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CDC Project: Volume of Contamination and Nosocomial Infection Control

Project Summary:

Personal protective equipment (PPE) protects both healthcare workers and their patients from infections. The recent Ebola outbreak demonstrated both the importance of PPE in protecting healthcare workers (HCW) from infection and the importance of proper technique for safely donning and doffing PPE. Environmental sources have been linked to nosocomial transmission of vancomycin-resistant enterococci, *Clostridium difficile*, *Acinetobacter sp.*, norovirus, and other pathogens. Contamination of the environment with multidrug-resistant (MDR) bacteria is the strongest independent predictor of whether HCWs' PPE becomes contaminated during patient care and of the tasks associated with PPE contamination. HCW frequently contaminate their hands when removing gowns and gloves. Through our literature review, we identified 4 barriers to the safe and effective use of PPE for protecting HCW and patients from Ebola virus infection and from cross-transmission of MDR-pathogens in healthcare facilities: 1) poor compliance with existing PPE and inability to automate PPE surveillance; 2) self-contamination when removing PPE due to flawed design, improper donning/doffing technique, inadequate training, and lack of an antimicrobial safety net; 3) PPE contamination resulting from contact with microorganisms spread to surfaces in patients' rooms by contaminated toilet plumes generated by flushing toilets; 4) HCWs' dual perceptions that the literature suggests PPE is not effective and PPE use is associated with adverse events. Thus, we propose 4 distinct projects with specific aims targeting each of these barriers. The overall aims of the 4 proposed projects are to: 1) Determine if we can exploit the commercially available Microsoft Kinect platform to reliably detect use of gowns, gloves, face masks, face shields, and shoe covers as HCW enter or exit patient rooms, distinguish when HCW come close enough to touch a patient, touch the environment immediately surrounding the patient, or come within droplet range, and measure gown, glove, and mask adherence and the number and length of potential direct contacts and droplet-range proximity events between HCW and patients with influenza; 2) Assess methods to reduce self-contamination as HCW remove PPE including by applying Provodine™, a long-acting Povidone iodine hand rub, to HCWs' hands before they care for patients and by improving PPE doffing techniques through improved training; 3) Determine if temporary toilet covers reduce environmental contamination, glove contamination, contamination of HCWs' hands, and the incidence of *C. difficile* infections; 4) Complete systematic reviews and meta-analyses to determine if universal contact precautions prevent healthcare-associated infections (HAI), to assess the association between contact precautions and psychological or physical adverse events, and to determine if Ebola preparedness had beneficial effects. To complete these aims, we assembled a methodologically diverse team with a strong history of multicenter collaborations, > 200 years of HAI research experience, and > 1400 peer-reviewed publications.