JBI EVIDENCE SUMMARY

INFECTION TRANSMISSION (HEALTHCARE WORKERS): APRONS AND GOWNS

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Question

What is the best available evidence regarding the effectiveness of gowns and aprons in reducing the transmission of infection among healthcare workers?

Clinical Bottom Line

Personal protective equipment (PPE), such as gowns and aprons, is used in healthcare to protect healthcare workers from body fluids and the transmission of infection via contact, droplet, or airborne pathogens.[1,2] Personal protective equipment use in healthcare involves three phases: (1) donning, (2) wearing while providing patient care, and (3) doffing (removing).[3] Effective donning and doffing techniques for PPE may reduce the risk of infection.[3]

- A mathematical model based on a two-arm randomized controlled trial (RCT) aimed to determine what proportion of any reduction in acquisition rates of methicillin-resistant Staphylococcus aureus (MRSA), had been due to improved hand hygiene, reduced contact rates, and universal glove and gown use, using agent-based simulation modeling. For the RCT, healthcare workers had been required to wear gloves and gowns for all patient contacts; the control arm undertook usual standard of care which required healthcare workers to follow Centers for Disease Control and Prevention (CDC) guidelines for contact precautions (i.e. gloves and gowns) when caring for patients known to have infection or colonization with antibiotic-resistant bacteria, such as vancomycin-resistant enterococci (VRE) or MRSA. Although the RCT had found that universal glove and gown use had no effect on VRE in intensive care unit (ICU) settings, a significant effect on MRSA acquisition rates was observed (40.2% relative reduction in the intervention ICUs compared with a 15.0% reduction in the controls). However, this may have been confounded by the higher rates of hand hygiene compliance, and lower rates of healthcare workers contact with patients, during the study period. In the present study, it was found that approximately 44% of the decrease in MRSA acquisition was due to universal glove and gown use, 38.1% to the improvement in hand hygiene compliance on exiting patient rooms, and 14.5% to the reduction in healthcare worker's contact rates (3.4% due to random probability). Authors concluded that their mathematical modeling had shown that the decrease in MRSA acquisition was primarily due to a barrier effect of universal glove and gown use, followed by hand hygiene, and that ICUs may benefit from healthcare workers using universal glove and gown policies for all patient contacts.[1] (Level 1)
- A point-prevalence and intervention study examined the frequency and sites of contamination on the skin and clothing of healthcare workers, during PPE removal. Results for both studies were reported together:[2] (Level 2)
  - Healthcare workers took part in 435 glove and gown removal simulations, using fluorescent lotions or powders to simulate pathogens, for the first study; contamination was observed in 46% (n=200), occurring significantly more frequently during the removal of contaminated gloves compared to

contaminated gowns (52.9% and 37.8% respectively), and when lapses in technique were observed (70.3% technique observed compared to 30.0% when not observed). However, although contamination was more common when removal technique was incorrect, even when no lapses in technique were observed, contamination occurred in approximately one-third of the simulations.

- The intervention for the second study included education and practice in removal of contaminated PPE with immediate visual feedback based on fluorescent lotion contamination of skin and clothing, given in a 10-minute video presentation and 20 minutes of demonstrations and practice in the PPE donning and/or doffing technique. The intervention resulted in a significant reduction (41.1%) in skin and clothing contamination during glove and gown removal that was sustained after one and three months (12.0% at both time points). Authors concluded that providing education that included practice in PPE removal with immediate visual feedback resulted in significantly reduced contamination during glove and gown removal.

- A systematic review evaluated which type of full-body PPE and which method of donning or doffing PPE have the least risk of contamination or infection for healthcare workers (HCW). The study showed that the use of powered air-purifying respirator with hood and coverall resulted in less contamination compared with a gown and an N95 mask. The study also showed that gowns were better than aprons and that long gowns protected better than a coverall or isolation gown. With regards to modifications of PPE versus standard attire, a sealed glove-gown interface, better fitting gown at the neck, wrists and hands and the addition of tabs to improve ease of donning of masks or gloves showed less contamination. On the other hand, with regards to donning and doffing, following the CDC recommendations and one-step removal of gloves and gowns may also decrease the risk of contamination. Instructions during doffing may also increase compliance and reduce errors. Finally, the study also showed that active training like video or computer simulation or face to face training may lead to less doffing errors and better skill scores than passive training like lectures.[3] (Level 1)

Characteristics Of The Evidence

This evidence summary is based on a structured search of the literature and selected evidence-based health care databases. The evidence in this summary comes from:

- A cluster RCT involving 20 ICUs and 40 simulated replications.[1]
- A point-prevalence and quasi-experimental study using a convenience sample of HCWs (n=246 nurses, 117 allied health care personnel, and 72 physicians) from four hospitals for the first study and 50 HCWs from one medical center for the second.[2]
- A systematic review and meta-analysis of 24 studies (14 RCTs, one pseudo-RCT and nine non-randomized trials) involving 2,278 participants.[3]

Best Practice Recommendations

- Educational interventions that include practice in PPE removal with immediate visual feedback on skin and clothing contamination is recommended as it can significantly reduce the risk of contamination during removal of PPE. (Grade A)

References

1. Harris AD, Morgan DJ, Pineles L, Perencevich EN, Barnes SL. Deconstructing the relative benefits of a universal glove and gown intervention on MRSA acquisition. J Hosp Infect. 2017; 96(1):49-53.
2. Tomas ME, Kundrapu S, Thota P, Sunkesula VC, Cadnum JL, Mana TS, et al. Contamination of Health Care Personnel During Removal of Personal Protective Equipment. JAMA Intern Med. 2015; 175(12):1904-10.
3. Verbeek JH, Rajamaki B, Ijaz S, Sauni R, Toomey E, Blackwood B, et al. Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. Cochrane Database of Syst Rev. 2020; 4: CD011621.

Archived Publications

1. JBI-ES-2179-1 (Published at 13 October 2021)

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For details on the method for development see Munn Z, Lockwood C, Moola S. The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach. Worldviews Evid Based Nurs. 2015;12(3):131-8.