



April 4, 2020

Oregon Guidance for Healthcare Personnel on Use of Personal Protective Equipment in Resource-Constrained Settings

Personal Protective Equipment (PPE) (e.g. masks, gowns and gloves) protects healthcare personnel who are taking care of ill patients. Widespread use of PPE during the current COVID-19 pandemic has led to shortages of PPE, especially N95 respirators and facemasks. The Centers for Disease Control and Prevention (CDC) has issued recommendations¹ on the use of PPE in general, as well as in resource-constrained environments. Implementing these recommendations locally depends on the epidemiology of COVID-19 and the current status of available resources.

To provide guidance to Oregon healthcare personnel and health systems, the Oregon Health Authority (OHA) worked with a technical advisory group of infectious disease physicians and infection preventionists throughout the state. The guidance outlined in this document relies both on scientifically proven infection prevention measures, as well as expert opinion when evidence is lacking.

[Note: Employers and healthcare personnel are reminded that PPE is only one aspect of safe care of patients with COVID-19. For healthcare workers taking care of patients with COVID-19, it is important to consider environmental controls (e.g. patient isolation) and administrative controls (e.g., limiting number of healthcare personnel per patient), as well as PPE.]

This guidance is arranged in four tiers; each successive tier outlines approaches under increasingly resource-constrained situations.

Tier 1 approaches

- Healthcare workers evaluating or treating patients with suspect or known COVID-19 should use NIOSH-approved PPE when possible.
- Avoid unnecessary use of PPE by limiting the number of HCP entering the room of patients with suspect or known COVID-19 and by bundling activities; minimize direct, close contact with mildly ill, infectious patients not requiring aggressive acute care, including out-of-room monitoring, phone/intercom communication, and self-administration of oral medications.

¹ <https://www.cdc.gov/coronavirus/2019-ncov/hcp/healthcare-supply-ppe.html>
<https://www.cdc.gov/coronavirus/2019-ncov/hcp/checklist-n95-strategy.html>

- Prioritize use of PPE by the type of activity required for patient care and the associated risk of transmission (e.g. reserving N95 use for aerosol-generating procedures, rather than as a replacement for surgical masks).
- Use PPE that can be disinfected and re-used rather than disposable items when possible (e.g. use launderable, reusable gowns).
- When available, use medical-grade PPE manufactured for COVID-19 response.
 - OHA, OR-OSHA, other federal and state agencies, and private-sector companies have collaborated to identify readily available materials that are likely to meet specifications for medical-grade PPE.
 - These are being made into prototypes, then tested to ensure that they are effective for infection prevention.
 - When prototypes meet these specifications, they will go into full production and made available through state allocation.
- Consider using protective equipment designed for use in other industries and determined by federal regulatory agencies to provide adequate protection in a healthcare setting. FDA issued Emergency Use Authorizations on March 2 and March 27 allowing use of filtering facepiece respirators (including N95s) and of powered air-purifying respirators (PAPRs). www.fda.gov/media/135763/download

Tier 2 approaches

If PPE supply and rate of use makes the above approaches unsustainable, consider:

- Extended use of respiratory PPE and eye protection, particularly for those HCP providing care to those with acute respiratory symptoms. Note: CDC recommends discarding N95s after use during aerosol-generating procedures. This guidance might change in light of recent federal guidance about possible re-use after decontamination. www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
CDC outlines other considerations around extended use at: www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html
 - HCP must take care not to touch their eye protection, respirator or facemask.
 - Eye protection and respirator or facemask should be removed, and hand hygiene performed, if equipment becomes damaged or soiled, and when leaving the unit.
- Secondary coverage of medical-grade respiratory protection with a face shield or possibly a cloth fabric mask to avoid contamination of the medical-grade PPE; if cloth mask is used, discard or launder after each use
- Decontamination of PPE through a process that destroys pathogens and leaves integrity of PPE intact.
 - On 03/28/2020 FDA issued emergency use authorization (EUA) to decontaminate N95 or N95-equivalent respirators² only with the Battelle CCDS

² www.fda.gov/medical-devices/emergency-situations-medical-devices/emergency-use-authorizations#COVID19ppe

Critical Care Decontamination System™ that relies on vaporized hydrogen peroxide to decontaminate. CDC and NIOSH do not recommend that filtering facepiece respirators (FFRs) be decontaminated and then reused as standard care. However, they recognize this may be necessary during an FFR shortage crisis. On 03/31/2020 CDC issued guidance for FFR decontamination with UVGI, vaporous hydrogen peroxide, and moist heat that includes best practices for FFR handling³.

- **UV treatment.** Review of literature suggests effective decontamination of N95 respirators without loss of filtration efficiency after a large dose equivalent to hundreds of decontamination cycles⁴. Repeated human wear for at least 5 decontamination cycles did not appreciably affect fit, odor, wear discomfort, or donning ease^{5,6}. The state is checking whether sterilization boxes in a dental office, nail salon or other venues with devices that use UVC light are adequate to decontaminate PPE.
- **Vaporized hydrogen peroxide.** Appears effective in decontaminating PPE. Duke University researchers report sustained filtration efficiency and no distortion of fit of 3M 1860 N95 masks after 50 rounds of decontamination⁷. www.safety.duke.edu/sites/default/files/N-95_VHP-Decon-Re-Use.pdf. Under an FDA contract, Battelle (Columbus, OH) achieved a similar result by using with the following process www.fda.gov/media/136386/download⁸ on the same mask. The authors reported that the integrity of the elastic bands on the FFRs was compromised after 20-30 cycles of decontamination.
- **Dry heat incubation at 75°C** for 30 minutes has been shown to render SARS-CoV-1, the COVID-19 virus's closest known relative, non-infectious⁹ and did not degrade filtration efficiency of materials used to make N95 masks or physical integrity of one style of N95 after up to 20 decontamination cycles. This has not been tested on multiple masks and there are anecdotal reports of mask deformation when heated in a kitchen oven. <https://stanfordmedicine.app.box.com/v/covid19-PPE-1-2>
- **Moist heat incubation** at 60°C and 80% RH for 15 min – 30 min has been shown to decontaminate the H1N1 influenza virus, although its efficacy against other pathogens is not fully investigated¹⁰

³ www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html

⁴ www.ncbi.nlm.nih.gov/pmc/articles/PMC4699414/pdf/nihms747549.pdf

⁵ www.isrp.com/the-isrp-journal/journal-public-abstracts/1135-vol-28-no-1-2011-pp-48-59-bergman-open-access/file

⁶ www.ncbi.nlm.nih.gov/pubmed/21732856

⁷ Used Bioquell 61 Clarus™ C system with a 35% hydrogen peroxide solution and distribution system to disperse the generated vapor uniformly into a room. Peroxide Vapor standard operating procedure requires processing room attain 480+ ppm Hydrogen Peroxide Vapor with a “Gassing” time of 25 minutes and a “Gassing Dwell” time of 20 minutes.

⁸ Bioquell Clarus C HPV. Hospital systems and other agencies who wish to learn more about this system are asked to visit www.battelle.org/decon or contact Battelle directly at: 1-800-201-2011.

⁹ www.ncbi.nlm.nih.gov/pubmed/14631830

¹⁰ Heimbuch, B.K., et al., A pandemic influenza preparedness study: use of energetic methods to decontaminate filtering facepiece respirators contaminated with H1N1 aerosols and droplets. American Journal of Infection Control, 2011. 39(1): p. e1-e9

Extended use may change the shape of a disposable respirator and affect fit. Perform a seal check¹¹ at each use and discard if the seal check unsuccessful.

Tier 3 approaches

If PPE supply and rate of use makes the above approaches unsustainable, consider:

- Using PPE beyond the manufacturer-designated shelf life in settings with a lower risk of transmission (e.g., non-surgical)
 - First inspect PPE and confirm it is intact and without visible defect. If there are concerns (such as degraded materials or visible tears), discard the product.
- Re-using surgical masks during care for multiple patients for activities with low transmission risk (e.g. dispensing medications or other activities that don't involve close, direct contact with patients). In this situation, practice proper hand hygiene and avoid touching mask to prevent contamination. If contamination occurs, remove and discard mask.
- Re-using N95 or similar disposable respirators without decontamination as outlined in: www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
- Prioritizing the use of unexpired FDA-cleared surgical masks for healthcare providers in procedures with high risk of transmission to the healthcare provider or the patient due to exposure to blood, respiratory secretions, or other body fluids.

Tier 4 approaches

If PPE supply and rate of use makes the above approaches unsustainable, consider:

- If no surgical masks or gowns are available, see CDC's [Considerations for Selecting Protective Clothing used in Healthcare for Protection against Microorganisms in Blood and Body Fluids](#)
- [OSHA](#) has issued standards and recommendations for protective clothing based on fluid barrier properties.
- Using re-purposed items as PPE: swim masks, gas masks; industrial or sports goggles or eye protectors; plastic ponchos or garbage bags
- Using self-made or locally produced PPE with characteristics that suggest efficacy in providing necessary level of infection prevention. Examples include:
 - **Eye protection:** impermeable, transparent shield with sufficient coverage of the face, fashioned from plastic beverage bottles or other clear plastic.
 - **Masks:** multi-ply, tight woven material that is reasonably moisture resistant, such as GORE-TEX, sterilization wrap (typically used to wrap surgical instruments to maintain sterility), or material from furnace filters or vacuum cleaner bags might be used to produce masks that completely cover the nose, mouth, and chin.
 - **Gowns:** use multi-ply or moisture-resistant material designed to cover all clothing.

¹¹ https://www.osha.gov/video/respiratory_protection/fittesting_transcript.html

www.cdc.gov/coronavirus/2019-ncov/infection-control/control-recommendations.html

www.fda.gov/medical-devices/letters-health-care-providers/surgical-mask-and-gown-conservation-strategies-letter-healthcare-providers