Caring For Our Frontliners: Personal Protective Equipment Reusability Protocols Under Crisis Capacity During COVID-19 Pandemic

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Introduction

As the COVID-19 pandemic intensifies, personal protective equipment (PPE) shortage throughout hospitals worldwide has inevitably ensued. In order to combat current and future shortages, this proposed framework can be adapted to secure a better supply of PPE for medical personnel. Following the latest recommendations from the Center for Disease Control (CDC), protocols can be made for three operating capacities:

- Conventional: standard protocols that do not change daily contemporary practices
- Contingency: minor daily changes that do not significantly impact the care delivered to patients nor the safety of healthcare personnel (HCP)
- Crisis: only to be used under severe current or expected shortages, with dramatic changes justified by the perceived benefit of a possible scenario of complete absence of PPE

This outline is intended for personnel working in areas not exposed to nebulized fluids, such as those with active ventilators or an ICU. However, decontaminated PPE would merit consideration over total absence of PPE or the use of non-decontaminated PPE in crisis scenarios for those in higher-risk environments.

Methods and Materials

This framework adapts multiple recommendations used throughout hospitals in efforts to provide the minimal protection required to work in settings with COVID-19 positive patients. The phospholipid bilayer of the SARS-CoV-2 viral envelope makes it susceptible to various methods of disinfection. Here, we propose three easily applied methods that take advantage of said susceptibility. Each method alone has evidence of deactivating enveloped viruses. However, the presence of all three is proposed to provide greater safety:

- Heat cycle: 140-158°F for 30 minutes
- Sodium Hypochlorite cycle: 5000 PPM bleach solution sprayed and then rinsed with clean water
- UV germicidal cycle: Direct exposure for 30 minutes

Decontamination Protocols

Decontamination protocol would be determined by the manufacturer’s recommendations on the resistance of its materials to the proposed options. Under this protocol, the PPE kit includes a N95 mask, eye protection, and a gown. General published guidelines state that N95 masks should only receive heat treatment. Eye protection and gowns are resistant to all three treatment options.

- Heat cycle: Space heaters are distributed throughout room and temperature is recorded using a thermometer. Temperature required (140-158°F) must be assured to be continuously applied for the duration of the cycle.
- Sodium hypochlorite solution is prepared to a concentration of 5000 PPM and applied using a portable sprayer ensuring to fully cover all PPE surfaces. At the end of the cycle, equipment should be rinsed with clear water and allowed to air dry.
- UV germicidal bulbs are oriented along opposite sides of PPE equipment at a distance to provide direct line of sight to all equipment. This cycle must be run using a timer with no personnel within the area, as UVC light is extremely dangerous to skin and eyes.

Protocol Cycles

The proposed general protocol includes the following:

1. At medical supply, personnel are assigned and rotated through five (5) PPE kits identified with name, date expedited, and labeling. Each kit is stored in an individually marked paper bag and kept at supply point.
2. At start of shift, personnel is provided one (1) clean PPE kit from marked bag.
3. At end of shift, used kits are recovered at decontamination area and returned to assigned paper bag and promptly labeled as “used” and placed in a secured container.
4. Kits are then transported to decontamination room and hanged along racks with 1-2 inches between items using wooden clothes pins.
5. Area is closed, and pre-determined decontamination protocol is initiated.
6. After completion, individual kits receive “DECON TALLY” and are placed in clean identified paper bags and taken to storage for 36 hours (3 days).
7. Kits are then returned to central supply for re-circulation.

Discussion & Conclusions

Although ideal work environments for healthcare workers exposed to highly infective and lethal agents would not warrant reuse of PPEs, the current global health crisis leaves little room for standard practices. Major government agencies have gradually shifted policies towards more permissive measures when it comes to the reuse of these medical supplies in light of their increasing scarcity. In order to be able to fight the frontlines of the COVID-19 challenge, it is crucial that we guarantee adequate protection for the healthcare personnel who are at the vanguard and responsible for the future care of patients worldwide. Because guidelines on this matter are still undergoing constant change, it is important for hospitals and workers to stay informed and adaptable to rapid changes. We hope that this summary of current guidelines and the suggested protocols for their implementation will serve as a guide towards applying improved safety measures, and thus help our frontline healthcare workers be safe and stand strong in their fight against the COVID-19 pandemic.

Future Directions

Our team is currently working on expansion of these guidelines, as well as creation of new protocols to optimize PPE usage and supply in different work settings, such as:

- Creation of N-95 (or equivalent) reusable masks
- Decontamination of face shields
- 3D printing of face shields
- Designing of portable decontamination units
- Production of virtual education materials on COVID-19 decontamination guidelines
- Among others...

References

- *N95 filtering facemask respirator ultraviolet germicidal irridation (uvgi) process for decontamination and reuse decontamination equipment decontamination room setup and equipment labeling

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