

INFECTION TRANSMISSION (HEALTHCARE WORKERS): APRONS AND GOWNS

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Author

Tania Marin (MPH BHSc)

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.¹⁻³ PPE use in healthcare involves three phases: (1) donning, (2) wearing while providing patient care, and (3) doffing (removing).¹⁻³ Effective donning and doffing techniques for PPE may reduce the risk of infection.¹

- A randomized controlled trial (RCT) compared a standard polyethylene gown to a modified gown, for contamination of healthcare workers. The modified gown had increased hand coverage at the hands and wrists and included an elastic band at the wrist for a tighter fit. It was modified to cover the entire wrist, palms and dorsum of the hands to just above the fingers. Participants donned and removed the gowns and nitrile gloves in the usual manner swapping to the alternative gown after a washout period of at least five minutes. At the second crossover, an additional group of healthcare workers participated in the same trial after a five-minute education session was provided on the proper technique for donning and doffing (one-step protocol for PPE removal recommended by Centers for Disease Control and Prevention [CDC]). In the initial trial (without education), those wearing the alternative gown showed significantly lower contamination of the hands and/or wrists, compared to the standard gown (16/60; 27% and 32/60; 53%, respectively). Donning and/or doffing technique was assessed (deemed incorrect in 40% of simulations), and when the CDC technique was used, contamination occurred less frequently for both gowns. In the second trial after education, contamination was significantly lower for those using the alternative gown, compared to the standard gown (2/40; 5% and 9/40; 23% respectively), and there was a significant lower contamination rate in the education group, in comparison to the none-education group, for both gowns. It was concluded that the frequency of contamination can be reduced by education; furthermore, a gown designed to increase skin coverage at the hands and wrists also significantly reduces contamination of healthcare workers during removal of contaminated PPE.¹ (Level 1)
- A mathematical model based on a two-arm 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 modelling. 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 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 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.² (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:³ (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.

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 crossover RCT involving 100 healthcare workers.¹
- A cluster RCT involving 20 ICUs and 40 simulated replications.²
- A point-prevalence and quasi-experimental study using a convenience sample of healthcare workers (n=246 nurses, 117 allied health care personnel, and 72 physicians) from four hospitals for the first study and 50 healthcare workers from one medical center for the second.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

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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.

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