect, repair (if applicable) and dispose of PPE when it is damaged or no longer suitable for use (52).

One approach may be to develop and operationalize strategies for decontamination or reprocessing, inspection/testing, and adequate storage of reprocessed PPE ahead of an anticipated stockout. This will allow for the development of a standard operating procedure for reprocessing and emergency stockpile of reprocessed PPE to be available to health facilities if supply chain mechanisms are unable to replenish stock of PPE (53).

Decontamination or reprocessing of single-use PPE is an evolving area that is undergoing research and development, in which additional studies are urgently needed. Methods that can be considered are described in Annex 2 of this document; as more evidence becomes available, WHO will update these considerations accordingly.

3) Alternative PPE materials

Several alternative options for PPE have been proposed or implemented in the context of COVID-19 by repurposing items from healthcare and other industries to serve as a temporary replacement to PPE items in limited supply. If alternatives for any PPE item used in health care settings are proposed locally in situations of shortage or impending/immediate stockout, a local authority should assess any proposed alternative PPE item according to specific minimum standards and technical specifications.

Medical masks

The use of FFP1 respirators, which are mainly used in industrial settings, have been proposed as an alternative to medical masks. FFP1 respirators are designed with technical specifications that can be considered to provide comparable protection for health workers compared to medical masks. However, many FFP1 models use exhalation valves that bypass the filtration media to reduce resistance during exhalation and will therefore not ensure source control (54).

In the instance of a stockout of medical masks, face shields used without masks, or paired with non-medical fabric masks (non-medical fabric masks should be validated per essential parameters listed in the WHO interim guidance *Mask use in the context of COVID-19*) have been proposed as alternatives for medical masks (29). It should be noted, however, that both options are inferior to medical masks for protection against respiratory pathogens and should be considered a temporary last resort measure (see Table 1).

Gowns

Disposable or launderable aprons, lab coats, and patient gowns have been repurposed as alternatives to PPE gowns in the context of shortages. In some instances, these alternatives may not effectively shield health workers' torsos or arms from contaminants and may not be tested for adequate resistance to fluid penetration.

Eye protection

Safety glasses and alternative manufacturing processes for face shields (such as 3D printing and homemade designs) have been used as alternatives in the context of eye protection item shortages (55-57). These alternatives are in many cases untested for eye protection performance and standards (57). Homemade designs are unlikely to be evaluated for their ability to protect eyes from inadvertent splashes of fluids.

Respirators

Powered air purifying respirators (PAPR) and elastomeric respirators are considered multi-use devices validated by international standards and, in some instances, manufacturer recommendations for reprocessing (48, 49). Both have been used conventionally and in the context of respirator shortages in health settings (58, 59). The quality of filtration of many models of PAPR and elastomeric respirators is equivalent to or greater than that of FFP2/N95 respirators (60, 61), and some evidence states that they are less likely to cause dermatological or inhalation safety harms compared to FFP2/N95 respirators (61, 62). However, there are caveats to the successful adoption of these alternatives, including:

- the high initial cost of implementation (58, 59)
- feasibility to maintain and replace the filters (and batteries if applicable) when needed (58, 59)

- ability to perform manual reprocessing of small mechanisms within the device including the filters effectively (63, 64) and in a timely manner (65),
- storage of the units following reprocessing between uses (58, 59, 66),
- potential disruption to the line of sight and hearing in some models (58, 59, 66)
- inability of many models with unfiltered exhalation ports to ensure source control from the wearer (66).

Gloves

In the context of a shortage of gloves, the best strategy is to temporarily reduce the activities in which gloves are used (including, as applicable, within the bundle of PPE used for contact precautions while caring for patients with suspected, probable, or confirmed COVID-19) (67). Alcohol-based hand rub and hand washing with soap and water have been demonstrated to effectively decontaminate hands from SARS-CoV-2, but only when performed thoroughly with the recommended surface coverage friction, and time (73). Health workers with non-intact skin on their hands should not perform direct care on patients without gloves (68).

In instances of a shortage of gloves, available supplies of medical grade gloves should be rationed where possible for use in high-risk activities including:

- hazardous medication or chemical handling (e.g. chemotherapy administration, medical device reprocessing),
- surgical/oral health settings,
- procedures with high body fluid exposure risks
- cleaning of excrement or large spills of blood

Protective gloves that are used for safety in other industries, such as those for laboratories and for the handling of chemical hazards, have been proposed as alternatives in the context of prolonged shortages of available gloves in the PPE global supply chain (69). In some instances, there are internationally recognized standards associated with the manufacturing processes and integrity of gloves used in other industries. However, there are important precautions that should be considered if sourcing non-medical gloves, including:

- possible poor elasticity and tear strength
- possible lack of tactile sensitivity/dexterity
- not purpose-built to provide protection against hazards present in a health care environment (70).

Table 1. Options for temporary measures in the context of shortages of Personal Protective Equipment (PPE)

The table below summarizes temporary measures that can be used by health workers in the context of severe PPE shortage or stock-out. For each option, there is a description of how the measure should be used, what the limitations are, criteria for PPE removal and precautions. Each of these measures carries significant risks and limitations and thus should be considered only as a last resort when all other strategies for rational use and procurement of PPE have been exhausted.

WHO stresses that these temporary measures should be avoided as much as possible when caring for patients with severe COVID-19, patients who are critically ill, and for patients with known co-infections of multi-drug resistant organisms or other organisms requiring contact precautions (e.g. Clostridiodes difficile), droplet precautions (e.g. influenza virus), or airborne precautions (e.g. pulmonary tuberculosis).

Type of PPE	Measure	Description	Limitations/risks/removal criteria
Medical mask used by health workers	1) Extended use (for use with multiple patients)	Use without removing for up to 6 hours, when caring for a cohort of patients with COVID-19	Risks: • Extended use of a medical mask may increase risk of contamination of the mask with SARS-CoV-2 and other pathogens. • Wearing the mask for a prolonged period may increase the chance of the health care worker touching the mask or inadvertently touching underneath the mask. • Damage to or reactions of facial skin tissue may occur with prolonged use of medical masks. • Filtration media of the medical mask may become clogged, thereby increasing breathing resistance and the risk of breathing unfiltered ambient air from the sides of the medical mask. • Extended periods of time in active patient wards are required for health workers. Removal criteria and precautions: • Follow safe procedures for removal and do not touch the front of the mask. • If the mask is touched/adjusted, hand hygiene must be performed immediately. • Masks must be changed if they become wet, soiled, or damaged; difficult to breathe through; exposed to a splash of chemicals, infectious substances, or body fluids; or if the have been removed for any reason, including when drinking fluids or eating meals. • A new medical mask should be worn when providing care outside of a designated cohort of patients with COVID-19. • Use of the same medical mask by a health care worker between a patient with COVID-19 and a patient who does not have COVID-19 is not recommended owing to the risk of transmission.
	2) Reprocessing	No quality evidence is available to date on medical mask reprocessing, and it is not advised	NA
	3) Alternative items (in the absence of medical masks)	FFP1 Respirator without exhalation valve	Risks: • Damage to or reactions of facial skin tissue may occur with prolonged use of respirators. • If the respirator contains an unfiltered exhalation valve, it reduces the capacity of the respirator to ensure source control from a potentially infected wearer. Removal criteria and precautions: • If the respirator is touched/adjusted, hand hygiene must be performed immediately.

			• Respirators must be changed if they become wet, soiled, or damaged; difficult to breathe through; exposed to a splash of chemicals, infectious substances, or body fluids; or if they been removed for any reason, including when drinking fluids or eating meals. • Respirators need to be removed whenever providing care outside of a designated cohort of patients with COVID-19. • Follow the safe procedure for removal and do not touch the front of the respirator.
		Face shield alone (with proper design to cover the entire face, wrap around the sides of the face and extend below the chin) or paired with validated* non-medical mask *Per Essential parameters (minimum and preferred thresholds) for manufactured non-medical mask in WHO interim guidance *Mask use in the context of COVID-19* (29) **Temporary measure only in the critical emergency situation of a stockout of medical masks**	<u>Risks</u>: • The face shield is an incomplete physical barrier and does not provide the filtration layers of a mask. • Face shields are considered to provide a level of eye protection only and should not be considered as an equivalent to masks with respect to respiratory droplet protection and/or source control. • Reusable face shields carry risk of residual contamination and must be properly cleaned and stored after each use. • Caution should be taken to avoid injury when donning, wearing and doffing face shields. • Non-medical fabric masks are not regulated as protective masks or part of the PPE directive and should only be considered a source control measure. • Non-medical fabric masks vary in quality and filtration efficiency will degrade with subsequent laundering for reuse. <u>Removal criteria and precautions:</u> • Face shields should be removed if they are contaminated by a splash of chemicals, infectious substances, or body fluids; or if they obstruct visibility. • Follow the safe procedure for removal and do not touch the front of the face shield.
Respirator (FFP2, FFP3, N95, N99, N100 or equivalent) used by health workers	1) Extended use (for use with multiple patients)	Use without removal for up to 6 hours, when caring for a cohort of patients with COVID-19.	<u>Risks:</u> • Extended use of respirators may increase the risk of contamination with SARS-CoV-2 and other pathogens. because it may increase the chance of health workers touching the respirator or inadvertently touching under the respirator. • Extended use of respirators may clog the filtration media, leading to increased breathing resistance. • Damage to or reactions of facial skin tissue may occur with prolonged use of respirators. <u>Removal criteria and precautions:</u> • A respirator must be removed if it becomes wet, soiled, damaged, or difficult to breathe through or if it is exposed to a splash of chemicals, infectious substances or body fluids. • If respirators are touched or adjusted or removed from the face for any reason, hand hygiene must be performed immediately. • Follow the safe procedure for removal and do not touch the front of the respirator. • Use of the same respirator by a health worker when caring for patients with COVID-19 and patients not suspected of having COVID-19 is not recommended owing to the risk of transmission from exterior contamination of the respirator.
	2) Reprocessing	Process to decontaminate a respirator using disinfection or sterilization methods.	<u>Limitations/ Risks:</u> • There are currently no standardized decontamination and reprocessing methods or protocols for ensuring the effectiveness or integrity of the respirators.

	(see Annex 2 for evidence)	Methods (not validated) for respirator reprocessing (see Annex 2): per manufacturers instructions, where applicable: • vaporized hydrogen peroxide • ultraviolet germicidal irradiation • dry or moist heat • methylene blue dye + dry heat	• The shelf-life of reprocessed respirators is unknown. However, degradation of the filtration media or elastic strap after one or more sterilization cycles affects the fit of a respirator to the face and may affect protection properties. • The number of reprocessing cycles which may be performed without degradation of protection is highly variable, depending on the reprocessing method used and the respirator brand/model. Removal criteria and precautions: • After a pre-defined number of reprocessing cycles, the respirator should be discarded in an appropriate waste receptacle according to local guidance/policy. • When a respirator is removed from the face, it should be placed immediately into a designated container for reprocessing and labeled with the original wearer's name. • Respirator should only be donned by a wearer a maximum of five times. • The respirator should be returned to the original wearer after a reprocessing cycle. • Health workers should always inspect the respirator and perform a seal-check before use.
	3) Alternatives	Powered air purifying respirators (PAPRs) or elastomeric respirators designed with the capability of being reprocessed without damaging the seal and effectiveness of filtration (58, 59)	Limitations/Risks: • Staff members may be unfamiliar with the use, operation and handling of PAPRs or elastomeric respirators and will need training to ensure safe operation and practices. • Most models do not ensure source control for wearer, as exhalation valves allow unfiltered exhaled air to escape into the environment. PAPRs and elastomeric respirators that facilitate both protection and source control through filtered inhalation and exhalation should be selected where available. • PAPRs with hood designs and/or with irregular placement of components or cords may interfere with health worker mobility and visibility. • The ability to hear may be reduced because of the blower noise and noise induced by the movement of a loose head

ced when indicated.
nount of storage space in between shifts.

elow manufacturer specified levels.
each use.
instructions, and the facility must train staff to maintain and

cated to a single wearer and returned to this wearer during

ation.
nission of other pathogens between patients.