Evidence Table
Guideline for Environmental Hygiene

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
1	Mitchell BG, Hall L, White N et al. An environmental cleaning bundle and health-care-associated infections in hospitals (REACH): a multicentre, randomised trial. *Lancet Infect Dis* . 2019;19(4):410–418.	Quasi-experimental	Patient wards in 11 hospitals, Australia	Sequential roll-out of environmental cleaning bundle over 62-week period	Current environmental cleaning practices	Incidence of health-care associated VRE, C. diff and *S. aureus* infections; high touch object cleaning thoroughness	Significant reduction in Vancomycin-resistant enterococci infections. Frequency of cleaning high touch objects in bathroom increased from 55% to 76% and in bedrooms from 64% to 86%.	IB
2	Mitchell, McGhie, Whiteley, Farrington, Hall, Halton, White Evaluating bio-burden of frequently touched surfaces using adenosine triphosphate bioluminescence (ATP): Results from the researching effective approaches to cleaning in hospitals (REACH) trial. *Infection , Disease & Health* . 2020;25(3):168–174. doi: 10.1016/j.idh.2020.02.001.	RCT	6 frequent touch points (FTP), ICU patient rooms, 3 hospitals, Australia	Sequential roll-out of environmental cleaning bundle over 62-week period	Current environmental cleaning practices	Amount of bioburden using ATP bioluminescence	Findings confirm improvement in cleaning of FTPs, demonstrating that there were improvements in discharge cleaning that aligned with improvements overall when using ATP as a marker of performance.	IB
3	Moccia G., Motta O., Pironti C., Proto A., Capunzo M., De Caro F. An alternative approach for the decontamination of hospital settings. *J Infect Public Health* . 2020;13(12):2038 EP. doi: 10.1016/j.jiph.2020.09.020.	Nonexperimental	Different wards of two healthcare structures, Italy	Disposable cloths pre-impregnated with solutions containing different active formulations and biocidal agents specific to areas to be treated, dedicated cleaning cart, education,documentation	n/a	Total microbial count values on the different surfaces before and after the sanitization operations	The innovative disinfection protocol proved to be an effective alternative to conventional cleaning methods in healthcare settings, improving efficiency and reducing cross-contamination risks.	IIIC
4	Christenson EC, Cronk R, Atkinson H, et al. Evidence map and systematic review of disinfection efficacy on environmental surfaces in healthcare facilities. *Int J Environ Res Public Health* . 2021;18(21). doi: 10.3390/ijerph182111100.	Systematic Review	181 articles	n/a	n/a	Disinfection efficacy on environmental surfaces	Disinfectant guidelines rely largely on laboratory data, underscoring the need to evaluate system-level efficacy rather than focusing solely on the disinfectant itself.	IIIB

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5	Rutala WA, Weber D J. Best practices for disinfection of noncritical environmental surfaces and equipment in health care facilities: *A bundle approach. Am J Infect Control.* 2019;47S: A96–A105. doi.org/10.1016/j.ajic.2019.01.014	Literature Review	n/a	n/a	n/a	n/a	A bundle consisting of 5 elements is necessary to facilitate effective surface cleaning and disinfection .	VA
6	Browne K, Mitchell B. Multimodal environmental cleaning strategies to prevent healthcare-associated infections. *Antimicrobial Resistance and Infection Control* . 2023;12(1):83. doi.org/10.1186/s13756-023-01274-4.	Literature Review	8 studies examining effect of environmental hygiene using multimodal approach on HAIs, Australia	n/a	n/a	n/a	A multimodal approach to environmental cleaning is necessary to provide a meaningful and sustainable program.	VA
7	Havill NL. Best practices in disinfection of noncritical surfaces in the health care setting: creating a bundle for success. *Am J Infect Control* . 2013;41(5 Suppl):S26–S30.	Expert Opinion	n/a	n/a	n/a	n/a	Written policies, appropriate disinfectants and application methods, staff education, monitoring and feedback are all necessary for sustainment of a successful environmental cleaning program.	VB
8	Assadian O, Harbarth S, Vos M et al. Practical recommendations for routine cleaning and disinfection procedures in healthcare institutions: a narrative review. *J Hosp Infect.* 2021;113: 104-114.doi:10.1016/j.jhin.2021.03.010.	Literature Review	n/a	n/a	n/a	n/a	A bundled or comprehensive approach that includes risk assessment, hand hygiened, evidence-based proctures, training, and monitoring with feedback is critical to reducing HAIs.	VA
9	Alexander JW, Van Sweringen H, Vanoss K, Hooker EA, Edwards MJ. Surveillance of bacterial colonization in operating rooms. *Surg Infect (Larchmt)* . 2013;14(4):345–351.	Nonexperimental	517 cultures from surfaces in 33 ORs, United States	n/a	n/a	Colony-forming units (CFU)	CFUs highest on OR attire and high touch areas, such as telephone, computer mouse and patient warming blanket.	IIIB
10	Link T, Kleiner C, Mancuso MP, Dziadkowiec O, Halverson-Carpenter K. Determining high touch areas in the operating room with levels of contamination. *Am J Infect Control* . 2016;44(11):1350–1355.	Nonexperimental	460 cultures of OR surfaces, United States	n/a	n/a	Aerobic colony counts (ACC) per centimeter squared	Low touch surfaces were less contaminated than high touch surfaces, with exception of OR bed.	IIIA

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11	Parry, Sestovic, Renz, Pangan, Grant, Shah Environmental cleaning and disinfection: Sustaining changed practice and improving quality in the community hospital. *Antimicrobial Stewardship & Healthcare Epidemiolog* y. 2022;2(1):1–7. doi: 10.1017/ash.2022.257.	Organizational Experience	High-touch surfaces, community hospital, United States	n/a	n/a	Surface cleaning performance; HAI rates	Environmental service training, monitoring, and feedback, instituted 10 years ago enhanced environmental cleaning in multiple areas of hospital and have been sustained to present. A dramatic reduction in HAI rates also occurred.	VB
12	Levine E., Abo-Gush S., Ezagui B.S., David R., Kopuit P., Bagrish N., Zalut T., Assous M.V., Freier-Dror Y., Yinnon A.M., Benenson S. Assessing and upgrading the cleanliness of the emergency department brief title: Upgrading the emergency room's cleanliness. *Infect Control Hosp Epidemiol.* 2024.doi: 10.1017/ice.2024.177.	Nonexperimental	79 patient rooms, emergency department, medical center, Israel	Two-step cleaning and disinfection; addition of 1 cleaning person to evening shift	n/a	Cleanliness of patient rooms measured by fluorescence and ATP swabs	The data demonstrates that a two-step intervention significantly improves cleaning in a busy ED.	IIIC
13	Hung I-C, Chang H-Y,Cheng A, et al. Implementation of human factors engineering approach to improve environmental cleaning and disinfection in a medical center. *Antimicrob Resist Infect Control* ..2020;9(17):1-8.doi:10.1186/s13756-020-0677-1.	Nonexperimental	Environmental service personnel, 84 patient rooms in medical wards, surgical wards, and ICUs, academic medical center, Taiwan	Environmental cleaning strategies designed by human factors engineering (HFE) principles.	n/a	Terminal cleaning and disinfection (TCD) score, incidence of multidrug-resistant organism carriage by clinical culture	The HFE approach can improve the thoroughness and effectiveness of terminal cleaning and disinfection, resulting in a reduction of patient carriage of multidrug-resistant organisms at hospitals.	IIIC

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14	White, Barnett, Hall, Mitchell, Farrington, Halton, Paterson, Riley, Gardner, Page, Gericke, Graves Cost-effectiveness of an environmental cleaning bundle for reducing healthcare-associated infections. *Clinical Infectious Diseases.* 2020;70(12):2461–2468. doi: 10.1093/cid/ciz717.	Nonexperimental	11 hospitals using, 6 Australian states and territories	Cleaning bundle	n/a	Numbers of *Staphylococcus aureus* bacteremia, *Clostridium diffici* le infection, and vancomycin-resistant *enterococci* infections prevented, quality-adjusted life-years (QALYs) gained, cost savings from fewer infections	A bundled, evidence-based approach to improving hospital cleaning is a cost-effective intervention for reducing the incidence of healthcare-associated infections.	IIIA
15	Wright R. Guideline for a safe environment of care. Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for a safe environment of care related to patients and perioperative personnel and the equipment used in the perioperative environment.	IVA
16	deKay K. Guideline for transmission-based precautions. Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for implementing standard and transmission-based precautions.	IVA
17	deKay K. Guideline for hand hygiene. Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for hand hygiene in the perioperative setting.	IVA
18	Cahn JA.Guideline for Sterile Technique. Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for maintaining sterile technique during surgical and other invasive procedures.	IVA
19	Miner M, Perry D. Guideline for Design and Maintenance of the Surgical Suite. Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for design and maintenance of perioperative environments.	IVA

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20	Association for the Healthcare Environment, American Hospital Association, American Society for Healthcare Environmental Services. *Practice Guidance for Healthcare Environmental Cleaning: The Essential Resource for Environmental Cleaning and Disinfection* . Chicago, IL: Association for the Healthcare Environment of the American Hospital Association;2018,3rd edition.	Consensus	n/a	n/a	n/a	n/a	Provides guidance for environmental cleaning in the health care setting.	IVB
21	Kyle E. Guideline for medical device and product evaluation. . Kyle E, ed. e-Subscription ed. AORN, Inc.; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for evaluating US Food and Drug Administration-cleared medical devices and products for use in the perioperative setting.	IVA
22	Sehulster L, Chinn RY, Arduino MJ et al. *Guidelines for Environmental Infection Control in Health-Care Facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)* . [Updated: July 2019] ed. American Society for Healthcare Engineering/American Hospital Association; 2003.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for environmental infection control in health care facilities.	IVA
23	Healthcare Infection Control Practices Advisory Committee, ed. *Core Infection Prevention and Control Practices for Safe Healthcare Delivery in All Settings—Recommendations of the Health-care Infection Control Practices Advisory Committee (HICPAC)* . Atlanta, GA: Centers for Disease Control and Prevention; 2024.	Guideline	n/a	n/a	n/a	n/a	Provides guidance on core practices to prevent infection in healthcare settings (eg aseptic technique, cleaning)	IVA

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24	Leas BF, Sullivan N, Han JH, Pegues DA, Kaczmarek JL, Umscheid CA, eds. *Environmental Cleaning for the Prevention of Healthcare-Associated Infections [Technical brief no. 22 (Prepared by the ECRI Institute – Penn Medicine Evidence-Based Practice Center under contract no. 290-2012-00011-I)* . Vol AHRQ Publication No. 15-EHC020-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2015.	Systematic Review	n/a	n/a	n/a	n/a	Research on disinfection methods and monitoring is limited; future studies should compare emerging technologies, identify high-risk surfaces, establish standardized cleanliness metrics, and, when feasible, use patient colonization and infection rates as outcomes.	IIIA
25	Rutala WA, Weber DJ; Healthcare Infection Control Practices Advisory Committee. .*Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008.* [May 2019 update]. ed. Atlanta, GA: Centers for Disease Control and Prevention; 2008.	Guideline	n/a	n/a	n/a	n/a	Provides guidance on the preferred cleaning, disinfection and sterilization of patient care medical devices and the cleaning and disinfecting the healthcare environment.	IVA
26	Disinfectants for emerging viral pathogens[EVPs]: List Q. United States Environmental Protection Agency (EPA) Web site. https://www.epa.gov/pesticide-registration/disinfectants-emerging-viral-pathogens-evps-list-q	Regulatory	n/a	n/a	n/a	n/a	Provides guidance on environmental dsinfectants for emerging viral pathogens	n/a
27	ANSI/AAMI TIR68:2018. *Low and Intermediate-Level Disinfection in Healthcare Settings for Medical Devices and Patient Care Equipment and Sterile Processing Environmental Surfaces.* Arlington, VA: AAMI; 2018.	Expert Opinion	n/a	n/a	n/a	n/a	Provides guidance on selection and use of low and intermediate-level disinfectants and the processes for safe and effective disinfection.	VA

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28	Dumas O, Varraso R, Boggs KM, et al. Association of occupational exposure to disinfectants with incidence of chronic obstructive pulmonary disease among US female nurses. *JAMA netw open* . 2019;2(10):e1913563.doi: 10.1001/jamanetworkopen.2019.13563.	Nonexperimental	73,262 US female nurses, United States	n/a	n/a	Incident physician-diagnosed COPD evaluated by questionnaire	These longitudinal results suggest that regular use of chemical disinfectants among nurses may be a risk factor for developing COPD.	IIIB
29	Dang KTL, Garrido AN, Prasad S, et al. The relationship between cleaning product exposure and respiratory and skin symptoms among healthcare workers in a hospital setting: A systematic review and meta-analysis. *Heal Sci Rep* . 2022;5(3):e623. doi: 10.1002/hsr2.623.	Systematic Review with Meta-Analysis	34 studies	n/a	n/a	n/a	The results suggest a need for preventive practices to reduce the risk of asthma and asthma-like symptoms in hospital workers exposed to occupational cleaning/disinfecting agents.	IIIA
30	Rosenman K, Reilly MJ, Pechter E, et al. Cleaning products and work-related asthma, 10 year update. *J Occup Environ Med* . 2020;62(2):130–137. doi: 10.1097/JOM.0000000000001771.	Nonexperimental	Work-related asthma(WRA) with exposure to cleaning product, 5 states, 1998 to 2012	n/a	Work-related asthma with exposure to cleaning product, 4 states, 1993 to 1997	Frequency of WRA, individual characteristics	The percentage of WRA cases from exposure to cleaning products from 1998 to 2012 was unchanged from 1993 to 1997 indicating that continued and additional prevention efforts are needed to reduce unnecessary use, identify safer products, and implement safer work. processes.	IIIB
31	Loven K, Isaxon C, Wierzbicka A, Gudmundsson A. Characterization of airborne particles from cleaning sprays and their corresponding respiratory deposition fractions. *J Occup Environ Hyg.* 2019;16(9):656–667. doi: 10.1080/15459624.2019.1643466.	Nonexperimental	7 trigger cleaning spray products, test chamber, Sweden	Spraying cleaning product	No sprayingof product	Total airborne mass fraction, particle size distribution, new particle formation from ozone reactions, respiratory deposition fraction	The use of cleaning sprays can result in chemical airway exposure, with particles in the relevant size range for both nasal and alveolar deposition.	IIIB

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32	Dalton, Maute, Hicks, Watson, Loccisano, Kerger Environmental chamber studies of eye and respiratory irritation from use of a peracetic acid-based hospital surface disinfectant. *Antimicrob Steward Healthc Epidemiol* . 2023;3(1):e71. doi: 10.1017/ash.2023.138.	Quasi-Experimental	44 healthy adult volunteers, simulated hospital room, laboratory, United States	Use of peracetic acid (PAA)-based surface disinfectant, acetic acid (AA), and hydrogen peroxide (HP)	Deionized water	Eye and respiratory tract irritation, breathing-zone concentrations of PAA, AA, and HP, tissue injury or inflammation measures, subjective odor or irritation scores	Simulated hospital use of PAA-based disinfectant led to no significant increases in objective markers of tissue injury, inflammation, or allergic sensitization, and no frank signs of eye or respiratory tract irritation.	IIC
33	Cadnum JL, Pearlmutter BS, Haq MF, Jencson AL, Donskey CJ. Effectiveness and real-world materials compatibility of a novel hydrogen peroxide disinfectant cleaner. *Am J Infect Control* . 2021;49(12):1572–1574. doi: 10.1016/j.ajic.2021.08.008.	Nonexperimental	4 chemical disinfectants applied with cotton cloth to treated carriers, mattress, bedside table, laboratory, United States	n/a	n/a	Log reduction of organisms on stainless steel carriers; material compatibility	The hydrogen peroxide disinfectant was effective against methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridioides difficil* e spores, carbapenem-resistant *Escherichia coli* , and 2 strains of *Candida auris* .	IIIB
34	Brown E, Dhanireddy K, Teska P, Eifert J, Williams RC, Boyer R. Influence of drying time on prewetted disinfectant towelettes to disinfect glass surfaces. *Am J Infect Control* . 2020;48(7):846 EP. doi: 10.1016/j.ajic.2019.11.006.	Nonexperimental	4 types of disinfectant wipes applied to glass surface inoculated with *Staphylococcus aureus* for 10 contact times, laboratory, United States	n/a	n/a	Drying time; elimination of *Staphylococcus aureus*	Prewetted disinfectant wipes dry quickly and further disinfection after drying time on glass surfaces is minimal, depending on the type of disinfectant.	IIIC
35	Wesgate R, Robertson A, Barrell M, Teska P, Maillard J-Y. Impact of test protocols and material binding on the efficacy of antimicrobial wipes. *J Hosp Infect* . 2019;103(1):e25 EP. doi: 10.1016/j.jhin.2018.09.016.	Quasi-experimental	*Pseudomonas aeruginosa* and *Staphylococcus aureus* innoculated on brushed stainless steel discs, laboratory, United Kingdom	2 quaternary ammonium (QAC)-based disinfectants, 1 hydrogen-peroxide based disinfectant combined with: microfibre, cotton, non-woven material	Neutral cleaner combined with: microfibre, cotton, non-woven material	Efficacy before and after binding with materials	Wiping cloth material has minimal impact on disinfectants despite varying absorption, though low-concentration QAC formulations pose higher risk. Efficacy varied widely by test method, emphasizing the need for stricter test selection for product labeling	IIC

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36	Otterspoor S., Farrell J. An evaluation of buffered peracetic acid as an alternative to chlorine and hydrogen peroxide based disinfectants. *Infecti , Dis Health* . 2019;24(4):240 EP. doi: 10.1016/j.idh.2019.06.003.	Case Report	n/a	n/a	n/a	n/a	Buffered peracetic acid was evaluated as an alternative to chlorine and hydrogen peroxide-based disinfectants within an operating theatre. The peracetic acid-based product met all criteria for use, including staff acceptance, cleaning expectation, cost, and efficacy requirements.	VB
37	Li J, Zhang Y, Zhang Z, et al. The effect of different concentrations of chlorine-containing disinfectants on high-frequency contact table in intensive care units: A quasi-experimental study. *PLoS ONE* . 2023;18(2):e0281802. doi: 10.1371/journal.pone.0281802.	Quasi-experimental	4 high-touch surfaces per bed unit, ICU, university hospital, China	Disinfection with 1000 mg/L and 2000 mg/L of chlorine	Disinfection with 500 mg/L of chlorine	ATP fluorescence monitoring and bacterial count detection	By reducing the concentration of ICU chlorine-containing disinfectants, it is possible to reduce the risk of long-term contamination and cost of using disinfectants.	IIB
38	Tyski S, Grzybowska W, Bocian E. Application of EN 16615 (4-field test) for the evaluation of the antimicrobial activity of the selected commercial and self-made disinfectant wipes. *Int J Environ Res Public Health* . 2021;18(11). doi: 10.3390/ijerph18115932.	Nonexperimental	Commercial wipes soaked in 6 disinfectants applied to polyvinyl chloride plates innoculated with bacteria, yeast, and multi-resistant bacteria, laboratory, Poland	n/a	Self-made non-woven fabric wipe soaked in 6 disinfectants	Log_{10} reduction in microorganisms, spread of microorganisms to subsequent areas	Self-made wipes with ethanol, propanol, and quaternary ammonium compounds were most effective with the shortest contact time, outperforming commercial propanol wipes. Commercial wipes with ethanol or sodium hypochlorite were least effective	IIIC
39	Summary of the federal insecticide, fungicide, and rodenticide act. https://www.epa.gov/laws-regulations/summary-federal-insecticide-fungicide-and-rodenticide-act.	Regulatory	n/a	n/a	n/a	n/a	Provides federal regulation for pesticide distributin, sale, and use.	n/a

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40	29 CFR 1910.1200: Hazard communication. Occupational Safety and Health Administration. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10099&p_table=STANDARDS.	Regulatory	n/a	n/a	n/a	n/a	Occupational Safety and Health Administration (OSHA) Hazard Communication standard which prescribes safeguards to protect workers against health hazards caused by chemicals.	n/a
41	Alfa MJ. Biofilms on instruments and environmental surfaces: Do they interfere with instrument reprocessing and surface disinfection? review of the literature. *Am J Infect Control* . 2019;47S:A39–A45.. doi: 10.1016/j.ajic.2019.02.027.	Literature Review	n/a	n/a	n/a	n/a	The article reviews the evidence supporting infection transmission from biofilm that accumulates in reprocessed instruments and likelihood dry surface biofilm on environmental reservoirs contributes to hospital-acuired infections.	VB
42	Schapira A, Dramé M, Olive C, Marion-Sanchez K. Bacterial viability in dry-surface biofilms in healthcare facilities: A systematic review. *J Hosp Infec* t. 2024;144:94–110. doi: 10.1016/j.jhin.2023.11.004.	Systematic Review	24 articles	n/a	n/a	n/a	To improve both surface monitoring and cleaning and disinfection protocols, it is necessary to integrate the concept of dry-surface biofilms which appears to contain a significant amount of viable but non-culturable bacteria.	IIA
43	Voorn MG, Kelley AM, Chaggar GK, Li X, Teska PJ, Oliver HF. Contact time and disinfectant formulation significantly impact the efficacies of disinfectant towelettes against candida auris on hard, non-porous surfaces. *Sci Rep* . 2023;13(1):5849. doi: 10.1038/s41598-023-32876-y.	Quasi-experimental	Formica surface contaminated with *C auris* , laboratory, United States	Off-label contact times (30 s, 1-, 2-, 3- and 10-min)	5 EPA registered disinfectant towelette products (3 quaternary ammonium (QAC), 1 QAC plus alcohol, 1 hydrogen-peroxide-based)	Log_{10} reduction	Disinfectant towelette efficacy is dependent upon product formulation and contact time, with hydrogen peroxide-based towelettes being more efficacious than quaternary ammonium chloride-alcohol-based towelettes, especially at contact times longer than 30 seconds.	IIC

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44	Hong Y, Teska PJ, Oliver HF. Effects of contact time and concentration on bactericidal efficacy of 3 disinfectants on hard nonporous surfaces. *Am J Infect Control* . 2017;45(11):1284–1285.	Nonexperimental	Stainless steel carriers in lab, United States	n/a	Accelerated hydrogen peroxide (AHP), quaternary ammonium compounds (Quats), sodium hypochlorite, no disinfectant	Bacterial reduction (log10)	Quat most affected by decrease in contact time and concentration, whereas sodium hypochlorite was least affected.	IIIB
45	Kelley AM, Voorn MG, Tembo GM, et al. Contact time has limited impact on the efficacy of disinfectant towelettes when tested under conditions reflective of realistic use. *Antimicrob Resist Infect Control* . 2023;12(1):71.. doi: 10.1186/s13756-023-01266-4.	Quasi-experimental	*Staphylococcus aureus* and *Pseudomonas aeruginosa* applied to laminate templates, laboratory, United States	5 types disinfectant towelettes with 30 s, 2 min, 3 min, 10 min contact times	5 types disinfectant towelettes with 1-minute contact time	Efficacy measured in log reduction	The efficacy of disinfectant towelettes was primarily influenced by the product type when tested in a model simulating realistic use, with contact time having a limited effect.	IIC
46	Nkemngong CA, Chaggar GK, Li X, Teska PJ, Oliver HF. Disinfectant wipes transfer clostridioides difficile spores from contaminated surfaces to uncontaminated surfaces during the disinfection process. *Antimicrob Resist Infect Control* . 2020;9(1):176. doi: 10.1186/s13756-020-00844-0.	Quasi-experimental	Formica surfaces innoculated with *C difficile* spores, laboratory, United States	6 different disinfectant wipe products with nonsporicidal claims	1 disinfectant wipe with sporicidal claim	Number of CFU on previously uncontaminated distances from inoculation point and on the used wipes	Regardless of the product type, all disinfectant wipes had some sporicidal effect but transferred *C. difficile* spores from contaminated to otherwise previously uncontaminated surfaces.	IIC
47	Gonzalez EA, Nandy P, Lucas AD, Hithcins VM. Ability of cleaning-disinfecting wipes to remove bacteria from medical device surfaces. *Am J Infect Control.* 2015;43(12):1221=1335.	Quasi-experimental	2.5- x 2.5-cm squares on 1 anesthesia machine, flat caps and ridged caps inoculated with S. aureus, Bacillus atrophaeus spores and Clostridium spores	Wiping with 5 types of commercial disinfectant wipes, gauze with water, gauze with diluted 5% bleach (1:10)	No wiping with disinfectant wipes or gauze	Percentage of *S. aureus* , *Bacillus atrophaeu* s spores and *Clostridium* spores remaining measured in colony forming units (CFU)	Five commercial wipes and gauze with diluted bleach significantly reduced organisms compared to water-soaked gauze. Greater moisture does not improve efficacy and may damage surfaces, such as electronics.	IIC

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48	Fulenchek J, Glenn D, Fite M, Clark C. Comparing the microbial removal efficacy of new and reprocessed microfiber on health care surfaces. *Am J Infect Control.* 2022;50(11):1274–1276. doi: 10.1016/j.ajic.2022.05.002.	Quasi-experimental	sinks and counters, acute care hospital, United States	60 new microfiber cloths and mopheads	60 re-processed cloths and mopheads	Microbial removal efficacy	Reprocessed microfiber cloths and pads, laundered according to CDC laundry parameters, achieve microbial removal from healthcare surfaces that is substantially equivalent to that of new microfiber.	IIC
49	Rathod SS, Desai DS. Ergonomic risk assessment using the rapid entire body assessment (REBA) tool among cleaners: A cross-sectional study. *Indian Journal of Occupational & Environmental Medicine* . 2024;28(4):277–281. doi: 10.4103/ijoem.ijoem_313_23.	Nonexperimental	95 environmental cleaning personnel performing regular work, educational institutes and hospitals, India	n/a	n/a	Ergonomic risk assessment using the Rapid Entire Body Assessment (REBA)	Medium to high ergonomic risk in cleaning tasks calls for interventions such as ergonomic training, rest breaks, safe posture education, improved tool design, and comprehensive occupational safety policies.	IIIB
50	Maloney B, McKerlie T, Nasir M, et al. The environmental footprint of single-use versus reusable cloths for clinical surface decontamination: A life cycle approach. *J Hosp Infect.* 2022;130:7 EP. doi: 10.1016/j.jhin.2022.09.006.	Nonexperimental	Microfibre, cotton cloths and single-use cloths with 3 different disinfectants	n/a	n/a	Life cycle impact assessment (LCIA)	Impacts were primarily attributed with the use of the disinfectant agent and transport processes (land, sea).	IIIB
51	Alhmidi H, Cadnum JL, Jencson AL, Gweder AA, Donskey CJ. Sharing is not always a good thing: Use of a DNA marker to investigate the potential for ward-to-ward dissemination of healthcare-associated pathogens. *Infect Control Hosp Epidemiol* . 2019;40(2):214–216. doi: 10.1017/ice.2018.320.	Nonexperimental	DNA and fluorescent marker placed on high touch areas of 6 portable devices, medical ward, United States	n/a	n/a	Transfer of DNA marker; Removal of fluorescent marker	Viral DNA marker innoculated onto portable equipment on a medical ward was disseminated to other wards when equipment was shared and to the physical work area and hospital cafeteria by HCP.	IIIC
52	Khandelwal A, Lapolla B, Bair T, et al. Enhanced disinfection with hybrid hydrogen peroxide fogging in a critical care setting. *BMC Infect Dis* . 2022;22(1):758.l. doi: 10.1186/s12879-022-07704-9.	Quasi-experimental	5 high touch surfaces, 17 single patient rooms after patient discharge, adult and pediatric burn center, United states	Hybrid hydrogen peroxide (HHP) fogging technology	Standard cleaning or cleaning followed by ultraviolet (UV) light use for MDRO	Reduction in aerobic colony counts (ACC) and adenosine triphosphate (ATP) levels	HHP fogging is a thorough and efficacious technology which, when applied to critical care patient rooms, significantly reduces bioburden on surfaces, indicating potential benefits for implementation as part of infection prevention measures.	IIB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
53	Lee LD, Lie L, Bauer M, et al. Reduction of Airborne and Surface-Borne Bacteria in a Medical Center Burn Intensive Care Unit Using Active, Upper-Room, Germicidal Ultraviolet (GUV) Disinfection. *Infect Control Hosp Epidemiol* . 2024;45(3):367-373. doi.org/10.1017/ice.2023.223.	Quasi-Experimental	10 patient rooms, Burn ICU, academic medical center, United States	Automated upper room UV-light emitting device (UV Angel)	No UV-light emitting device	Airborne and surface bacterial counts (CFUs)	Active upper-room UV-C disinfection may decrease the concentration of bacteria in the air and on settled surfaces.	IIC
54	Sanguinet J, Edmiston C. Evaluation of dry hydrogen peroxide in reducing microbial bioburden in a healthcare facility. *Am J Infect Control.* 2021;49(8):985 EP. doi: 10.1016/j.ajic.2021.03.004.	Quasi-experimental	5 different units, tertiary hospital, United States	Dry hydrogen peroxide (DHP) used as an adjunct to routine cleaning and disinfection	No DHP	Reduction in microbial air and surface contamination measured as colony forming units (CFU)	Dry hydrogen peroxide was effective in reducing both air and surface microbial contamination in a variety of settings within a large, tertiary care hospital.	IIB
55	Wright D, Christie J, Lawrence J, Vaughn KL, Walsh TF. Effectiveness of dry hydrogen peroxide in reducing air and surface bioburden in a multicenter clinical setting. *Infect Control Hosp Epidemiol.* 2024;45:501-508.doi:10.1017/ice.2023.153.	Nonexperimental	74 patient care areas, free-standing ED with no negative pressure system and 2 tertiary-care hospitals, United States	Dry hydrogen peroxide (DHP) run continuously	No DHP; outside air	Air and surface microbial load, before deployment and on days 14, 20, 60 and 90 after deployment	DHP has the potential to reduce microbial air and surface bioburden in occupied patient rooms with standard ventilation parameters.	IIIB
56	Casini B, Tuvo B, Cristina ML, et al. Evaluation of an ultraviolet C (UVC) light-emitting device for disinfection of high touch surfaces in hospital critical areas. *Int J Environ Res Public Health* . 2019;16(19):3572. h doi: 10.3390/ijerph16193572.	Quasi-experimental	5 high touch surfaces in 5 patient rooms, 2 ICU isolation rooms, 9 ORs, academic hospital, Italy	Pulsed xenon-based ultraviolet light no-touch disinfection systems (PX-UVC) following SOP	Standard operating protocol (SOP)	Reduction in total bacterial count (TBC) on 5 high-touch surfaces and elimination of high-concern microorganisms	The implementation of the standard cleaning and disinfection procedure with the integration of the PX-UVC treatment had effective results in both the reduction of hygiene failures and in control of environmental contamination by high-concern microorganisms.	IIB

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57	Lowman W, Etheredge HR, Gaylard P, Fabian J. The novel application and effect of an ultraviolet light decontamination strategy on the healthcare acquisition of carbapenem-resistant enterobacterales in a hospital setting. *J Hosp Infect* . 2022;121:57–64. . doi: 10.1016/j.jhin.2021.12.008.	Quasi-experimental	Patients with carbapenem-resistant *Enterobacterales* (CRE) isolated from clinical speciment, 5 units, medical center, South Africa	Continuous ultraviolet light (C-UV) decontamination added to standard cleaning during and after room occupation	Standard cleaning	Incidence density rates of CRE	C-UV decontamination can potentially reduce healthcare acquisition of CRE when implemented with an in-use protocol.	IIB
58	Gagnon H, Pokhrel A, Bush K, et al. Limited reduction in clostridioides difficile and methicillin-resistant staphylococcus aureus with the use of an aerosolized hydrogen peroxide disinfection system in tertiary health care facilities in alberta, canada. *Am J Infect Control* . 2024;52(4):410–418. doi: 10.1016/j.ajic.2023.09.019.	Quasi-experimental	Rooms that had been occupied by patients with HAIs on 6 units, 3 acute care facilities, Canada	Following cleaning, use of aerosolized hydrogen peroxide disinfection system		Incidence rate ratio (IRR) of hospital-acquired *Clostridioides difficile* infection (HA-CDI) and hospital-acquired Methicillin-resistant *Staphylococcus aureus* (HA-MRSA), cleaning turnaround time, time to operate, and utilization	No significant changes in HA-CDI or HA-MRSA were observed after introducing aerosolized hydrogen peroxide. Implementing nonmanual room disinfection alongside standard cleaning requires substantial investment and careful consideration of multiple factors.	IIB
59	Kelly S, Schnugh D, Thomas T. Effectiveness of ultraviolet-C vs aerosolized hydrogen peroxide in ICU terminal disinfection. *J Hosp Infect* . 2022;121:114–119.doi: 10.1016/j.jhin.2021.12.004.	Nonexperimental	Media plates with 6 healthcare associated pathogens and 5 high touch surfaces, trauma ICU, academic hospital, Africa	n/a	Ultraviolet-C light room decontamination device ; Aerosolized hydrogen peroxide device	Mean microbial reduction in non-shaded and shaded areas, mean kill rate for all areas, microbial load on manually cleaned surfaces	UV-C devices achieved significantly higher microbial reduction than aerosolized hydrogen peroxide, particularly in unshaded areas, though both methods eliminated residual contamination after manual cleaning.	IIIC

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60	Nagaraj S, Chandrasingh S, Jose S, et al. Effectiveness of a novel, non-intrusive, continuous-use air decontamination technology to reduce microbial contamination in clinical settings: a multi-centric study. *J Hosp Inf.* 2022;123:15-22.doi:10.1016/j.jhin.2022.02.002.	Quasi-experimental	Single and multi-bed patient rooms, ICU, 2 hospitals, India	ZeBox technology (1 unit)	No ZeBox technology	Airborne and surface microbial loads	Significant reduction of both airborne and surface bacterial and fungal load. It thereby serves an unmet need for reducing the incidence of HAI.	IIB
61	Ramirez M, Matheu L, Gomez M, et al. Effectiveness of dry hydrogen peroxide on reducing environmental microbial bioburden risk in a pediatric oncology intensive care unit. *Am J Infect Contro* l. 2021;49(5):608 EP. doi: 10.1016/j.ajic.2020.08.026.	Quasi-experimental	Surface samples from 5 high-touch and 2 low-touch surfaces in 4 pediatric intensive care unit rooms, oncology hospital, Guatemala	Dry hydrogen peroxide (DHP) was deployed	DHP was not deployed	Total colony-forming units for cultures, relative light units for adenosine triphosphate, air samples	DHP was effective in reducing microbial surface contamination and improves quality of environmental cleaning.	IIB
62	Melgar M, Ramierez M, Chang A, Antillon F. Impact of dry hydrogen peroxide on hospital-acquired infection at a pediatric oncology hospital.*Am J Infect Control* . 2022;50(8):909–915. doi:10.1016/j.ajic.2021.12.010.	Nonexperimental	9 PICU beds, 15 IMCU beds , oncology hospital, Guatemala	Standard cleaning and Continuous Dry Hydrogen Peroxide (DHP) in PICU; Standard cleaning IMCU	n/a	Hospital-acquired infection (HAIs) incidence rate	Significant decrease in PICU overall HAI incidence rates including *Clostridiodes* -associated gastroenteritis. Logistic multivariate regression found a significiant association between DHP exposure and reduced odds of developing an HAI.	IIIB
63	Hakim H, Gilliam C, Tang L, Xu J, Lee LD. Effect of a shielded continuous ultraviolet-C air disinfection device on reduction of air and surface microbial contamination in a pediatric oncology outpatient care unit. *Am J Infect Control* . 2019;47(10):1248–1254. doi: 10.1016/j.ajic.2019.03.026.	Quasi-experimental	Outpatient care units, pediatric oncology center, United States	6 test locations with continuous shielded UV-C air disinfection devices	10 locations without continous shielded UV-C devices	Changes in bacterial and fungal colony forming unit (CFU) counts in air and surface samples	The effectiveness of UV-C air disinfection in reducing air and surface microbial contamination in outpatient clinical areas where immunocompromised children are encountered decreased, but not significantly. More studies needed to measure impact of this technology on patient outcomes.	IIB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
64	Amodeo D, Manzi P, De Palma I, et al. Efficacy of violet-blue (405 nm) LED lamps for disinfection of high-environmental-contact surfaces in healthcare facilities: leading to the inactivation of microorgansism and reduction of MRSA contamination. *Pathogens.* 2023;12:1228. . doi: 10.3390/pathogens12111338. doi:10.3390/pathogens12111338.	Quasi-experimental	High touch surfaces, steel and plastic MRSA-contaminated surfaces, Infection Control laboratory, hospital, Italy	Continuous violet-blue light (405 nm) 18 hours for 7 days on HTS ; continuous violet-blue light for 18 hours for 1 day on MRSA	No exposure to violet-blue light	Number of CFU of bacteria, yeasts, and molds	Significant reduction in the number of bacteria, yeasts, and molds on sampled surfaces. MRSA microbial load was also significantly reduced, with greater reduction on steel surfaces than plastic surfaces.	IIC
65	Chatterjee P, Choi H , Ochoa B, et al. Clade-specific variation in susceptibility of candida auris to broad-spectrum ultraviolet C light (UV-C). *Infect Control Hosp Epidemiol.* 2020;41(12):1384–1387. doi: 10.1017/ice.2020.410.	Nonexperimental	10 *Candida auris* isolates on 20-mm steel carriers, laboratory, United States	Pulsed xenon UV-C room disinfection for 10, 20, and 30 minutes at 5 feet.	No UV-C	Colony counts and log reductions of *Candida auris* isolates	Variability in susceptibility to UV-C of *C. auris* isolates belonging to different clades. More studies are needed to assess whether a cumulative impact of prolonged UV-C exposure provides additional benefit.	IIIC
66	Choi H, Chatterjee P, Hwang M, et al. Can multidrug-resistant organisms become resistant to ultraviolet (UV) light following serial exposures? characterization of post-UV genomic changes using whole-genome sequencing. *Infect Control Hosp Epidemiol* . 2022;43(1):72–78.doi: 10.1017/ice.2021.51.	Quasi-experimental	3 multi-drug resistant microbial strains innoculated onto plates, laminar flow hood, laboratory, United States	25 cycles of xenon-based UV lamp	25 cycles of mercury-based UV lamp	Surviving colony-forming units (CFUs); DNA changes using whole-genome sequence (WGS)analysis	Exposure of multidrug-resistant bacteria to UV produced from 2 different UV sources did not engender UV resistance after 25 serial exposures, as demonstrated by WGS analysis; thus, UV disinfection is unlikely to generate UV-resistant hospital flora.	IIC
67	Gorny Rl, Golofit-Szymczak M, Pawlak A, et al. Effectiveness of UV-C radiation in inactivation of microorganisms on materials with different surface structures. *Ann Agric Environ Med.* 2024;31(2):287–293. doi: 10.26444/aaem/189695.	Quasi-experimental	Five microorganisms (3 bacteria,1 virus,1 fungus) deposited on metal, plastic, and glass surfaces with smooth and rough texture, laboratory,Poland	UV-C light with low-pressure mercury lamp	UV-C emitting diodes (UV-C LEDs)	Survivability of microorganisms after 20-minute exposure to UV-C light at distances of 0.5 m, 1 m, and 1.5 m	Both UV-C sources were effective, with LEDs outperforming mercury lamps. Microbial survival decreased with distance and was highest on glass and plastic surfaces.	IIB

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68	Kimura T, Yahata H, Uchiyama Y. Examination of material compatibilities with ionized and vaporized hydrogen peroxide decontamination. *J Am Assoc Lab Anim Sci* . 2020;59(6):703 EP. doi: 10.30802/AALAS-JAALAS-19-000165.	Nonexperimental	24 kinds of materials exposed up to 100 cycles of ionized hydrogen peroxide (iHP); 36 kinds of materials exposed up to 200 cycles to vaporized hydrogen peroxide (VHP), laboratory, Japan	n/a	n/a	Material damage, discoloration, corrosion, hardening, softening, air-bubbling	Decontaminating equipment in a manner that avoids condensation of hydrogen peroxide is crucial, as the material damage is more severe under condensation conditions than under dry conditions.	IIIB
69	Lorenzo-Leal A, Tam W, Kheyrandish A, Mohseni M, Bach H. Antimicrobial activity of filtered far-UVC light (222 nm) against different pathogens. *Biomed Res Int* . 2023;2023:2085140.doi: 10.1155/2023/2085140.	Quasi-experimental	Gram-negative, gram-positive, and yeast pathogens on plastic surfaces placed 50 cm from UV-C lamp, laboratory, Canada	Far-UVC fixture applied for 5-30 minutes	n/a	Log reduction	Filtered far-UVC light (222 nm) effectively inactivated a range of bacteria and fungi, achieving >3-log reductions within 30 minutes at 50 cm. This technology shows promise as a safe, supplemental disinfection method for healthcare environments	IIB
70	Memic S, Osborne AO, Cadnum JL, Donskey CJ. Efficacy of a far-ultraviolet-C light technology for continuous decontamination of air and surfaces. *Infect Control Hosp Epidemiol.* 2024;45(1):132–134. doi: 10.1017/ice.2023.159.	Quasi-experimental	Aerosolized virus (bacteriophage MS2), healthcare-associated pathogens on carriers, room in laboratory, United States	2 wall-mounted, far-ultraviolet-C lights (222nm), 2 m from floor	Far UV-C technology turned off	Reduction in aerosolized virus; reduction in healthcare-associated pathogens	Far-UVC light reduced aerosolized virus and vegetative bacteria by >3 log10 within 30–45 minutes, but was ineffective against Candida auris and C. difficile spores.	IIC
71	*Guide to Understanding Health Technology Assessment (HTA)* . Institute for Clinical and Economic Review (ICER); 2018. https://icer.org.	Expert Opinion	n/a	n/a	n/a	n/a	Provides guidance on hand hygiene, appropriate precautions, and environmental disinfection to prevent and control *C auris* outbreaks.	VB

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72	Casini B, Tuvo B, Scarpaci M, et al. Implementation of an environmental cleaning protocol in hospital critical areas using a UV-C disinfection robot. *Int J Environ Res Public Health* . 2023;20(5). doi: 10.3390/ijerph2005428.	Nonexperimental	20 high-touch surfaces in single patient room, ICU isolation room and 2 ORs, academic hospital, Italy	UV-C disinfection robot following SOP	Standard operating protocol (SOP) cleaning and disinfection	Number of positive sampling sites, compliance with national hygienic standards	The addition of UV-C disinfection to the standard cleaning and disinfection procedure had effective results in reducing hygiene failures.	IIIB
73	Bosco R, Cevenini G, Gambelli S, Nante N, Messina G. Improvement and standardization of disinfection in hospital theatre with ultraviolet-C technology. *J Hosp Infect.* 2022;128:19-25.doi:10.1016/j.jhin.2022.07.006.	Nonexperimental	HTSs in 2 orthopedic surgery ORs, 1 opthalmologic surgery OR, hospital, Italy	UVC device (UVC-D) at 3 min, UVC-D at 5 min placed at 2 points near OR bed	No UVC-D	Percentage and log_{10} and reduction	Significant reduction in CFUs from before UVC-D use to after use of UVC-D. No difference in CFUs between UV exposure of 3 and 5 min.	IIIC
74	Villacis JE, Lopez M, Passey D, et al. Efficacy of pulsed-xenon ultraviolet light for disinfection of high-touch surfaces in an Ecuadorian hospital. 2019. *BMC Infectious Diseases;* 19(575):1-6.doi:10.1186/s12879-019-4200-3.	Nonexperimental	High-touch surfaces in 12 patient rooms, 4 ORs,public hospital; 4 resistant bacteria on petri dishes, laboratory , Ecuador	Pulsed xenon UV disinfection following terminal manual clean; Pulsed xenon UV for 5-minutes	n/a	Total number of colony forming units	Pulsed-xenon ultraviolet disifnection technology is an efficacious addition to established manual cleaning in reducing MDROs.	IIIC
75	Armellino D, Walsh TJ, Petraitis V, Kowalski W. Assessment of focused multivector ultraviolet disinfection with shadowless delivery using 5-point multisided sampling of patientcare equipment without manual-chemical disinfection. *Am J Infect Control* . 2019;47(4):409–414. doi: 10.1016/j.ajic.2018.09.019.	Quasi-experimental	ORS, 3 hospitals, United States	Focused multivector ultraviolet (FMUV) 90-second disinfection cycle for select surfaces between cases and before first case of day	Standard terminal manual-chemical cleaning and disinfection protocol for all surfaces	Microbial burden using 5-point sampling protocol	FMUV produced significant overall reduction of microbial burden in all phases and independent of manual cleaning and disinfection.	IIB

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76	Armellino D, Goldstein K, Thomas L, Walsh TJ, Petraitis V. Comparative evaluation of operating room terminal cleaning by two methods: Focused multivector ultraviolet (FMUV) versus manual-chemical disinfection. *Am J Infect Control* . 2020;48(2):147–152. doi: 10.1016/j.ajic.2019.10.009.	Quasi-experimental	6 ORs, community hospital, United States	Terminal clean with Focused multivector ultraviolet (FMUV) 90-second disinfection cycle if visibly clean	Terminal clean with standard manual-chemical cleaning and disinfection protocol	Microbial burden using 5-point sampling protocol	FMUV incorporated in a parallel process consistently produced thorouh and significant reduction on all "visibly cleaned" equipment.	IIB
77	Murrell LJ, Hamilton EK, Hohnso HB, Spencer M. Influence of visible-light continous environmental disinfection system on microbial contamination and surgical site infections in an orthopedic operating room. *Am J Infection Control* .2019;47:804-810.	Quasi-experimental	Orthopedic procedures, 2 adjacent ORs, regional hospital, US	Ceiling-mounted visible-light continuous disinfection system (CED) with violet-blue light (405-410 nm)	Adjacent OR with no CED	Total colony-forming units of 25 surfaces, SSIs over 1 year	An 81% reduction in CFUs in OR with CED system and 49% reduction in adjacent OR. SSIs decreased from 1.4% in the year prior to CED installation to 0.4% folllowing installation.	IIB
78	Dancer SJ, King M-F. Systematic review on use, cost and clinical efficacy of automated decontamination devices. *Antimicrob Resist Infect Control* . 2021;10(1):34. doi: 10.1186/s13756-021-00894-y.	Systematic Review	43 studies	n/a	n/a	n/a	Evidence for patient benefit from automated H_2O_2 or UV devices is mixed, with many studies lacking controls and raising concerns about cost, toxicity, and industry bias. Routine use should be justified by standardized, controlled research	IIIB
79	Resendiz M, Blanchard D, West GF. A systematic review of the germicidal effectiveness of ultraviolet disinfection across high-touch surfaces in the immediate patient environment. *J infect prev* . 2023;24(4):166–177. doi: 10.1177/17571774231159388.	Systematic Review	Twelve studies	n/a	n/a	n/a	UV-C disinfection is generally more effective than standard protocols, though its performance varies with surface and room characteristics.	IIIB

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80	Lucarelli V, Amodeo D, de Palma I, Nante N, Cevenini G, Messina G. The potential role of violet-blue light to preventing hospital acquired infections: A systematic review. *Front public health* . 2024;12:1474295. doi: 10.3389/fpubh.2024.1474295.	Systematic Review	47 studies	n/a	n/a	n/a	Violet-blue light can provide continuous environmental disinfection that is safe for room occupants and has a positive environmental impact.	IIIB
81	ANSI/HSI 2000-2023: Healthcare UV germicidal light whole-room surface disinfection ; 2022. https://webstore.ansi.org/standards/ansi/ansihsi20002023	Consensus	n/a	n/a	n/a	n/a	Performance standard with a reproducible patient-centric tool to evaluate the plethora of whole-room surface germicidal light systems for single occupancy patient room/bathroom as well as for an operating room.	IVB
82	De Novo Classification Request for LightStrike+. U.S. Food & Drug Administration (FDA) Web site. https://www.accessdata.fda.gov/cdrh_docs/reviews/DEN230007.pdf	Regulatory	n/a	n/a	n/a	n/a	Approval for new Class II medical device classification of "whole room microbial reduction device" for ultraviolet products intended to reduce microbial load on non-porous, non-critical medical device surfaces.	n/a
83	Claus H. Ozone generation by ultraviolet lamps. *Photochem Photobiol* . 2021;97(3):471–476. h. doi: 10.1111/php.13391	Expert Opinion	n/a	n/a	n/a	n/a	Illustrates ozone generation by UV-C lamps to provide users with a better understanding of the risks and how to control ozone when using UV-C lamps.	VA

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84	Suh D, Hockett Sherlock S, Dukes KC, Perencevich EN, Marra AR. Impact of UV-C on material degradation: a scoping literature review. Antimicrobial Stewardship & Healthcare Epidemiology. 2025;5(1):e199. doi:10.1017/ash.2025.10114.	Literature Review	n/a	n/a	n/a	n/a	UV-C exposure can substantially degrade many commonly used polymer materials. These results highlight the importance of choosing materials carefully for UV-C applications and point to the need for continued research on strategies to reduce damage and extend material lifespan.	VA
85	Pearson N, Naylor P J, Ashe MC, Fernandez M, Yoong SL, Wolfenden L. Guidance for conducting feasibility and pilot studies for implementation trials. *Pilot and Feasibility Studies.* 2020;6(1):167. doi:10.1186/s40814-020-00634-w.	Consensus	n/a	n/a	n/a	n/a	Provides guidance for conducting feasibility and pilot studies to enrich and inform larger scale implementation trials.	IVB
86	29 CFR 1910.1030: Bloodborne pathogens. Occupational Safety and Health Administration. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10051&p_table=STANDARDS.	Regulatory	n/a	n/a	n/a	n/a	Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens standard as amended pursuant to the Needlestick Safety and Prevention Act of 2000, which prescribes safeguards to protect workers against health hazards caused by bloodborne pathogens.	n/a
87	Dallolio L, Raggi A, Sanna T, et al. Surveillance of environmental and procedural measures of infection control in the operating theatre setting. *Int J Environ Res Public Health*. 2018;15(1):E46. doi:10.3390/ijerph15010046.	Nonexperimental	200 surface samples from 10 ORs in 2 hospitals, Italy	n/a	n/a	Total viable microbiological count on surfaces	Only 6 samples were slightly above recommended levels indicative of efficacy of the between case and end of day cleaning procedures.	IIIB

Evidence Table

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REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
88	Dancer SJ. The role of environmental cleaning in the control of hospital-acquired infection. *J Hosp Infect* . 2009;73(4):378–385.	Literature Review	n/a	n/a	n/a	n/a	Discusses links between hospital environment and pathogens (MRS, VRE, C diff). Discusses emphasis of cleaning high touch surfaces and defining what clean is.	VB
89	Richard RD, Bowen TR. What orthopaedic operating room surfaces are contaminated with bioburden? A study using the ATP bioluminescence assay. *Clin Orthop* . 2017;475(7):1819–1824. doi:10.1007/s11999-016-5221-5.	Nonexperimental	Surfaces in 6 orthopaedic OR's in large medical center, United States	n/a	n/a	ATP bioluminescence assay	ATP bioluminescence can identify uncleaned areas of OR that could potentially lead to increased infection rates.	IIIC
90	Kanamori H, Rutala W, Gergen M, Weber DJ. Perioperative Bacterial Contamination From Patients on Contact Precaution in Operating Room Environment. *Open Forum Infectious Diseases* . 2020. doi.org/10.1093/ofid/ofaa508.	Quasi-experimental	10 patients on contact precautions for MDRO undergoing surgery, OR, United States	Floors and surfaces cleaned with QUAT	No clean	Aerobe and MDR pathogens CFUs of 15 high-touch sites prior to patient, after patient leaves, after clean	The perioperative environment was contaminated with aerobic bacteria and methicillin-resistant *Staphylococcus aureus* after surgery, but cleaning and disinfection significantly reduced contamination. However, some MRSA remained.	IIB
91	Guh A, Carling P. *CDC Toolkit: Options for Evaluating Environmental Cleaning.* Environmental Evaluation Workgroup: Centers for Disease Control and Prevention (CDC); 2010.	Expert Opinion	n/a	n/a	n/a	n/a	Outlines 3 different programs, based on facility resources, to objectively monitor thoroughness of high touch surface room cleaning upon discharge in hospital settings.	VB
92	Dancer SJ, Kramer A. Four steps to clean hospitals: LOOK, PLAN, CLEAN and DRY. *J Hosp Infect* . 2019;103(1):e1–e8.doi:10.1016/j.jhin.2018.12.015.	Expert Opinion	n/a	n/a	n/a	n/a	Snthesizes existing literature and expert opinion to propose a systematic, evidence-informed cleaning protocol for hospital environments, particularly the occupied patient bed space.	VA

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93	Pedersen A, Getty Ritter E, Beaton M, Gibbons D. Remote video auditing in the surgical setting. *AORN J* . 2017;105(2):159–169. doi:10.1016/j.aorn.2016.11.019.	Organizational Experience	17 room OR of tertiary hospital, United States	n/a	n/a	n/a	Video monitoring of environmental cleaning protocol adherence, along with immediate feedback increased compliance to 93% and a 10% decrease in SSIs from previous year.	VA
94	Deshpande A, Cadnum JL, Fertelli D, et al. Are hospital floors an underappreciated reservoir for transmission of health care-associated pathogens? *Am J Infect Control.* 2017;45(3):336–338. doi:10.1016/j.ajic.2016.11.005.	Nonexperimental	Isolation patient rooms in 5 hospitals, United States	n/a	n/a	Cultured floor for *C-diff* , MRSA and VRE growth; observation of number and type of objects present on floor.	Floors of patient rooms during admission and after discharge cleaning were frequently contaminated with health care-associated pathogens and high-touch objects very often touched floor.	IIIB
95	Munoz-Price LS, Birnbach DJ, Lubarsky DA, et al. Decreasing operating room environmental pathogen contamination through improved cleaning practice. *Infect Control Hosp Epidemiol* . 2012;33(9):897–904. doi:10.1017/ice.2018.303.	Quasi-experimental	194 ORs in teaching hospital, United States	Verbal and graphic educational programs for staff.	Baseline before feedback and education	Removal of UV markers; environmental cultures	Thoroughness of cleaning was improved by providing feedback obtained from UV markers and gram staining of environmental cultures.	IIA
96	Munoz-Price LS, Bowdle A, Johnston BL et al. Infection prevention in the operating room anesthesia work area. *Infect Control Hosp Epidemiol.* 2018; December 11 :1–17.	Consensus	n/a	n/a	n/a	n/a	Provides recommendations for anesthesia work area infection prevention that include hand hygiene, environmental disinfection and implementing effective improvement efforts.	IVA

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
97	Kim YJ, Hong MY, Kang HM, et al. Using adenosine triphosphate bioluminescence level monitoring to identify bacterial reservoirs during two consecutive enterococcus faecium and staphylococcus capitis nosocomial infection outbreaks at a neonatal intensive care unit. *Antimicrob Resist Infect Contro* l. 2023;12(1):68.doi: 10.1186/s13756-023-01273-5.	Case Report	n/a	n/a	n/a	n/a	*Enterococcus faecium* isolated from keyboards and *Staphylococcus capitis isolated from* HCPs' hands were determined as source of transmission of two outbreaks in 50-bed neonatal intensive care unit.	VA
98	Das A, Conti J, Hanrahan J, Kaelber DC. Comparison of keyboard colonization before and after use in an inpatient setting and the effect of keyboard covers. *Am J Infect Control* . 2018;46(4):474–476.	Quasi-experimental	Adult medicine inpatient rooms, United States	Soft typeable keyboard cover	Uncovered keyboard	Bacterial count; bacterial type: nonpathogenic (NPB) or potentially pathogenic (PPB)	Keyboards with covers were colonized by NPF and PPB more often than keyboards without covers.	IIB
99	Siegel JD, Rhinehart E, Jackson M, Chiarello L, Health Care Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings. *Am J Infect Control* . 2007;35(10 Suppl 2):S65–S164. doi:S0196-6553(07)00740-7 [pii].	Guideline	n/a	n/a	n/a	n/a	Provides guidance for preventing transmission of infectious agents to patient and healthcare works in the United States.	IVA
100	ANSI/AAMI TIR67:2018. *Promoting safe practices pertaining to the use of sterilant and disinfectant chemicals in health care facilities* . Arlington, VA: Association for the Advancement of Medical Instrumentation; 2018.	Expert Opinion	n/a	n/a	n/a	n/a	Provides guidance on occupational safety when utilizing sterilant and disinfectant chemicals by providing relevant regulatory and general actions to ensure their safe use.	VA
101	42 CFR 416: Ambulatory surgical services. Government Publishing Office. https://www.govinfo.gov/app/details/CFR-2011-title42-vol3/CFR-2011-title42-vol3-part416.	Regulatory	n/a	n/a	n/a	n/a	Guidance on what may be included during a survey for ambulatory surgical centers (ASCs). Includes sanitary environment	n/a

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
102	42 CFR 482: Conditions of participation for hospitals. Government Publishing Office. https://www.govinfo.gov/app/details/CFR-2011-title42-vol5/CFR-2011-title42-vol5-part482.	Regulatory	n/a	n/a	n/a	n/a	Provides guidance for services hospitals should provide if participating in Medicare.	n/a
103	Goebel U, Gebele N, Ebner W et al. Bacterial contamination of the anesthesia workplace and efficiency of routine cleaning procedures: a prospective cohort study. *Anesth Analg* . 2016;122(5):1444–1447. doi:10.1213/ANE.0000000000001220.	Nonexperimental	200 orthopedic surgeries in university hospital, Germany	n/a	n/a	Decontamination time, visible marker and bacterial load of anesthesia workplace	Significant difference found in all 3 outcome measures in trained housekeeping staff compared to anesthesia nurses, supporting the need for specialized training.	IIIB
104	van 't Veen A, van der Zee A, Nelson J, Speelberg B, Kluytmans JA, Buiting AG. Outbreak of infection with a multiresistant Klebsiella pneumoniae strain associated with contaminated roll boards in operating rooms. *J Clin Microbiol.* 2005;43(10):4961–4967.	Case Report	n/a	n/a	n/a	n/a	Roller boards contaminated with multiresistant *Klebsiella pneumoniae* used in 2 operating rooms resulted in 7 patients becoming colonized or infected with the strain.	VB
105	Infection Prevention and Control Guidelines for Anesthesia CareAmerican Association of Nurse Anesthetists (AANA); 2025. https://www.aana.com/practice/clinical-practice/clinical-practice-resources/infection-prevention-and-control/.	Guideline	n/a	n/a	n/a	n/a	Guidance on infection prevention and control best pratices in the anesthesia workarea	IVB
106	Balkissoon R, Nayfeh T, Adams KL, Belkoff SM, Riedel S, Mears SC. Microbial surface contamination after standard operating room cleaning practices following surgical treatment of infection. *Orthopedics* . 2014;37(4):e339–e344. doi:10.3928/01477447-20140401-53.	Nonexperimental	270 surface samples from 14 infected and 16 noninfected surgeries at a academic medical center, United States	n/a	n/a	Microbial surface contamination (colony-forming units).	No significant difference was found in colony counts between surfaces in infected or noninfected cases. No relationship found between infected case organisms and OR surfaces.	IIIB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
107	Berrios-Torres SI, Umscheid CA, Bratzler DW; Healthcare Infection Control Practices Advisory Committee. et al.. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection; 2017. *JAMA Surg* . 2017;152(8):784–791.	Guideline	n/a	n/a	n/a	n/a	Re-emphasis of select 1999 CDC and HICPAC recommendations for prevention of SSIs.	IVA
108	Abolghasemian M, Sternheim A, Shakib A, Safir OA, Backstein D. Is arthroplasty immediately after an infected case a risk factor for infection? *Clin Orthop.* 2013;471(7):2253–2258.	Quasi-experimental	83 arthroplasties following an infected arthroplasty at large hospital, Canada	Surgery following an infected case	Surgery not following an infected case	Incidence of infection within 12 months following surgery	A deep infection will no more likely occur in a patient following an infected case than a non-infected case.	IIB
109	Harnoss JC, Assadian O, Diener MK et al. Microbial load in septic and aseptic procedure rooms. *Dtsch Arztebl Int* . 2017;114(27-28):465–475. doi:10.3238/arztebl.2017.0465.	Nonexperimental	16 septic and 14 aseptic operations at university hospital, Germany	n/a	n/a	Microbial room air concentration and microbial sedimentation	Septic and aseptic procedures do not need to be spatially separated, even if a ventilation system is not present.	IIIC
110	Hess AS, Shardell M, Johnson JK et al. A randomized controlled trial of enhanced cleaning to reduce contamination of healthcare worker gowns and gloves with multidrug-resistant bacteria. *Infect Control Hosp Epidemiol* . 2013;34(5):487–493.doi:10.1086/670205.	RCT	MRSA and multidrug-resistant *Acinetobacter baumannii (MDRAB)* patient occupied rooms in 4 ICUs of a teaching hospital, United States	Standard room cleaning along with extra enhanced daily cleaning of high touch surfaces	Standard room cleaning	Isolation of MRSA or MDRAB from disposable gown and gloves of healthcare workers (HCW) after routine care activity	A reduction in contamination of HCW gowns and gloves after routine patient care did occur as a result of intense enhanced daily cleaning.	IA
111	Cadogan K, Bashar S, Magnusson S, et al. Assessment of cleaning methods on bacterial burden of hospital privacy curtains: A pilot randomized controlled trial. *Scientific report* s. 2021;11(1):21866. doi: 10.1038/s41598-021-01198-2.	RCT	72 curtains, regional burn/plastic surgery ward, Canada	24 curtains cleaned with disinfectant spray at 3-4 day intervals, 24 curtains cleaned with disinfectant wipes at 3-4 day intervals	24 curtains not cleaned	Difference in mean CFU/cm2 between day 0 to day 21, proportion of curtains contaminated with MRSA	Regular cleaning of hospital privacy curtains with disinfectant spray or wipes reduces bacterial burden and MRSA contamination.	IB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
112	Jang J, Jeong IS, Kang CM. The effect of decontamination using quaternary ammonium chloride on the bacterial burden of hospital privacy curtains. *Nurs Health Sci* . 2023;25(2):187–196. doi: 10.1111/nhs.13019.	Quasi-experimental	66 newly laundered polyester curtains in inpatient wards	Daily (n = 22), twice-weekly (n = 22) decontamination using quaternary ammonium chloride	Not performed (n = 22)	Number of bacteria, proportion of curtains with >2.5 colony-forming unit/cm2, proportion of curtains with multidrug-resistant organisms (MDROs)	Daily or twice-weekly decontamination groups showed a significantly lower increase in bacterial burden than the no-decontamination group overall and at all four posttest times.	IIA
113	ANSI/AAMI ST79:2010 & A1:2010 & A2:2011 & A3:2012: *Comprehensive Guide to Steam Sterilization and Sterility Assurance in Health Care Facilities* . Arlington, VA: Association for the Advancement of Medical Instrumentation; 2017.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for steam sterilization in health care facilities. The recommendations are intended to promote sterility assurance and to guide health care personnel in the proper use of processing equipment and care of the environment.	IVC
114	Ofstead CL, Hopkins KM, Daniels FE, Smatr AG, Wetzler HP> Splash generation and droplet dispersal in a well-designed, centralized high-level disinfection unit. *Am J Infect Contro* l. 2022;50(11):1200–1207. doi: 10.1016/j.ajic.2022.08.016.	Organizational Experience	Large urban hospital, United States	n/a	n/a	Detection of droplets on chemical indicator paper, distance of droplets, PPE exposure to droplets	Manual cleaning of devices generated substantial splash, drenching technicians and the environment with droplets that traveled more than 7 feet.	VB
115	ANSI/AAMI ST79/ (R)2022 w/ AMDs A1:2020, A2:2020, A3:2020, A4:2020: *Comprehensive guide to steam sterilization and sterility assurance in health care facilities.* Association for the Advancement of Medical Instrumentation (AAMI); 2017.	Guideline	n/a	n/a	n/a	n/a	Amendement to include guidance on cleaning environmental surfaces, use of fans, and no food or drink	IVC

Evidence Table
Guideline for Environmental Hygiene

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
116	Wood A. Guideline for Sterilization. Kyle E, ed. AORN; 2025	Guideline	n/a	n/a	n/a	n/a	Provides guidance for sterilizing reusable medical devices to be used in perioperative and procedural settings.	IVA
117	Wood A. Guideline for Sterilization Packaging Systems. Kyle E, ed. AORN; 2025	Guideline	n/a	n/a	n/a	n/a	Provides guidance for evaluating, selecting, and using sterilization packaging systems and for packaging the items to be sterilized.	IVA
118	ASHRAE Guideline 43-2025: Operations Guideline for Ventilation of Health Care FacilitiesAmerican Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); 2025. https://www.ashrae.org/technical-resources/standards-and-guidelines/read-only-versions-of-ashrae-standards.	Consensus	n/a	n/a	n/a	n/a	Standards for safe operation and maintenance of health care heating, ventilation and air conditioning (HVAC) systems.	IVB
119	Bilgic A, Kodjikian L, Gonzalez-Cortes J, et al. Postoperative aspergillus infection: a case series. *Ocul Immunol Inflamm.* 2023;31(7):1486-1489.doi:10.1080/09273948.2022.2103714.	Nonexperimental	11 patients with *Aspergillus* infection with cataract surgery and IOL implantation on same day, in same OR, university hospital, France	n/a	n/a	Microscopic evaluation and culture of eyes; cultures from OR surfaces, air-conditioning vents and operative supplies	Source of infection was air conditioning ducts in OR where surgery took place iterating necessity of regular microbiological testing and fumigation if indicated.	IIIB
120	Wood A. Guideline for Care and Cleaning of Surgical Instruments. Kyle E, ed. AORN; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for cleaning surgical insturments, point-of-use-treatment, transport, decontamination, inspection, and general care of reusable medical devices.	IVA

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REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
121	Infection Control Guidance: Candida auris. Centers for Disease Control and Prevention (CDC) Web site. https://www.cdc.gov/candida-auris/hcp/infection-control/index.html.	Consensus	n/a	n/a	n/a	n/a	Provides guidance on hand hygiene, appropriate precautions, and environmental disinfection to prevent and control C auris outbreaks	IVC
122	Anderson DJ, Chen LF, Weber DJ et al. Enhanced terminal room disinfection and acquisition and infection caused by multidrug-resistant organisms and *Clostridium difficile* (the benefits of enhanced terminal room disinfection study): a cluster-randomised, multicentre, crossover study. *Lancet.* 2017;389(10071):805–814. doi:10.1016/S0140-6736(16)31588-4.	RCT	Inpatient rooms of 9 hospitals, United States	3 Strategies: Quaternary ammonium (Quat) and disinfecting ultraviolet (UV-C), but if *C.difficile* then Bleach and UV-C, Bleach only	Quat, but bleach if *C-difficile*	Incidence of infection or colonization in exposed patients to methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), multidrug-resistant *Acinetobacter* or *C.difficile*	Addition of UV-C to terminal cleaning significantly lowered incidence of target organisms among exposed patients, however *C. difficile* incidence among exposed patients was not significant after adding UV-C to use of bleach.	IA
123	Siegel JD, Rhinehart E, Jackson M, Chiarello L; Healthcare Infection Control Practices Advisory Committee. . Management of Multidrug-Resistant Organisms in Healthcare Settings. Atlanta, GA: Centers for Disease Control and Prevention; 2006.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for management of MRSA, VRE, and other MDROs in health care organizations in the United States.	IVA

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
124	Wendelboe AM, Kim SE, Kinney S, Cuellar AE, Salinas L, Chou AF. Cost-benefit analysis of allowing additional time in cleaning hospital contact precautions rooms. *Hosp Top* . 2021;99(3):130–139. doi: 10.1080/00185868.2021.1873083.	Nonexperimental	Terminally cleaned hospital patient rooms, tertiary hospital, United States	n/a	n/a	Direct costs and probability of risk reduction associated with implementing an enhanced cleaning protocol that included additional 15 minutes in hospital contact precautions rooms.	Increasing cleaning time may reduce hospital-acquired transmission of *C. difficile* , MRSA, and VRE, and implementing an enhanced cleaning protocol can result in significant cost savings for hospitals.	IIIB
125	Kanamori H, Rutala WA, Gergen M, et al. Microbial assessment of health care–associated pathogens on various environmental sites in patient rooms after terminal room disinfection. *Open Forum Infectious Diseases* . 2021. doi.org/10.1093/ofid/ofab008.	Nonexperimental	High touch surfaces, patient rooms, university hospital, United States	n/a	Standard terminal disinfection (Quat);Enhanced terminal disinfection (Quat/UV-C, Bleach, or Bleach/UV-C)	Colony-forming units of aerobes and multidrug resistant *Acinetobacter* , *C difficil* e, MRSA, VRE	An enhanced terminal room disinfection reduced microbial burden of healthcare-associated pathogens on environmental sites better than standard room disinfection.	IIIA
126	Shek K, Patidar R, Kohja Z et al. Rate of contamination of hospital privacy curtains in a burns/plastic ward: a longitudinal study. *Am J Infect Control.* 2018;46(9):1019–1021.	Nonexperimental	Regional Burns/Plastic Unit in university hospital, Canada	n/a	n/a	Microbial contamination (CFUs); MRSA presence	Curtains became progressively contaminated with bacteria, including MRSA. Between day 10 and 14, MRSA presence increased.	IIIB
127	EPA's Registered Antimicrobial Products Effective Against *Clostridioides difficile* (C. diff) Spores [List K]. United States Environmental Protection Agency (EPA) Web site. https://www.epa.gov/pesticide-registration/epas-registered-antimicrobial-products-effective-against-.	Regulatory	n/a	n/a	n/a	n/a	Provides guidance on environmental dsinfectants for surfaces contaminated with *Clostridioides difficile*	n/a

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Guideline for Environmental Hygiene

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
128	McDonald LC, Gerding DN, Johnson S et al. Clinical practice guidelines for Clostridium difficile infection in adults and children: 2017 update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA). *Clin Infect Dis.* 2018;66(7):e1–e48.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for management and treatment of *Clostridium difficile* infection.	IVA
129	EPA's Registered Antimicrobial Products Effective Against Candida auris [List P]. United States Environtmental Protection Agency (EPA}) Web site. https://www.epa.gov/pesticide-registration/epas-registered-antimicrobial-products-effective-against-candida-auris-list.	Regulatory	n/a	n/a	n/a	n/a	Provides guidance on environmental dsinfectants for surfaces contaminated with *Candida auris*	n/a
130	Kumar JA, Cadnum JL, Jencson AL, Donskey CJ. Are reduced concentrations of chlorine-based disinfectants effective against candida auris? *Am J Infect Contro* l. 2020;48(4):448–450. doi: 10.1016/j.ajic.2019.08.027.	Quasi-experimental	*Candida auris* on multiple surfaces in simulated patient room, laboratory, United States	Sodium hypochlorite with 5 different concentrations with contact times of 1, 2, and 4 minutes	Sodium dichloroisocyanurate (NaDCC) with 3 different concentrations with contact times of 1, 2, and 4 minutes	Efficacy measured in log reduction; adverse effects	Chlorine-based disinfectants were effective against *Candida auris* at ≥4,000 ppm with 1-minute contact; lower concentrations required impractical contact times.	IIC
131	Jensen PA, Lambert LA, Iademarco MF, Ridzon R, CDC.. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *MMWR Recomm Re* p. 2005;54(RR-17):1–141. [PubMed: 16382216]	Guideline	n/a	n/a	n/a	n/a	Provides guidance for preventing the transmission of Mycobacterium tuberculosis (TB) in health care settings.	IVA

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Guideline for Environmental Hygiene

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
132	Rutala WA, Weber DJ. Society for Healthcare Epidemiology of America. Guideline for disinfection and sterilization of prion-contaminated medical instruments. *Infect Control Hosp Epidemiol* . 2010;31(2):107–117. doi:10.1086/650197.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for cleaning and disinfection of non-critical environmental surfaces contaminated with Creutzfeldt-Jakob disease (CJD) patient tissue. The recommendations are intended to prevent transmission of CJD and to guide health care personnel in the proper application of disinfectant.	IVA
133	Simmons SM, Payne VL, Hrdlicka JC. Rapid and sensitive determination of residual prion infectivity from prion-decontaminated surfaces. *mSphere* . 2024;9(9):e0050424.doi:10.1128/msphere.00504-24.	Quasi-experimental	Prion contaminated glass slides, stainless steel, and benchtop surfaces, university laoratory, U.S.	Disinfection using: 1.water 2.70% EtOH 3. Undiluted bleach ; Real-Time Quaking-Induced Conversion (RT-QuIC)	Non disinfection ; animal bioassay	Residual surface-associated prions	Water and ethanol were ineffective, with prions still dectectable and infectious. Bleach completely eliminated prion ineffectivity as confirmed by both testing methods.	IIA
134	*Using the Health Care Physical Environment to Prevent and Control Infection.* The Health Research & Educational Trust of the American Hospital Association, American Society for Health Care Engineering, Association for Professionals in Infection Control and Epidemiology, Society of Hospital Medicine, University of Michigan; 2015.	Expert Opinion	n/a	n/a	n/a	n/a	Outlines what design, construction, and operational changes can be made in health care environment to reduce infection transmission.	VB
135	Infection control risk assessment [ICRA] 2.0 matrix of precautions for construction, renovation and operations. 2022:[8]	Guideline	n/a	n/a	n/a	n/a	Systematic process to determine level of risk during construction to patients and defines controls to reduce risk.	IVB

Evidence Table

Guideline for Environmental Hygiene

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
136	Gibb AP, Fleck BW, Kempton-Smith L. A cluster of deep bacterial infections following eye surgery associated with construction dust. *J Hosp Infect.* 2006;63(2):197–200.	Case Report	n/a	n/a	n/a	n/a	Presence of foreign material, such as dust from construction can contribute to intra-ocular fluid organisms, possibly contributing to endophthalmitis.	VB
137	Kanamori H, Rutala WA, Sickbert-Bennett EE, Weber DJ. Review of fungal outbreaks and infection prevention in healthcare settings during construction and renovation. *Clin Infect Dis.* 2015;61(3):433–444.doi:10.1093/cid/civ297.	Literature Review	n/a	n/a	n/a	n/a	Construction-related fungal cases are declining possibly due to guidelines and policies on infection prevention and control.	VA
138	Park JH, Rye SH, Lee JY, et al. Airborne fungal spores and invasive aspergillosis in hematologic units in a tertiary hospital during construction: a prospective cohort study. *Antimicrob Resist Infect Control.* 2019;8(1):88. doi:10.1186/s13756-019-0543-1.	Nonexperimental	Patients on 3 hematologic wards during construction of radiotherapy center,medical center, Korea	n/a	n/a	Total mold and *Aspergillus* spp spore levels; invasive *Aspergillis (IA)* incidence for 2 phases of construction	Airborne fungal spores and incidence of IA tended to be higher during heavier construction phase.	IIIB
139	Abdolmaleki Z, Mashak Z, Safarpoor Dehkordi F. Phenotypic and genotypic characterization of antibiotic resistance in the methicillin-resistant Staphylococcus aureus strains isolated from hospital cockroaches. *Antimicrob Resist Infect Control*. 2019;8(1):54. doi:10.1186/s13756-019-0505-7.	Nonexperimental	536 cockroaches collected from hospitals, Iran	n/a	n/a	Isolation of *Staphylococcus aureus* and methicillin-resistant *S. aureus* strains	Hospital cockroaches harbor virulent and resistant MRSA strains and can act as a vector for transmission of these strains.	IIIB
140	Schulz-Stübner S, Danner K, Hauer T, Tabori E. Psychodidae (drain fly) infestation in an operating room. *Infect Control Hosp Epidemiol*. 2015;36(3):366–367. doi:10.1017/ice.2014.43.	Case Report	n/a	n/a	n/a	n/a	Complete separation of drain pipes and electrical wiring, along with sufficient sealing of flood-prone areas are key to preventing drain fly infestation.	VA

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
141	Munoz-Price LS, Safdar N, Beier JC, Doggett SL. Bed bugs in healthcare settings. *Infect Control Hosp Epidemiol* . 2012;33(11):1137–1142.	Expert Opinion	n/a	n/a	n/a	n/a	Bed bugs have reemerged in past decade and hospitals should have policies in place before infestation occurs. Further research needed on their role in horizontal transmission of pathogenic bacteria.	VB
142	Schouest JM, Heinrich L, Nicholas B, Drach F. Fly rounds: validation and pilot of a novel epidemiologic tool to guide infection control response to an infestation of Sarcophagidae flies in a community hospital's perioperative department. *Am J Infect Control.* 2017;45(9):e91–e93. doi:10.1016/j.ajic.2017.02.037.	Case Report	n/a	n/a	n/a	n/a	Complete separation of drain pipes and electrical wiring, along with sufficient sealing of flood-prone areas are key to preventing drain fly infestation.	VB
143	Hazardous Drugs: Handling in Healthcare Settings (800). 15. Deactivating, Decontaminating, Cleaning, and Disinfecting.Hazardous Drugs: Handling in Healthcare Settings (800). 15. Deactivating, Decontaminating, Cleaning, and Disinfecting.2021st ed. US Pharmacopeial Convention; 2021:88–89.	Consensus	n/a	n/a	n/a	n/a	Guidance on deactivation, decontamination, cleaning and disinfection of areas used for compounding hazardous drugs.	IVB
144	Ametsbichler P, Bohlandt A, Nowak D, Schierl R. Occupational exposure to cisplatin/oxaliplatin during pressurized intraperitoneal aerosol chemotherapy? *Eur J Surg Oncol.* 2018;44:1793-1799.doi:10.1016/j.ejso.2018.05.020.	Nonexperimental	14 procedures with cis-or oxaliplatin, OR, two hospitals, Germany	n/a	n/a	air, surface, device and trocar contamination	There was a wide range of contamination rates, some items were contaminated before the procedures, and the risk of aerosolization is low.	IIIB
145	Cahn J. Guideline for Medication Safety. Kyle E, ed. AORN; 2025.	Guideline	n/a	n/a	n/a	n/a	Provides guidance for a safe handling of medications in the perioperative environment.	IVA

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS
146	Kennedy K, Coakley N, Daley-Morris J, et al. Safe handling of hazardous drugs. *J Oncol Pharm Practice.* 2023;29(2):401-412.doi:10.1177/10781552221135121.	Guideline	n/a	n/a	n/a	n/a	Guideline recommendations on safe handling of hazardous drugs.	IVA
147	Controlling occupational exposure to hazardous drugs. https://www.osha.gov/hazardous-drugs/controlling-occex.	Guideline	n/a	n/a	n/a	n/a	Provides guidance on management of antineoplastic drugs in the workplace	IVB
148	Simon N, Guichard N, Odou P, et al. Efficiency of four solutions in removing 23 conventional antineoplastic drugs from contaminated surfaces. *PLoS ON* E. 2020;15(6):e0235131. doi: 10.1371/journal.pone.0235131.	Quasi-experimental	Solution with 23 antineoplastic drugs spread over 100 cm^2 stainless steel, laboratory, Switzerland	4 decontamination solutions: 70% isopropanol, ethanol-hydrogen peroxide 91.6-50.0 mg/g, 10-2 M sodium dodecyl sulphate/isopropanol 80/20 (SDS), and 0.5% sodium hypochlorite using a single wipe motion or vigorous wiping	No decontamination	Decontamination efficiency (EffQ) measured by residual contamination with liquid chromatography and tandem mass spectrometry detection	Decontamination efficiency depended on the solution used and the application modality. An SDS admixture seems to be a good alternative to sodium hypochlorite.	IIB
149	Kato G, Mitome H, Teshima K, et al. Study on the use of ozone water as a chemical decontamination agent for antineoplastic drugs in clinical settings. *Ann Work Expo Health.* 2023;67(2):241 EP. doi:10.1093/annweh/wxac075.	Quasi-experimental	Eight neoplastic drugs, laboratory, Japan	Ozone water	No ozone water	Degradation and inactivation of neoplastic drugs	Ozone water should be restrictedly used according to the situation of contamination in clinical settings because the ozonation enhances toxicity depending on the drug and deactivation varied between drugs.	IIB
150	Sciubba F, Spagnoli M, Iavicoli S, et al. Efficacy of sodium hypochlorite in the degradation antineoplastic drugs by NMR spectroscopy. *G Ital Med Lav Ergon* . 2020;42(2):109–120.	Quasi-experimental	Degradation of four antineoplastic drugs: 5-fluorouracil, azacitidine, cytarabine and irinotecan, laboratory, Italy	Effectiveness of degradation with 0.115% sodium hypochlorite solution	Effectiveness of degradation with 99.9% ethanol solution	Degradation efficiency of antineoplastic drugs monitored by hydrogen nuclear magnetic spectroscopy (^{1}H NMR)	The best degradation efficiency (> 90%) of antineoplastic drugs is obtained with a 0.115% sodium hypochlorite solution after 15 minutes.	IIB

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151	Palamini M, Floutier M, Gagne S, et al. Evaluation of decontamination efficacy of four antineoplastics after deliberate contamination. *J Occup Environ Hyg.* 2021;18(2):43-50.doi:10.1080/15459624.2020.1854458.	Quasi-experimental	8 areas of laminar hood stainless-steel surface deliberately contaminated with four antineoplastics, pharmacy, Canada	Single, double, triple, and quadruple decontamination with each product: water, quaternary ammonium, and 0.1% chlorine	No decontamination	Decontamination efficacy	0.1% chlorine removed all traces of most drugs, while ifosfamide required up to three cycles. Water and quaternary ammonium removed >99.5% but often needed repeats, highlighting the need for optimized methods.	IIC
152	Roussin F, Taibi A, Canal-Raffin M, et al. Assessment of workplace environmental contamination and occupational exposure to cisplatin and doxorubicin aerosols during electrostatic pressurized intraperitoneal aerosol chemotherapy. *Eur J Surg Oncol.* 2021;47:2939-2947.doi:10.1016/j.ejso.2021.05.020.	Quasi-experimental	Two consecutive ePIPAC procedures with cisplatin and doxorubicin, digestive surgery OR,France	Surgical team (surgeon, anesthesia, nurses, environmental service worker)	non-exposed pharmacy residents	Toxicological analysis of air, surface, gloves and urine	No airborne or personnel contamination was detected, but low-level surface contamination persisted after cleaning, emphasizing the need for strict safety protocols during ePIPAC.	IIC
153	Gorski LA, Hadaway L, Hagle ME et al. Infusion therapy standards of practice, 8th ed. *J Infus Nurs.* 2021;44(1S Suppl 1):S1–S224. doi:10.1097/NAN.0000000000000396.	Guidline	n/a	n/a	n/a	n/a	Infusion Nurses Society guidance on infusion therapy.	IVB
154	Arpino P, Yeomelakis J, Oommen A. Effectiveness of a decontamination procedure in a pharmacy buffer room contaminated by 5 antineoplastic agents. *American Journal of Health-System Pharmacy* . 2020;77(24):2081–2088. doi: 10.1093/ajhp/zxaa320.	Nonexperimental	10 locations contaminated with 5 antineiplastic drugs, pharmacy buffer room, community hospital, United States (n=239)	Decontamination procedure	n/a	Residual hazardous drug (HD) levels	The employed decontamination procedures effectively reduced residual HD surface contamination.	IIIC

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155	Bhutiani N, White MG, Kim BJ, et al. Decreasing environmental operating room chemotherapy levels following heated intraperitoneal chemotherapy through implementation of standard protocols. *Ann Surg Oncol.* 2023;30:6981-6982. doi:10.1245/s10434-023-13409-3.	Organizational Experience	3 HICPAC procedures before and 3 after implementation of safety protocol, OR, United States	n/a	n/a	ChemGLO wipes to measure cisplatin concentrations on inner door knob, anesthesia keyboard, shoe, floor)	Standardized chemotherapy precautions during HICPEC may decrease overall exposure in the OR.	VB
156	Hewage SCN, Cao LTT, Jones RM, Fraser AM. Factors associated with environmental service worker cleaning practices in health care settings: A systematic review of the literature. *Am J Infect Contr* ol. 2021;49(7):919–927. doi: 10.1016/j.ajic.2021.01.001.	Systematic Review	31 studies	n/a	n/a	n/a	Education combined with performance feedback is essential to improve disinfection outcomes, and continuous education/training sessions along with long-term organizational commitment are necessary for sustained improvements.	IIIB
157	Oliveira BADS, Bernardes LdO, Ferreira AM, et al. Impact of educational intervention on cleaning and disinfection of an emergency unit. *Int J Environ Res Public Health* . 2020;17(9). doi: 10.3390/ijerph17093313.	Nonexperimental	4 high touch surfaces, emergency unit, hospital, Brazil	Educational intervention on surface cleaning and disinfection that included standaridzation of practices, disinfectants and supplies	Current environmental cleaning practices	Visual inspection, CFU count using contact plates, and ATP before intervention, during intervention and 2 mos after intervention.	The educational intervention had a positive impact in the short term for ATP approval rates; however, long-term rates were lower, and the colony-forming units (CFU) method showed high sensitivity and detected structural defects on surfaces.	IIIB
158	Armellino D, Dowling O, Newman SB, et al. Remote video auditing to verify OR cleaning: a quality improvement project. *AORN J* . 2018;108(6):634–642.doi:10.1002/aorn.12426.	Organizational Experience	31 ORs in 2 hospitals, United States	n/a	n/a	n/a	Remote video auditing was economic efficient way to assess, improve and maintain optimal cleaning standards.	VA
159	Mitchell BG, White N, Farrington A, et al. Changes in knowledge and attitudes of hospital environmental services staff: the researching effective approaches to cleaning in hospitals (REACH) study. *Am J Infect Control.* 2018;46(9):980–985.	Nonexperimental	Environmental services staff members at 11 hospitals, Australia	n/a	Cleaning bundle comprised of 5 interdependent components	Knowledge, reported practice, attitudes, roles and perceived organizational support	Environmental service staff have a high level of knowledge regarding cleaning practices and also understand the importance of their roles.	IIIA

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160	da Silva Nascimento EA, De Brito Poveda V. Evaluation of operating room surfaces cleaning and disinfection by visual inspection, microbiological analysis and adenosine triphosphate. *Antimicrob Resist Infect Contro* l. doi: 10.1186/s13756-019-0567-6.	Nonexperimental	45 visual inspections 90 ATP samples, 90 microbiological samples of 5 high touch surfaces, 9 ORs, public hospital, Brazil	n/a	n/a	Presence of organic or biological material	Cleaning reduced microbes and organic matter, but visual checks can mislead. ATP bioluminescence is effective for assessing cleanliness, though cost may limit use.	IIIB
161	Knelson LP, Ramadanovic GK, Chen LF, et al. Self-monitoring by environmental services may not accurately measure thoroughness of hospital room cleaning. *Infect Control Hosp Epidemiol.* 2017;38(11):1371–1373. doi:10.1017/ice.2017.205.	Nonexperimental	Patient room surfaces in 2 hospitals, United States	n/a	n/a	Fluorescent markers	Significant difference in reported clean surfaces between Environmental Services supervisor and study personnel. Use of independent observers is most objective approach for cleaning validation.	IIIA
162	Tyan K, Zuckerman JM, Cutler C, et al. A multiphase intervention of novel color additive for bleach disinfectant wipes improves thoroughness of cleaning in an academic medical center. *Am J Infect Control* . 2022;50(4):469 EP. doi: 10.1016/j.ajic.2021.11.002	Quasi-experimental	High touch surfaces, patient isolation rooms, medical center, United States	Terminal discharge clean with novel color additive to bleach wipes	Terminal discharge clean with bleach wipes	Failure rates of cleaning based on fluorescent marker removal and adenosine triphosphate bioluminescence assay	The use of the novel color additive to bleach wipes, improved thoroughness of cleaning in an academic medical center by reducing failure rates in cleaning.	IIC

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163	Ziegler MJ, Babcock HH, Welbel SF, et al. Stopping hospital infections with environmental services (SHINE): A cluster-randomized trial of intensive monitoring methods for terminal room cleaning on rates of multidrug-resistant organisms in the intensive care unit.*Clinical Infectious Diseases* . 2022;75(7):1217–1223. doi: 10.1093/cid/ciac070.	RCT	Six ICUs at 3 medical centers, surveying 10 surfaces each in 5 rooms weekly, United States	ATP monitoring method	Ultra-violet fluorescent marker (UV/F) method	Monthly rates of MDRO infection or colonization, including methicillin-resistant *Staphylococcus aureus* , *Clostridioides difficile* , vancomycin-resistant *Enterococcus* , and MDR gram-negative bacilli (MDR-GNB)	Intensive monitoring of ICU terminal room cleaning with an ATP modality is associated with a reduction of MDRO infection and colonization.	IB
164	Burnham JP, Shives ER, Warren DK, Han JH, Babcock HM. Assessment of percent positive agreement between fluorescent marker and ATPase for environmental cleaning monitoring during sequential application in an intensive care unit. *Am J Infect Contro* l. 2020;48(4):454–455. doi: 10.1016/j.ajic.2019.09.015.	Nonexperimental	13 high-touch items, 13 patient rooms, Surgical ICU, United States	n/a	n/a	Cleanliness assessment	No significant differences were found between the fluorescent marker and adenosine triphosphate bioluminescence method in cleanliness assessment.	IIIB
165	Alfonso-Sanchez J, Martinez IM, Martín-Moreno JM, González RS, Botía F. Analyzing the risk factors influencing surgical site infections: the site of environmental factors. *Can J Surg* . 2017;60(3):155–161. doi:10.1503/cjs.017916.	Nonexperimental	18,910 patients from 8 similar size hospitals, Spain	n/a	n/a	SSIs and related risk factors	Superficial SSIs associated with environmental contamination; deep and organ/space SSIs associated with patient factors and surgery type.	IIIA

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166	Ellis O, Godwin H, David M, Morse DJ, Humphries R, Uslan DZ. How to better monitor and clean irregular surfaces in operating rooms: insights gained by using both ATP luminescence and RODAC assays. *Am J Infect Control.* 2018;46(8):906–912. doi:10.1503/cjs.017916.	Nonexperimental	5 high touch surfaces in operating rooms of large teaching hospital , United States	n/a	n/a	ATP, RODAC, and mass spectrometry for presence of viable organisms before and after room cleaning.	Irregular surfaces such as keyboards, door handles and overhead lights may need enhanced cleaning, covering and monitoring.	IIIB
167	Bradley DF, Rodriguez JA. Using adenosine triphosphate bioluminescence-based technology to verify cleanliness of perioperative high-touch surfaces. *AORN J* . 2022;115(4):347. doi: 10.1002/aorn.13644.	Organizational Experience	High touch surfaces in 18 ORs, military hospital, United States	Education on high touch surface cleaning; performing high touch surface cleaning	n/a	Verification of cleaning with Adenosine Triphosphate (ATP) Bioluminescence (<45 relative light units)	Utilization of ATP optimizes safety for patient and personnel and leaders should consider its implementation for use with high-touch surfaces.	VA
168	Ramirez A, Mohan S, Miller R, Tumin D, Uffman JC, Tobias JD. Surface contamination in the operating room: Use of adenosine triphosphate monitoring. *J ANESTH* . 2019;33(1):85–89. doi: 10.1007/s00540-018-2590-9.	Organizational Experience	10 high touch surfaces, 8 ORs, Children's Hospital, United States	n/a	n/a	Degree of contamination (RLUs) between morning and afternoon	Apart from the OR floors, laryngoscope handles emerged as a key OR site where improved cleaning practices may reduce cross-contamination risk. Current turnover practices appear effective for most sites.	VB
169	Burian BK, Clebone A, Dismukes K, Ruskin KJ. More than a tick box: medical checklist development, design, and use. *Anesth Ana* lg.2018;126(1):223–232.doi:10.1213/ANE.0000000000002286.	Literature Review	n/a	n/a	n/a	n/a	A checklist should be designed for the specific setting and flow work in that area. There are five stages to follow when developing a checklist.	VA
170	Hamed NMH, Deif OA, El-Zoka A, Abdel-Atty M, Hussein MF.The impact of enhanced cleaning on bacterial contamination of the hospital environmental surfaces: A clinical trial in critical care unit in an egyptian hospital. *Antimicrob resist infect control* .2024;13(1):138. doi: 10.1186/s13756-024-01489-z.	Quasi-experimental	20 environmental service personnel and 16 nurses, neurosurgery ICU (14 beds), university hospital,Egypt	Enhanced cleaning techniques; educational program	Routine cleaning	Bacterial contamination in high-touch areas (around each bed, nursing counter, door knob); knowledge score	Enhanced cleaning techniques significantly decreased bacterial counts in high-touch areas around patients and consequently reduced healthcare acquired infection rates in the ICU.	IIB