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Brief report

Variation in health care worker removal of personal protective equipment

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In the current era of emerging pathogens such as Ebola virus, removal of personal protective equipment (PPE) is crucial to reduce contamination of health care workers. However, current removal practices are not well described. We undertook a systematic evaluation of health care worker removal of PPE for contact isolation to examine variation in removal procedures. Findings indicate that under usual conditions, only about half of health care workers correctly remove their PPE, and very few remove their PPE in the correct order and dispose of it in the proper location.

For many infectious diseases, standard and transmission-based precautions are commonly employed by health care workers (HCWs). These involve the use of personal protective equipment (PPE), which may include precautions against droplet, contact, or airborne transmission. Appropriate, consistent use of PPE is essential to reducing nosocomial transmission and protecting patients and HCWs. In the current age of emerging pathogens such as Ebola virus, the order and technique with which HCWs remove their PPE is of the utmost importance. Improper removal of PPE may result in the transmission of infections to HCW. However, there is a paucity of literature on practices regarding removal of PPE in the setting of routine clinical care. It has been shown that breaches in PPE use and removal provide opportunities for transmission of infections to HCWs. A previous study that took place shortly after the severe acute respiratory syndrome outbreak of the early 2000s, concluded that conflicting PPE removal recommendations are available and that few HCWs are familiar with how to avoid contaminating themselves. We undertook direct observations to examine the sequence and technique of PPE removal in an academic health center.

METHODS

Direct observations using a previously created and routinely used checklist were undertaken to collect data on the PPE removal practices of HCWs. Observations were undertaken from October 13–31, 2014, at various times during the week. Health care workers entering and exiting patient rooms were observed and documented, including physicians, nurses, physical therapists, occupational therapists, and nursing assistants. Observations were undertaken on 5 different units in our tertiary academic medical center: surgical transplant, internal medicine, general surgery, hematology/oncology, and cardiothoracic medicine. A single trained observer performed these observations outside of patient rooms for no longer than 3 hours at a time. All patient rooms observed were specified as following isolation precautions. HCWs caring for patients in these rooms were not made aware of the observer’s presence, nor was the observer a part of the hospital’s infection control team. No efforts were made to disguise the purpose of the observations if directly asked, but the presence of students at our teaching hospital is commonplace and usually does not provoke attention. Auditing of infection control and prevention practices is a component of typical infection control activities. We used the Centers for Disease Control and Prevention recommendations to guide our direct observations. These recommendations regarding correct removal of PPE state that removal of contaminated gloves should occur first followed by gentle removal of the gown from the back of the neck while in the isolation patient’s room. This was considered full compliance. If an individual failed to remove his or her PPE in the proper order, or wore a component of the PPE outside of the isolation patient’s room, that individual was considered to be partially compliant. We observed PPE removal technique by assessing how the gowns were removed. An HCW’s PPE removal was not considered gentle if the removal process...
involved forceful movements and flourish. The PPE removal was considered gentle if it lacked flourish and forceful movement.

RESULTS

Thirty HCWs were observed removing their PPE (see Table 1). Forty-three percent of HCWs (13 of 30) removed their PPE in the correct order. However, only 17% of HCWs observed (5 of 30) removed their PPE in the correct order and disposed of it in the patient room. Only 13% of individuals (4 of 30) observed removed their PPE in the correct order and did so gently as recommended. Twenty-three percent (7 of 30) failed to remove their gloves gently. Forty percent (12 of 30) removed their PPE in the hallway, outside of the designated isolation area in the patient room. Fifty-seven percent (17 of 30) removed their PPE in the hallway, outside of the designated isolation area in the patient room. Fifty-seven percent (17 of 30) properly disposed of their PPE in the patient room.

DISCUSSION

In our study we found that the majority of HCWs did not remove PPE in the correct order. Further, many of those who did remove the PPE in the correct order failed to properly dispose of their contaminated PPE in the isolated patient’s room. Deviations from protocol were common. A previous study found that despite HCW review of the Centers for Disease Control and Prevention PPE removal protocol before beginning the PPE removal process, and having it in front of them while removing their PPE, errors in removal order were still prevalent. Previous studies have found that viruses on PPE transfer to hands in experiments involving model viruses and fluorescent tracers. We found that many HCWs did not tie the back of their gown, leading to the gown falling over the patient and increasing the risk of contamination. Additionally, many HCWs removed their PPE—both gowns and gloves—by rolling the equipment against their previously uncontaminated work clothes or bare hands before disposal. These breaches of PPE removal protocol may be due to a lack of awareness of the proper protocol, time constraints, or lack of realization of the importance of proper PPE removal. The poor HCW compliance with the proper PPE removal protocol indicates that further education and collaboration with hospital and HCW leaders to improve compliance are needed. As a result of the current Ebola virus outbreak, the critical issue of proper PPE removal has come front and center. Health care facilities should use this opportunity of heightened interest to undertake practice improvement focused on PPE removal protocol, including technique, for all health care-associated conditions that require the donning and doffing of PPE. Our study has several limitations. First, many instances of PPE removal occurred behind closed doors in a patient room; thus, we were not able to observe a larger number of PPE removal opportunities. It is a common practice for privacy reasons to shut patient room doors when an HCW is with a patient. Thus this was not something the observer could change without drawing attention, which would undoubtedly have led to change in behavior on the part of the HCW and compromised our study. Second, the study was completed at a single site. Finally, we did not make an assessment of contamination of the HCW following PPE removal. These limitations notwithstanding we believe the findings of our study have implications for infection prevention, indicate inadequate adherence to proper PPE removal, and highlight the increased likelihood of the inadvertent transmission of infectious agents by HCWs.

Table 1
Rates of health care worker (HCW) compliance to Centers for Disease Control and Prevention recommended personal protective equipment (PPE) removal protocol for patients in contact isolation

| Protocol item | Result |
|---------------|--------|
| HCWs who removed gowns first | 17 out of 30 (57%) |
| HCWs who removed gloves first | 13 out of 30 (43%) |
| HCWs who removed gown in a manner that was not gentle | 15 out of 30 (50%) |
| HCWs who removed gloves in a manner that was not gentle | 7 out of 30 (23%) |
| HCWs who properly disposed of PPE in the patient room | 18 out of 30 (60%) |
| HCWs who disposed of PPE in hall | 12 out of 30 (40%) |
| People who removed PPE in the correct order | 17 out of 30 (57%) |
| People who removed PPE in the incorrect order | 13 out of 30 (43%) |
| People who wore PPE in hall | 16 out of 30 (53%) |
| People who removed PPE in the correct order but did so without flourish | 9 out of 30 (30%) |
| People who removed PPE in the incorrect order and did so without flourish | 4 out of 30 (13%) |
| People who disposed of PPE in the patient room | 5 out of 30 (17%) |

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