patients, visitors, or personnel in association with the operation of the DHP systems. **Conclusions:** These findings suggest that DHP is effective in reducing surface *C. auris* contamination in a variety of patient and health-care worker surfaces.

Disclosures: None

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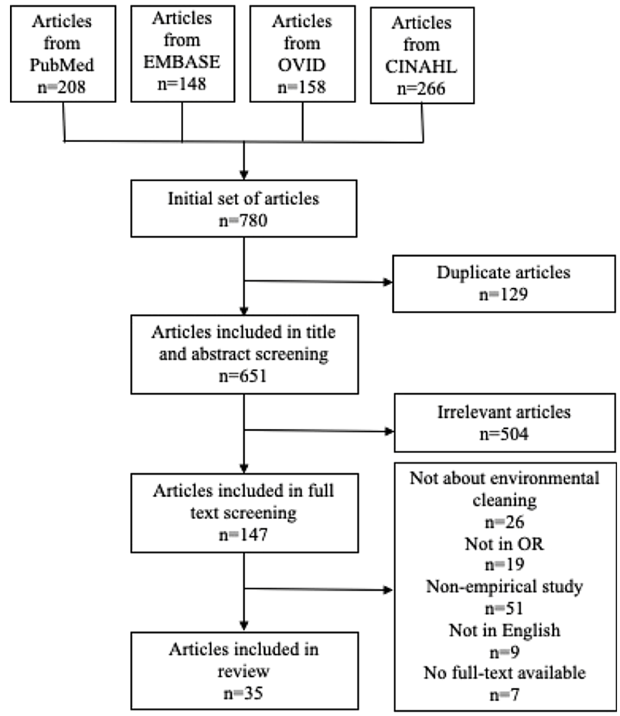
Presentation Type:
Poster Presentation - Poster Presentation
Subject Category: Environmental Cleaning

Environmental cleaning in operating rooms: A systematic review from the human factors engineering perspective

Anping Xie PhD; Hugo Sax; Oluseyi Daodu; Lamia Alam; Marium Sultan; Clare Rock; Shawna Perry and Ayse Gurses

Background: Environmental cleaning is critical in preventing pathogen transmission and potential consecutive healthcare-acquired infections. In operating rooms (ORs), multiple invasive procedures increase the infectious risk for patients, making proper cleaning and disinfection of environmental surfaces of paramount importance. A human-factors engineering (HFE) approach emphasizing the impact of the entire work system on care processes and outcomes has been proposed to improve environmental cleaning. Using the lens of this HFE approach, we conducted a systematic review to synthesize existing evidence and identify gaps in the literature on OR cleaning. **Methods:** The systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and limited to English-written, peer-reviewed journal articles



Studies examining the effectiveness of OR cleaning in reducing environmental contamination								
First author (year)	Work system factors					Process	Outcome measures	Measuring techniques
	P	T	T&T	E	O			
Balkissoon (2014)	Infected vs. noninfected patients	nil	nil	nil	nil	Turnover cleaning	Surface contamination after turnover cleaning	Culture
Dallolio (2018)	nil	nil	nil	nil	nil	Turnover cleaning	Surface and air contamination before first procedure and after turnover cleaning following first procedures	Culture
Dehghani (2018)	nil	nil	nil	nil	nil	Turnover cleaning	Air contamination before and after turnover cleaning	Culture
Ellis (2018)	nil	nil	nil	Flat covered vs. irregular uncovered surfaces	nil	Turnover cleaning	Surface and air contamination before and after turnover cleaning	Culture, ATP
Frabetti (2009)	nil	nil	nil	Vertical vs. horizontal surfaces, smooth vs. porous surfaces	nil	Terminal cleaning	Surface contamination before and after terminal cleaning	Culture
Griffith (2000)	nil	nil	nil	nil	nil	Turnover cleaning	Surface contamination before and after turnover cleaning	Culture, ATP, visual inspection
Matinyi (2018)	nil	nil	nil	nil	nil	Morning cleaning before first procedure	Surface and air contamination after morning disinfection	Culture
Nascimento (2021)	nil	nil	nil	nil	nil	Turnover cleaning	Surface contamination before and after turnover cleaning	Culture, ATP, visual inspection
Richard (2017)	nil	nil	nil	nil	nil	Turnover cleaning	Surface contamination after turnover cleaning	ATP
Sanna (2018)	nil	nil	nil	nil	nil	Turnover cleaning	Surface contamination before first procedure and after turnover cleaning following first procedures	Culture, ATP

Studies examined the compliance of OR cleaning practices								
First author (year)	Work system factors					Process	Outcome measures	Measuring techniques
	P	T	T&T	E	O			
Jefferson (2011)	nil	nil	nil	nil	nil	Terminal cleaning	Cleaning thoroughness	Fluorescent gel marker

Studies examined interventions for improving OR cleaning effectiveness and/or compliance								
First author (year)	Work system factors					Process	Outcome measures	Measuring techniques
	P	T	T&T	E	O			
Armellino (2018)	nil	nil	nil	nil	Monitoring and feedback	Terminal cleaning	Compliance with cleaning protocol	Remote monitoring with audit checklist
Armellino (2019)	nil	nil	UV	nil	nil	Equipment disinfection during and beyond turnover cleaning	Surface contamination of (non-critical) patient care equipment	Culture
Armellino (2020)	nil	nil	FMUV	nil	nil	Terminal cleaning	Surface contamination	Culture
Casini (2019)	nil	nil	PX UVC	nil	nil	Terminal cleaning	Surface contamination	Culture
ElHaddad (2017)	nil	nil	PX UV	nil	nil	Turnover cleaning	Surface contamination	Culture
Gillespie (2016)	EVC and clinical staff education	Surface cleaning frequency reduced, additional areas included on cleaning schedule	Microfiber and steam technology	nil	Monitoring and feedback	Cleaning in general	Cleaning thoroughness and other outcomes (e.g., staff health and safety, cost, SSI)	Fluorescent gel marker
Green (2017)	nil	nil	Portable PX UVD	nil	nil	Terminal cleaning	Surface and air contamination, HAI	Culture
Huayun (2019)	nil	nil	Hydrogen peroxide fumigation		nil	Terminal cleaning	Surface contamination before and after terminal cleaning and after hydrogen peroxide fumigation	Culture
Jennings (2021)	nil	nil	UV	nil	nil	Local disinfection of OR during surgery	Surface contamination	Culture
Lacourciere (2019)	nil	nil	Decision support tool for determine if UVC is needed	nil	nil	Turnover cleaning	Usefulness and acceptance of the decision support tool	Survey
Lemmen (2015)	nil	nil	Hydrogen peroxide vapor (HPV)	Porous vs. nonporous surfaces	nil	HPV decontamination cycles	Surface contamination	Culture
Lewis (2015)	nil	nil	Antimicrobial surface disinfectant	nil	nil	Terminal cleaning	Surface contamination	Culture
Loftus (2020)	nil	Cleaning of anesthesia machine and monitors before patient entry and patient admission to	nil	nil	nil	Cleaning in perioperative process (as part of bundle)	SSI	--

reporting empirical studies on OR cleaning. Figure 1 shows the flowchart of study search and screening. The following data were extracted from each included article: (1) general information of the article (eg, first author, title, journal, year of publication) and (2) characteristics of the study (eg, country, objectives, design, outcome measures and measuring techniques, findings, funding source). In addition, work-system elements (eg, people, tasks, tools and technologies, physical environment, organizational conditions) and cleaning processes (eg, turnover cleaning, terminal cleaning) addressed in each included studywere coded based on the Systems Engineering Initiative for Patient Safety (SEIPS) model. The methodological quality of included studies using a (non)randomized controlled design was assessed using the version 2 of the Cochrane risk-of-bias tool for randomized trials. **Results:** In total, 35 studies were included in this review, among which 10 examined the effectiveness of OR cleaning in reducing

Characteristics	Count (N=35)	%
Countries		
United States	20	57
Italy	4	11
United Kingdom	3	9
Japan	2	6
Others	6	17
Years		
2020 and after	4	11
2010-2019	23	66
2000-2009	5	14
1999 and before	3	9
Study topics		
Effectiveness of OR cleaning in reducing environmental contamination	10	29
Compliance of OR cleaning practices	1	3
Interventions for improving OR cleaning effectiveness and/or compliance	24	68
Study designs		
(Non-)randomized controlled trial	8	23
Quasi-experimental	20	57
Observational	5	14
Qualitative and mixed-methods design	2	6
Funding		
Commercial	9	26
Non-commercial	5	14
Not reported	21	60

environmental contamination (Fig. 2), 1 examined the compliance of OR cleaning practices (Fig. 3), and 24 examined interventions for improving OR cleaning effectiveness and/or compliance (Fig. 4). Figure 5 summarizes the characteristics of the included studies. **Conclusions:** In this review, OR cleaning was inconsistently performed in practice, and mixed findings were reported regarding the effectiveness of OR cleaning in reducing environmental contamination. No study has systematically examined work-system factors influencing OR cleaning. Efforts to improve OR cleaning focused on cleaning tools and technologies (eg, ultraviolet light) and staff monitoring and training. Interventions targeting the broader work system influencing the cleaning processes are lacking. The scientific rigor of the included studies was modest. Most studies were either commercially funded or did not reveal their funding sources, which might introduce a desirability bias.

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Disclosures: None

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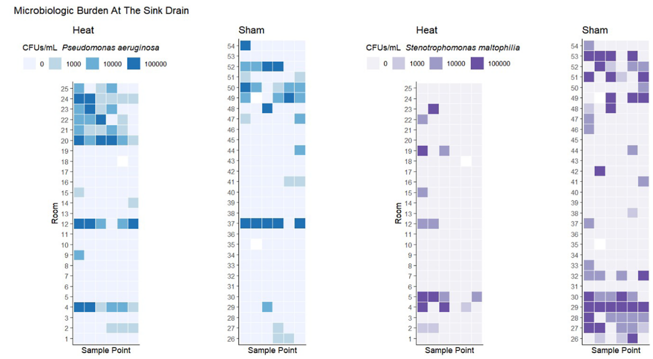
Subject Category: Environmental Cleaning

Some like it hot: Variable impact of a tailpiece heating device on different gram-negative bacteria

Stacy Park; Shireen Kotay; Katie Barry; Joanne Carroll; April Attai; William Guilford and Amy Mathers

Background: Transmission of multidrug-resistant bacteria to patients from colonized hospital sink drains has prompted attempts to interrupt transmission through a variety of interventions directed at the wastewater environment. We previously found that use of a heating device designed to disrupt biofilm formation between the P trap and the sink drain, which is the major point of dispersal of bacteria to the patient-care environment, was associated with reduced risk of detectable gram-negative organisms on hospital sink drains. However, there was no observed effect on some important pathogens, including *Pseudomonas aeruginosa* and *Stenotrophomonas maltophilia*. We hypothesized that heating to a higher temperature would provide additional efficacy in preventing drain colonization. **Methods:** As part of a previous randomized study, 54 tailpiece heaters were installed in 3 intensive care units in an academic hospital and 2 acute-care units in an associated regional hospital; half of these devices were shams (ie, no heat). The devices were programmed to heat for 1 hour every fourth hour. Prior to this study, a device update increased the heating temperature (during the previous study the median heated temperature was 65.9°C). Sink drains and P traps were sampled monthly. Samples were assessed for semiquantitative growth of gram-negative bacteria on MacConkey agar, looking



especially for *P. aeruginosa* and *S. maltophilia*. Frontline personnel were blinded to device assignment. **Results:** The mean heated temperature reached was 74.4°C. Based on proportional odds logistic regression (wherein the odds ratio reflects the likelihood of a given sample falling in a lower microbiologic burden level versus the levels above it), the heating device was associated with increased likelihood of lower microbiologic burden at the drain level for general growth on MacConkey agar (OR, 2.47; 95% CI, 1.11–5.51) and for growth of *S. maltophilia* (OR, 5.39; 95% CI, 2.20–13.18). The device did not have an effect on burden of Enterobacterales (OR, 1.38; 95% CI, 0.58–3.24). For *P. aeruginosa*, there was a trend toward decreased likelihood of lower microbiologic burden (OR, 0.41; 95% CI, 0.18–1.07) that did not reach statistical significance at the drain level, and the heating device was associated with decreased likelihood of lower microbiologic burden of *P. aeruginosa* at the P-trap level (OR, 0.20; 95% CI, 0.10–0.39). **Conclusions:** Heat disruption of biofilm between the P trap and sink may be a promising strategy for prevention of hospital sink drain colonization; however, the impact is variable across different bacterial species. Further understanding of the dynamics of the microbiome within wastewater is needed.

Disclosures: None

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Presentation Type:

Poster Presentation - Poster Presentation

Subject Category: Hand Hygiene

Measuring hand hygiene opportunities per hour across two neonatal intensive care units

Eugene Lee; Souad Al-Muthree; Paige Reason; Meghan Donohue; Michael Dunn; Meghan Statchuk; Sarah Khan; Shikha Gupta-Bhatnagar; Salhab El-Helou; Jerome Leis and Dominik Mertz

Background: To estimate hand hygiene compliance using electronic hand hygiene monitoring, the number of hand hygiene opportunities (HHOs) per period must be known in a given setting. Data on the number of HHOs in a neonatal ICU (NICU) are limited. We measured HHOs per hour and identified factors that may influence the number of HHOs per hour to calibrate compliance estimates for electronic hand hygiene monitoring. **Methods:** The study was conducted in 2 large NICUs in Ontario, Canada (72 and 42 beds, respectively). We centrally trained observers to identify HHOs using the Ontario-based "Four Moments of Hand Hygiene," which is similar to combining moments 4 and 5 of the WHO "Five Moments of Hand Hygiene." To apply the moments of hand hygiene to the NICU setting, the following modifications were made: moment 1 was entering the incubator or contact with anything within the 'baby space' directly around the incubator, and moment 4 was when hands exited the incubator and, as such, the 'baby space.' Using a standardized tool, the investigators conducted direct observation of HHOs during randomized observation periods from July 1, 2022, to January 9, 2023. In addition to HHOs, data on covariables potentially associated with the frequency of HHOs were collected: time and day of the week, acuity, additional precautions, corrected gestational age, and private