

Surge Capacity and Health Care Worker Protective Clothing During COVID-19 Care

Audience: Infection preventionists, nursing directors, medical officers, administrators, emergency managers.

Purpose: Provide health care facilities with contingency and crisis strategies to reduce risk of COVID-19, and optimize supplies of gowns and other protective clothing in resource-limited settings.

Key Messages

- When gowns or coveralls are in short supply, they should be prioritized for aerosol-generating procedures, activities possibly involving splashes or sprays, high-contact activities, and the care of patients with non-COVID-19 transmissible diagnoses (for example, *Clostridioides difficile*, multidrug-resistant organisms, *Candida auris*).
- The same isolation gown or coverall can be used for a patient cohort (such as COVID-19) to conserve protective clothing; patient care should be batched to conserve personal protective equipment (PPE) to the extent possible.
- When practicing extended use and reuse of PPE, dedicated areas are required for doffing (removing) and safe storage, with training of all health care workers on safe removal and redonning.
- Isolation gowns or coveralls must be removed when going to “clean zone” non-patient care areas, such as nurses station, charting area, clean supply room or staff break areas.
- Custom “ensemble” protective clothing (for example, aprons worn with or without sleeves) must either cover all areas of exposure or have a protocol for arm and hand hygiene for uncovered areas.
- Alternative disposable overlying protective clothing (ponchos, paper coats, poly bags) can be used to protect gowns and coveralls from contamination. Ideally they should not be used between multiple patients and should be safely discarded after single patient care sessions.

Background

SARS-CoV-2, the virus that causes COVID-19, is most commonly transmitted person-to-person via respiratory droplets produced when the infected person speaks, coughs or sneezes. The virus can also be spread through direct contact with either an infected person, or with objects in the environment that have been contaminated with virus shed by an infected person. As such, recommended transmission-based precautions for health care workers (HCWs) providing care to patients with confirmed or possible COVID-19 include droplet and contact precautions with eye protection. PPE, in the absence of aerosol-generating procedures, consists of a face mask, eye protection (face shield or goggles), gown and gloves. Ultimately, along with hand

hygiene and environmental cleaning, use of these measures protects HCWs from mucous membrane exposure to SARS-CoV-2 and infection with COVID-19.

Protective Clothing

Protective clothing is the PPE worn by HCWs to cover exposed body areas during patient care to prevent patient-to-patient transmission through contact with contaminated HCW clothing and to prevent the HCW from becoming exposed and infected. However, HCWs are not completely protected from blood, body fluids and other potentially infectious materials when they wear this clothing.

A protective clothing item should be chosen based on the activities being performed. Standard protective clothing can include isolation gowns, surgical gowns, coveralls, aprons and protective sleeves. They can be either disposable or reusable. Some can be fluid resistant (for example, isolation gowns, some cloth gowns) and some are fluid impervious (for example, sterile surgical gowns, Tyvek coveralls). For routine care of COVID-19 patients, fluid resistant isolation gowns and similar items provide adequate protection. However, when procedures or other activities are being performed, where splashes or significant exposure to bodily fluids are expected, fluid impervious items such as sterile surgical gowns should be worn.

To make sure proper protective clothing is available, it is critical for facilities to understand their protective clothing needs, inventory, supply chain, and their utilization rates in order to prioritize the use of protective clothing. Visit the U.S. Food and Drug Administration website to read more about [medical gowns](#).

Protective Clothing and Other PPE

In addition to barrier resistance properties, there are other critical characteristics of protective clothing. It is particularly important to consider how the selected element will interact with other items of PPE worn by the individual HCW. For instance, gloves need to cover the cuff at the wrist of the gown, and face masks and eye protection need to fit with the hood or collar area of the gown. These interfaces are essential to the HCW's overall protection because the overall combination of PPE prevents exposure. Also, with coveralls, heat stress generated due to the added layer of clothing should be considered.

It is also critical that HCWs be trained on the correct use of protective clothing, especially doffing, to avoid contaminating themselves. Doffing difficulty is a critical issue, as it is the step most likely to lead to inadvertent exposures if not done properly. After use, isolation gowns and other items should never be pulled over the head or otherwise placed in contact with the face, where exposure to mucous membranes can occur. Coveralls can provide wide coverage of protection against contact transmission because they are designed to cover the whole body, depending on the design. However, HCWs are generally more familiar and able to correctly use and remove gowns, while coveralls are difficult to put on and take off. HCWs unfamiliar with the use of coveralls must be trained and practiced in their use, prior to using them during patient care.

Visit the Centers for Disease Control and Prevention (CDC) website to read more about the [use of PPE for COVID-19](#).

Use of Protective Clothing in Resource-Limited Settings

During the COVID-19 pandemic, supply chains have been strained due to decreased production capacity and increased global demand. Measures should be implemented as early as possible to conserve existing supplies of PPE. During times of severe shortages, health care facilities may not be able to maintain standard practices.

There are three general levels used to describe surge capacity and to prioritize measures to conserve isolation gown supplies along the continuum of care:

1. **Conventional capacity:** The spaces, staff and supplies used are consistent with daily practices within the institution and provide patient care without any change in daily contemporary practices.
2. **Contingency capacity:** The spaces, staff and supplies used are not consistent with daily standard practices but provides functionally equivalent care to the patient and may not have any significant impact on the safety of HCWs. These practices may be used temporarily during periods of expected isolation gown and other protective clothing shortages.
3. **Crisis capacity:** Adaptive spaces, staff and supplies that are not commensurate with conventional U.S. standards of care but provide sufficiency of care in the context of a catastrophic disaster (i.e., provide the best possible care to patients given the circumstances and resources available). These measures, or a combination of these measures, may need to be considered during periods of known isolation gown and other protective clothing shortages.

Visit the New York City (NYC) Health Department website to read more about crisis standards of care and [Preparing for Crisis Care](#).

Contingency and Crisis Capacity Strategies for COVID-19 Care

These strategies are based on the experiences and lessons learned in NYC during the COVID-19 surge when we were experiencing severe shortages of isolation gowns and other protective equipment. These approaches are only advised for routine patient care in general medical units and non-acute patient care settings, such as ambulatory clinics and long-term care residential environments.

Supplies should be prioritized to maintain higher-level protections:

1. For surgical and other sterile procedures, or intensive care settings.
2. During care activities where splashes and sprays are anticipated, including aerosol-generating procedures.
3. During high-contact patient care activities that provide opportunities for gross contamination of HCWs, such as assisting with toileting, device placement or wound care.

Visit the Centers for Disease Control and Prevention website to read more about [optimizing the supply of gowns in resource-limited settings](#) and the NYC Health Department website to read more about [Strategies for Reuse and Extended Use of PPE during COVID-19](#).

Use of Reusable Cloth Isolation Gowns

Nonsterile, disposable patient isolation gowns, which are used for routine patient care in health care settings, are most appropriate for use by HCWs when caring for patients with suspected or confirmed COVID-19.

Reusable cloth gowns that are laundered after use can also be used. Cloth gowns could be considered for reuse without washing if there was minimal to no direct physical contact with the patient or nearby surfaces (e.g., bedrails). Laundry operations and personnel may need to facilitate additional washing loads and cycles. Systems should be established to routinely inspect, maintain (for instance, mend a small hole in a gown or replace missing fastening ties), and replace reusable gowns when needed (for instance, when they are thin or ripped).

Use of Expired Gowns

Expired gowns may still be serviceable if they are intact.

Use of Gowns Made From Cut, Repurposed Materials

Tyvek and other water resistant cotton/polyester or water repellent materials can be cut and made into isolation gowns.¹ As with coveralls, it is important that protective clothing made from repurposed materials provide complete coverage with good fit. Design should focus on ease of doffing in ways that minimize exposures to the HCW either by being able to pull off gowns with minimal contact with the contaminated front of the garment or by being able to slip the garment downward through the legs, rather than pull them over the head, which could lead to self-contamination.

Use of Coveralls

When gowns or materials for gowns are unavailable, other options need to be used for protective clothing, like coveralls.

Coveralls can replace the need for a gown after training in donning, doffing and use. **If a coverall is used underneath other protective clothing, it should be worn only in patient care areas for patients with the same COVID-19 infection status. Coveralls should be taken off before entering non-patient care areas where PPE is not being used.** Visit the World Health Organization's website to read more about [how to put on and remove coveralls](#).

Extended Use and Reuse of Protective Clothing

¹Kilinc FS. A Review of Isolation Gowns in Healthcare: Fabric and Gown Properties. *J Eng Fiber Fabr.* 2015;10(3):180-190.

With significant shortages of protective clothing, extended use and reuse of gowns should be considered. Wearing a disposable apron over gowns and coveralls may further extend their use by reducing contamination over longer periods. However, there should be a dedicated area for doffing before exiting the patient care area. Reusable equipment should be cleaned and disinfected according to the manufacturers instructions before redonning. Reuse of *single-use non-washable coveralls* is **not** recommended because redonning poses a significant risk of self-contamination. Disinfection of such items may make coveralls safer to remove but does not guarantee they are safe for reuse.²

Visit the NYC Health Department website to read more about [Strategies for Reuse and Extended Use of PPE during COVID-19](#).

Alternatives to Isolation Gowns

In severe crisis situations, complete protective clothing may not be available. Isolation gown alternatives include disposable impermeable plastic aprons, reusable patient gowns or lab coats, and disposable lab coats.³ Although there are no data supporting the efficacy of their use, plastic ponchos, paper coats, poly bags and bedbug sheet material have been suggested as substitutes for isolation gowns.⁴ Material must be inspected to ensure there are no exposing holes or tears and that the item covers the intended areas. Disposable belts, clothespins or other types of ties or clips can be used to reduce gaping and improve fit, but they should be considered contaminated after use.

It is important to note that none of these options can be considered PPE, since their capability to protect HCWs is unproven and should only be considered when supplies of appropriate PPE are completely exhausted. These alternatives should only be used in the absence of aerosol-generating procedures, activities where splashes or sprays are anticipated, or high-contact patient care activities.

Combinations of Protective Clothing to Reduce Exposure Risk

Coveralls: If coveralls are worn in combination with other protective clothing, such as aprons, they should be worn throughout the entire work shift since doffing and redonning poses a high risk of self-contamination. **Do not wear coveralls in non-patient care areas after exposure to patients. Even when worn with another overlying item (apron, poncho), coveralls should be considered contaminated.**

²Dupont. Considerations for healthcare, first responders, and occupational health professionals on the disinfection and reuse of Tyvek garments during the COVID-19 pandemic. https://www.dupont.com/content/dam/dupont/amer/us/en/personal-protection/public/documents/en/COVID-19_Tyvek_Disinfection%20and%20Reuse_4-16-2020.pdf.

³World Health Organization. Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages. [https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-\(covid-19\)-and-considerations-during-severe-shortages](https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages). Published online April 6, 2020.

⁴Livingston E, Desai A, Berkwits M. Sourcing Personal Protective Equipment During the COVID-19 Pandemic. *JAMA*. 2020;323(19):1912–1914. doi:10.1001/jama.2020.5317.

Aprons: Aprons can be used in substitute for isolation gowns. Exposed arms can either be covered with longer gloves and/or with disposable sleeves. Disposable aprons can also be worn over gowns, coveralls or other items to protect the underlayer from contamination when practicing extended use or reuse. **When using this strategy, be mindful of parts of the underlayer that are exposed (such as arms) that should be considered contaminated.**

Disposable sleeves and long-sleeve underlayers: Disposable sleeves, paper long-sleeve shirts, or other long-sleeve protective clothing can be used to cover arms when wearing aprons or ponchos and when prolonged close patient contact or exposure to body fluids are expected. However, as it is difficult to determine when the sleeves are contaminated, they should be changed out between patient encounters if possible, and they should not be worn outside of the patient care area. **If disposable sleeves or long-sleeve underlayers are limited or unavailable, bare arms with attention to disinfection with hand and arm hygiene may be preferable to extended use and reuse of sleeves.**

Ponchos, paper coats and poly bags: Ponchos (thin plastic material used to keep dry in outdoor events), paper coats, and poly bags can be used as disposable outer covering over other PPE items (such as reusable gowns or lab coats) for use in individual patient care, **but should not be worn continuously on a shift and should be discarded between patients or after seeing a cohort of patients with confirmed COVID-19.** HCWs should consider how to doff these items safely without pulling them over the head. One approach would be to cut a slit up the back of a poncho or poly bag, leaving a connected piece at the neck and securing the flaps with a belt, tie or clip to improve fit and facilitate easy doffing after use.

Additional References

Centers for Disease Control and Prevention. Personal Protective Equipment: Questions and Answers on Gowns. [cdc.gov/coronavirus/2019-ncov/hcp/respirator-use-faq.html#Gowns](https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirator-use-faq.html#Gowns).

Kilinc FS. A Review of Isolation Gowns in Healthcare: Fabric and Gown Properties. *Journal of Engineered Fibers and Fabrics*. 2015;10:180-190. [ncbi.nlm.nih.gov/pmc/articles/PMC4791533](https://pubmed.ncbi.nlm.nih.gov/pmc/articles/PMC4791533/).

National Institute for Occupational Safety and Health Considerations for Selecting Protective Clothing. used in Healthcare for Protection against Microorganisms in Blood and Body Fluids. [cdc.gov/niosh/npptl/topics/protectiveclothing/default.html](https://www.cdc.gov/niosh/npptl/topics/protectiveclothing/default.html).

The NYC Health Department may change recommendations as the situation evolves.

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