
Semmelweis was one of the first doctors to recognize the importance of nosocomial transmission of disease. Known as the “savior of mothers,” Semmelweis noted over 150 years ago that women who received pelvic examinations from medical students contracted and died from “childbed fever” at an alarming rate. These medical students went from the “death house”, where cadavers were dissected to the bedside of pregnant women and transmitted pathogens from dead to live patients via their bare hands. Semmelweis instituted a strict hand washing policy, and this tremendously reduced the morbidity and mortality of childbed fever. His work was widely ridiculed and ignored by his peers, but years later it was recognized as brilliant.

Fast forward to 2015. HAIs continue to occur despite sequential and substantial advances in infection control. We now know much but not enough about how hospitalized patients acquire infections. For example, we know that pathogens such as MRSA, VRE, C. difficile and Acinetobacter can live on surfaces for weeks to months, and that C. difficile spores can survive in the environment for as long as 5 months (1). These organisms are recovered easily from both nonporous and porous surfaces in the inpatient environment, and thus it is not surprising that various studies have shown that environmental transmission of these organisms can occur. However, we had no idea how often this transmission occurs in real world settings in various types of hospitals until recently. DICON researchers designed a set of studies to evaluate further the importance and frequency of environmental transmission and these results were presented at IDWeek 2015. Discussion of findings from three selected studies is the subject of this month’s newsletter.

Study 1: A Prospective Study of Transmission of Multi-Drug Resistant Organisms (MDRO) between Environmental Sites and Hospitalized Patients—the TransFER study (2):

The aim of this study was to prospectively describe: 1) the profile of multidrug resistant organisms (MDROs) on surfaces in hospital rooms, 2) if and when transfer of MDROs from environment-to-patient or patient-to-environment took place, and 3) the molecular relatedness between MDRO isolates found in both patient and environmental cultures. To do this, we cultured hospital rooms and patients at the time of patient admission to a room and then serially throughout their subsequent hospitalization.
Fourteen of 65 (22%) patients had a “possible transfer event” defined as when the same microorganism was cultured from the environmental surface and the patient. Molecular testing confirmed that 6 of these patient-environment pairs were clonally related. Observed transfer events were multi-directional; in other words, sometimes MDROs were transferred from patient to environment and other times environment to patient.

**Take home points:**
- Clonal transmission of MDROs from patient-to-environment or environment-to-patient occurred in at least 9% of hospital room admissions

**Study 2: The Benefits of Enhanced Terminal Room (BETR) Disinfection Study (3):**

The TransFER study confirmed a microbiologic link between residual pathogens in the rooms of index patients and transmission of these organisms to susceptible patients who then entered these vacated rooms. This finding leads to the important next question: what more can we do to reduce transmission of pathogens in hospitals? This question led to the specific aim of the BETR Disinfection Study: Is there a better strategy for terminal room cleaning— the final cleaning that takes place after a patient vacates a hospital room--that will in turn reduce the risk of transfer of environmental pathogens to the next patient to enter the room. The BETR study compared three strategies for enhanced terminal room cleaning to standard terminal room cleaning. Standard terminal cleaning was defined as: “Quat:” Quaternary ammonium used for all contact precaution rooms EXCEPT for *C. difficile* rooms, for which bleach was used. Enhanced terminal cleaning was defined as: 1) “Bleach:” Bleach used for all contact precaution rooms. 2) “Quat + UV-C:” Quaternary ammonium + UV-C used for all contact precaution rooms EXCEPT for *C. difficile* rooms, for which bleach + UV-C was used; 3) “Bleach + UV-C:” Bleach + UV-C used for all contact precaution rooms.

Six DICON hospitals, 2 tertiary care hospitals, and a VA hospital participated in this 28-month study. Study hospitals randomly were assigned to four different cleaning strategies during different “blocks” of the study. The main study outcome was composite incidence rate of MRSA, VRE, *C. difficile*, and MDR- *Acinetobacter* positive cultures in patients admitted to terminally cleaned rooms. Simply put—we looked at the incidence of new MDRO infections in patients admitted to rooms that had undergone three different enhanced terminal room cleaning strategies and compared patient outcomes to those of patients admitted to rooms that had undergone standard terminal cleaning. Overall, there was a statistically significant benefit to using enhanced terminal cleaning strategies for contact precaution rooms.

**Take home point:**
- Enhanced terminal cleaning of contact precaution rooms effectively reduces transmission of hospital-acquired infections due to MRSA, VRE, *Acinetobacter* and *C. difficile*.

**Study 3: EVS Self-Monitoring study (4):**

As highlighted in the two summaries above, the hospital environment contributes to transmission of MDR pathogens, and enhanced terminal cleaning measures are effective in combating the patient-environment-patient transmission cycle. However, the quality of daily and terminal cleaning by EVS personnel is also important. The Center for Disease Control and Prevention (CDC) addressed the evaluation of environmental cleaning in their 2010 toolkit (4). The CDC recommends that hospitals use any one of several strategies to evaluate the quality of EVS room cleaning.
The aim of our third study was to compare the accuracy of monitoring of hospital room cleanliness by EVS personnel (i.e., self-monitoring) to that of independent, external monitors. Fluorescent dots were placed on 5-7 high-touch surfaces in hospital rooms prior to terminal cleaning. EVS supervisors and study personnel then re-examined rooms following their terminal cleaning to determine if the fluorescent dots were still present. We compared the overall proportion of “cleaned” surfaces between the self-monitoring and external monitoring strategies. Ultimately, we found that 264 of 320 (83%) surfaces were deemed “clean” by self-monitoring compared to only 153 of 292 (52%) surfaces evaluated by external independent external. Our observations suggest that external validation may provide more accurate data than self-monitoring regarding the overall quality of room cleaning by EVS.

Take home point:
- External monitoring of EVS cleaning may provide more accurate data than EVS self-monitoring of room cleanliness. Infection prevention must work collaboratively with EVS personnel to ensure high-quality cleaning.

DICON is excited about its ongoing research in environmental transmission of pathogens in healthcare settings, and we are grateful for the participation of each member hospital. Thank you for your help! Stay tuned for further discussion of the BETR study at our upcoming DICON Symposium on November 20, 2015. We look forward to seeing you all there!

References:
2. Chen, LF et al. “A Prospective Study of Transmission of Multi-drug Resistant Organisms (MDRO) between Environmental Sites and Hospitalized Patients: The TransFER study.” Publication pending
4. Knelson, LP et al. “Self-Monitoring of Hospital Room Cleaning by Environmental Services (EVS) May Not Accurately Measure Cleanliness.” Publication pending