Office of Evidence Based Practice (EBP) – Critically Appraised Topics: High Touch Surface Cleaning

Specific Care Question:

Does the cleaning and disinfection of high touch surfaces reduce hospital acquired infections?

Question Originator:

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Literature Summary:

Background

Hospital acquired conditions (HAC) are a leading cause of illness and death in the United States and worldwide. In 2011, an estimated 721,800 HAIs occurred in the United States (Magill et al., 2014). Environmental cleaning, particularly high touch areas, is a major component of preventing HAIs. Children's Mercy's (CM) policy entitled Cleaning Responsibilities Matrix states:

1. A clean, healthy, and safe environment will be maintained by all employees.
2. Environmental cleaning will occur in a regular and systematic manner, assuring appropriate cleaning occurs utilizing a CM-approved germicide where indicated.
3. The direct patient care environment will be maintained in a manner to minimize the risk of infection, including cleaning, removal and/or replacement of grossly soiled or contaminated supplies and equipment.

Study characteristics

The search for suitable studies was completed on 11/27/2018. One hundred and ten titles and abstracts were found in the search and two systematic reviews were believed to answer the question. An in-depth review found one systematic review answered the question (Leas et al., 2015).

Key results

No recommendation can be made on the relative effectiveness of various cleaning, disinfecting, and monitoring strategies. There are limited studies that assess clinical, patient-centered outcomes, including health care–associated infection rates. The Office of Evidence Based Practice recommends following the CMH cleaning policy and the standard work developed by Children's Mercy.

Summary:

Children's Mercy has developed a policy for what is deemed high-touch items and the responsibility of cleaning them (CM, 2017).

Item	Environmental Services (EVS)	Unit/Department Staff
Bed Rail	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Tray Tables	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Call Light	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Bedside Table	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Telephone	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Chair Arms	Terminal Cleaning after patient discharge	Cleaned daily and as need by unit/department staff while room is occupied
Computer keyboard and mouse and medication scanner		Daily, after each use, and as needed by unit/dept. staff
Alaris pump/ pole		Daily, after each use, and as needed by unit/dept. staff

Mechanical Ventilators and other therapy equipment such as cough assist, IPV		Daily, after each use, and as needed by Respiratory Therapy
Room sink/ faucets	Daily by EVS	
Room soap dispenser	Daily by EVS	
Room light switch	Daily by EVS	
Room inner doorknob	Daily by EVS	
Bathroom doorknobs/ plates/ switches	Daily by EVS	
Bathroom handrail	Daily by EVS	
Bathroom sink/ faucets/ soap dispenser	Daily by EVS	
Toilet seat/ handle/ sprayer	Daily by EVS	

A systemic review by the Agency for Healthcare Research and Quality (Leas et al., 2015) studied the various cleaning, disinfecting, implementation, and monitoring strategies found in the literature. The key findings from this systemic review are below.

Strategies for Environmental Cleaning Key Points (Leas et al., 2015)

- Use of quaternary ammonium compounds (QAC), chlorine-based disinfectants, and UV or hydrogen peroxide vapor devices were studied, while use of peracetic acid/hydrogen peroxide wipes, enhanced coatings, or microfiber cloths were not.
- Primary outcomes included variants of surface contamination, infection rate, and colonization.
- Studies examining chemical disinfectants reported mixed findings. Chlorine-based products were effective reducing infection rates for all but infections caused by C. difficile.
- Integrating wipes (e.g. hydrogen peroxide, peracetic acid) into preventive strategies reported positive outcomes, including significant and sustained reductions in C. difficile infection rates.
- Implementing no-touch interventions such as UV light and hydrogen peroxide vapor machines reported positive findings with reported reductions in infection rates.

Strategies for Monitoring Cleaning Key Points (Leas et al., 2015)

- Fluorescent/UV markers are well-studied monitoring methods. Fluorescent markers can be used in powder or gel form to mark high-touch surfaces before room cleaning and disinfection. Following cleaning and disinfection, UV light inspection is used to determine adequate removal of the fluorescent markers on these surfaces.
- Adenosine triphosphate (ATP) cleaning verification system is as a quick and objective monitoring method that is poorly standardized with low specificity and sensitivity to detect bacteria. ATP bioluminescence assays detect the presence of organic debris on surfaces. A special swab is used to sample the surface of interest and placed in a reaction tube and the reaction tube is subsequently entered into a device luminometer.
- Visual observation, agar slide cultures, and swab cultures are not well-studied.
- Most commonly reported primary outcomes were.
    - Results for percent of targets cleaned or cleaning rate were mainly positive for fluorescent/UV markers.
    - Visual observation was reported as inferior compared to various monitoring methods.

Implementing Cleaning and Monitoring Strategies Key Points (Leas et al., 2015)

- Implementation of environmental control strategies is highly influenced by appropriate preparation, application, and contact time of disinfectants; adherence to best practices (e.g., checklists); proper education and training; and clearly defined roles for cleaning high-touch areas.
- Institutional leaders should place less importance on room turnover time and more importance on the value of EVS staff.
- Institutional collaboration between Infection Prevention and Control and EVS Management is critical while developing EC programs.
- Educational tools on cleaning and monitoring, training tools, and protocols should be language-appropriate and written in a manner commensurate with education level.

Search Strategy and Results (see PRISMA diagram):
("Disinfection"[tw] OR "Disinfectants"[Mesh] OR disinfect[tw]) AND ("infusion pumps"[mesh] OR "Diagnostic Equipment"[mesh] OR "computer hardware" OR keyboard OR phone OR "hand rail*" OR "bed rail*" OR "touch surface*" OR "environmental surface*" OR "hand-touch" OR "high-touch") AND ("Health Facility Environment"[mesh] OR "Equipment Contamination"[mesh] OR "Housekeeping, Hospital"[Mesh] OR "patients' rooms"[mesh]) NOT endoscopes AND ("2007/12/01"[PDat] : "2018/12/31"[PDat]) Filters: 10 years
("computer hardware" OR keyboard) AND (disinfect* OR clean*)

Studies included in this review:
Leas et al. (2015)

Studies not included in this review with exclusion rationale:

Authors (YYYY)	Reason for exclusion
Han et al. (2015)	A review of Leas et al. (2015) by AHRQ

Method Used for Appraisal and Synthesis:
[a]Higgins, J. P. T., & Green, S. e. (2011). *Cochrane Handbook for Systematic Reviews of Interventions [updated March 2011]* (Version 5.1.0 ed.): The Cohcrane Collaboration, 2011.

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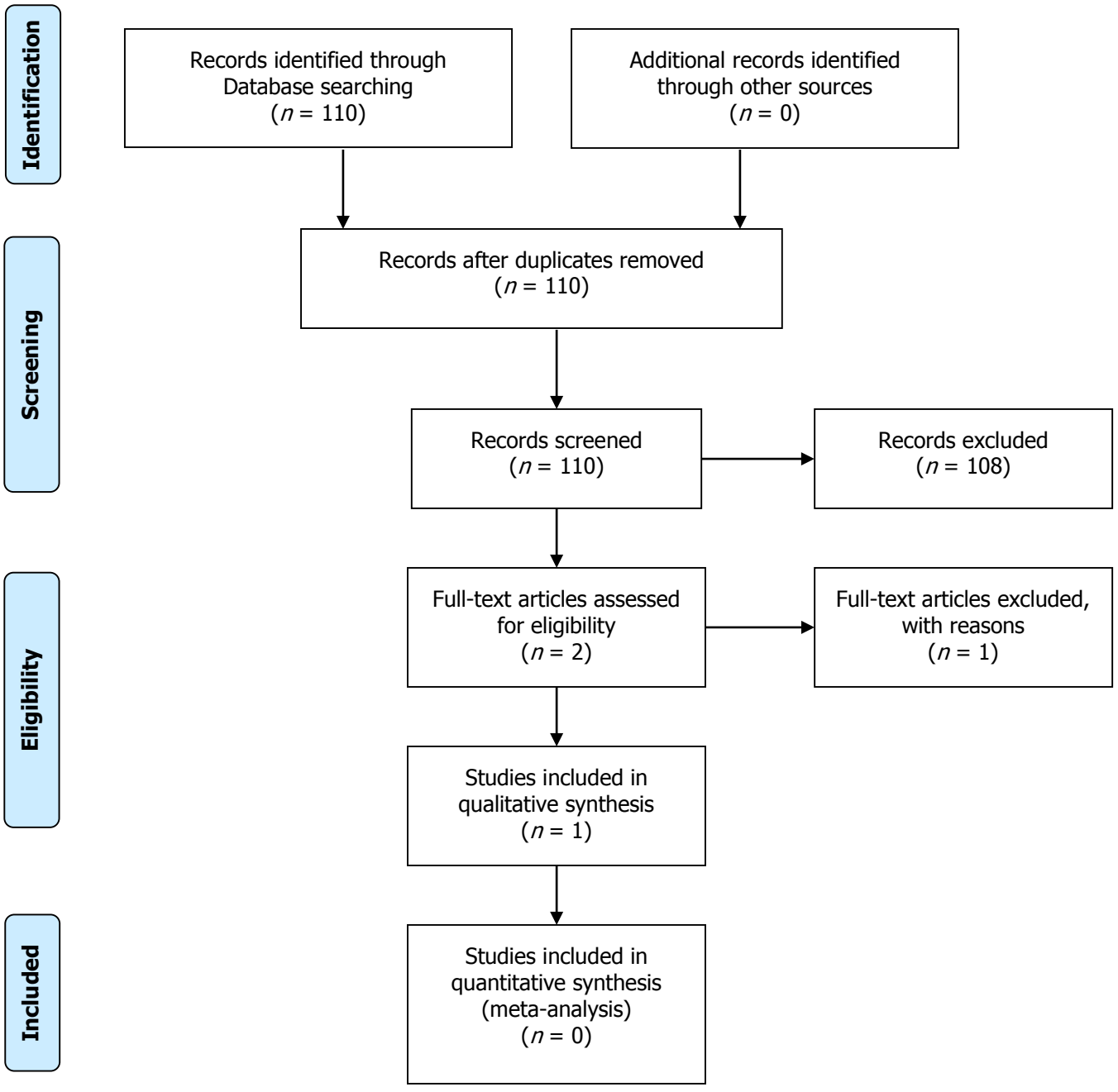
Date Developed/Updated: January 2018

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA)[b]



[b]Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Table *2 Characteristics of Studies*
Leas et al

Methods	Systematic Review
Background	**Objectives:** Cleaning of hard surfaces in hospital rooms to reduce the risk of healthcare-associated infections **Research questions:** 1. Currently used modalities of cleaning, disinfecting, and monitoring cleanliness of patient rooms 2. Barriers to implementation of cleaning, disinfecting, and monitoring modalities 3. Future direction for research on environmental cleaning, disinfecting and monitoring of cleanliness in patient rooms **Participants:** N/A **Interventions:** Question 1 - Cleaning and Disinfection Modalities • Chemical disinfectants • Self-disinfecting surfaces • No-touch modalities Question 2 - Monitoring Modalities • Visual inspection • Microbiologic methods • UV-visible surface marker • ATP assays • Polymerase chain reaction–based technology Question 3 - Implementation Barriers • Appropriate preparation, application, and contact time of disinfectants • Adherence to best practices (e.g., checklists) • Proper education and training • Clearly defined roles for cleaning high-touch surfaces (HTOs) Other factors of influence • Placing less importance on room turnover time and more importance on the value of environmental service (EVS) staff • Influence of external factors in environmental cleaning (EC) • Institutional collaboration between Infection Prevention and Control and EVS management while developing EC programs • Understanding local hospital culture • Educational tools, training tools, and protocols should be language-appropriate and written in a manner commensurate with education level Question 4 - Future plans • Determining what surfaces should be cleaned or disinfected • Methods for cleaning and disinfecting determined surfaces • Should cleaning and disinfecting be monitored and measured • Methods of implementation of interventions **Co-medications:** N/A

	Comparators: N/A **Outcomes:** Patient infection, colonization, or surface contamination with Clostridium difficile, methicillin-resistant Staphylococcus aureus, or vancomycin-resistant enterococci
Methods	**Eligibility criteria**: 1. Patient rooms and isolation rooms in acute care hospital wards in the United States, Canada, Western Europe, and Australia 2. Studies in English 3. High-touch objects with hard, nonporous surfaces 4. Pathogens: Clostridium difficile (*C. difficile)*, Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant Enterococcus (VRE), or unspecified pathogens where *C. difficile*, MRSA and VRE were not explicitly excluded in study 5. Products or processes currently available in the United States or undergoing investigational studies 6. Multicomponent interventions if change in cleaning, disinfection, or monitoring was a primary or prominent component **Information sources**: Published and gray literature found using PubMed, EMBASE, CINAHL, the Cochrane Library, and other resources since 1990 **Risk of bias:** N/A
Results	**Included studies** 80 clinical studies (4 systematic reviews, 76 primary studies) ▪ 49 studies (including 2 SR) focused on cleaning or disinfecting ▪ 14 studies (including 2 SR) focused on monitoring ▪ 17 studies focused on implementation of cleaning or monitoring strategies • Primary Setting was the ICU • Most common examined high touch objects included bedrails, call buttons, light switches, side or tray tables and toilets but selection across studies varied substantially **Synthesis of results** This Technical Paper describes cleaning, disinfecting and monitoring methods and in how interventions might be implemented. No recommendations for type of cleaning or disinfectant products, methods of cleaning or implementation of cleaning interventions were made. • **Strategies for Environmental Cleaning** ○ Studies examining chemical disinfectants reported mixed findings in ▪ reductions in VRE, *C. difficile* with the use of bleach disinfectants ▪ decreased *C. difficile* spore levels with use of accelerated hydrogen peroxide ▪ ineffectiveness of chlorine-based product in reducing *C. difficile* contamination and infection rates ○ Six Studies that integrated various wipes into prevention strategies reported positive outcomes including sustained reduction in *C. difficile* infection rates.

	○ Seventeen studies implementing no-touch methods (like ultra-violet lights and hydrogen peroxide vapor) reported positive findings and 3 studies found reduced infection rates. ○ Seven studies evaluated enhanced coatings, like copper-coated surfaces, reported positive findings. • **Strategies for Monitoring Cleanliness** ○ Six out of eight studies focusing on UV surface markers concluded that these monitoring methods were useful and highly objective and helped achieve substantial improvements in cleaning and disinfecting practices. ○ Visual observation was found to be inferior to other monitoring methods. • **Implementing Cleaning and Monitoring Strategies** ○ Three studies used multicomponent strategies to prevent *C. difficile* infections and reported positive findings. ○ Five studies described ongoing education, direct feedback, and commitment and flexibility of administrative leaders as key components to successful implementation. ○ Contextual factors: ▪ External factors that affect adherence were: a positive patient safety culture that fosters collaboration and respect ▪ Implementation and management tools include staff education, training, training time, use of internal audit and feedback and presence of internal or external persons responsible ▪ Twenty-four studies reported education as a key factor, specifically training staff **Description of the effect:** Multicomponent preventive strategies reported positive results including; ATP and fluorescent markers as monitoring, enhanced collaboration, communication and education, swab cultures, fluorescent markers, UV markers as useful tools to audit and educate staff.
Discussion	**Strengths and Limitations of evidence:** • Strength of the evidence is low-quality • Does not appraise risk of bias of individual studies or provide overall ratings of strength of evidence for each intervention and outcome. • Review restricted to *C. difficile*, MRSA and VRE and so results may not be generalizable to interventions for other pathogens. • Lack of rigorous, direct comparative studies of various technologies • Hospitals maybe reluctant to adopt methods like UV light and adenosine triphosphate surface markers given the relative absence of data • Lack of consensus for thresholds of cleanliness ○ No established benchmark for defining surface as "clean" • Real world goal of cleaning and disinfecting should be to reduce risk for pathogen transmission rather than establishing a continuously sterile surface **Interpretation:** • Environmental cleaning is an important component of infection control strategies. • Emerging technologies have led to increased interest in evaluating cleaning and disinfecting and monitoring in hospital setting.

	• A major limitation of evidence base is the lack of comparative studies addressing the relative effectiveness of various cleaning, disinfecting, and monitoring strategies. • Few studies assess clinical, patient-centered outcomes, including patient colonization and healthcare associated infection rates. • Future studies needed that directly compare newer disinfection and monitoring methods, assess the effect of related factors on implementation, and evaluate patient-centered outcomes.
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Han, J. H., Sullivan, N., Leas, B. F., Pegues, D. A., Kaczmarek, J. L., & Umscheid, C. A. (2015). Cleaning Hospital Room Surfaces to Prevent Health Care–Associated InfectionsA Technical BriefEnvironmental Cleaning and HAIs. *Annals of internal medicine, 163*(8), 598-607.

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