REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
1	Rutala WA, Weber DJ, eds. Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008. Update: May 2019. Washington, DC: Centers for Disease Control and Prevention; 2019.	Guideline	n/a	n/a	n/a	n/a	Disinfection and sterilization are essential for ensuring that medical and surgical instruments do not transmit infectious pathogens to patients. Health care policies must identify, on the basis of the items' intended use, whether cleaning, disinfection, or sterilization is indicated.	IVA
2	Rutala WA, Weber DJ. Disinfection and sterilization in health care facilities: an overview and current issues. Infect Dis Clin North Am. 2021;35(3):575–607.	Literature Review	n/a	n/a	n/a	n/a	Cleaning always must precede HLD and sterilization. Endoscopes are devices most commonly linked to outbreaks. Follow professional organization and/or manufacturer recommendations for HLD. Train staff performing HLD at initiation of employment and at least yearly.	VA
3	Guideline for Use of High-Level Disinfectants & Sterilants in the Gastroenterology Setting. Chicago, IL: Society of Gastroenterology Nurses and Associates, Inc; 2017.	Guideline	n/a	n/a	n/a	n/a	This guideline provides general information about the principles, product safety, and characteristics of high-level disinfectants and liquid chemical sterilants.	IVB
4	29 CFR 1910.1200 – Hazard Communication. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	Information concerning the hazards of all chemicals must be communicated to all employees.	n/a
5	Guideline for processing flexible endoscopes. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:213–266.	Guideline	n/a	n/a	n/a	n/a	Guidance is provided for processing all types of flexible endoscopes, as well as for controlling and maintaining the environment to support processing activities.	IVA
6	ANSI/AAMI ST58:2013. Chemical Sterilization and High-Level Disinfection in Health Care Facilities. Arlington, VA: Association for the Advancement of Medical Instrumentation; 2013.	Consensus	n/a	n/a	n/a	n/a	This recommended practice provides guidelines for the selection and use of liquid chemical sterilants/high-level disinfectants, and gaseous chemical sterilizers that have been cleared for marketing by the US FDA for use in hospitals and other health care facilities.	IVC
7	Guideline for medical device and product evaluation. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:777–788.	Guideline	n/a	n/a	n/a	n/a	Patient and worker safety, quality, and cost containment are primary concerns of perioperative RNs as they participate in evaluating and selecting medical devices and products for use in practice settings.	IVA
8	FDA-cleared sterilants and high level disinfectants with general claims for processing reusable medical and dental devices. US Food and Drug Administration. 2019. Accessed August 7, 2023.	Regulatory	n/a	n/a	n/a	n/a	FDA-cleared sterilants and high-level disinfectants	n/a

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9	Guidelines for cleaning and preparing external- and internal-use ultrasound transducers and equipment between patients as well as safe handling and use of ultrasound coupling gel. American Institute of Ultrasound in Medicine (AIUM). December 5 , 2022.	Guideline	n/a	n/a	n/a	n/a	Routine high-level disinfection of internal probes between patients is mandatory, in addition to the use of a high-quality probe cover during each examination.	IVC
10	Hawley B, Casey ML, Cox-Ganser JM, Edwards N, Fedan KB, Cummings KJ. Notes from the field: respiratory symptoms and skin irritation among hospital workers using a new disinfection product–Pennsylvania, 2015. MMWR Morb Mortal Wkly Rep. 2016;65(15):400–401.	Expert Opinion	n/a	n/a	n/a	n/a	Consideration of health and worker safety is important when choosing disinfectant products. Hospital personnel should be alert to respiratory, skin, and eye symptoms related to disinfectants.	VB
11	Nayebzadeh A. The effect of work practices on personal exposure to glutaraldehyde among health care workers. Ind Health. 2007;45(2):289–295.	Nonexperimental	Breathing zone air samples of 42 personnel and interviews of 53 personnel, Canada	n/a	n/a	Amount of glutaraldehyde vapor in air; Work practices.	Monitoring equipment and methods should be improved to better assist occupational hygienists in assessing levels of exposure of health care workers.	IIIB
12	Cohen NL, Patton CM. Worker safety and glutaraldehyde in the gastrointestinal lab environment. Gastroenterol Nurs. 2006;29(2):100–104.	Expert Opinion	n/a	n/a	n/a	n/a	Safe levels of glutaraldehyde vapor concentrations are a significant issue in the work environment. Uncontrolled glutaraldehyde exposure in selected work environments contributes to occupational asthma.	VB
13	Abdulla FR, Adams BB. Ortho-phthalaldehyde causing facial stains after cystoscopy. Arch Dermatol. 2007;143(5):670.	Case Report	n/a	n/a	n/a	n/a	A 28-year old urology resident presented with an asymptomatic brown oval patch on her nose allegedly present for less than 3 hours. The resident recalled resting a cystoscope on the right side of her nose during several procedures that morning. Once the skin is stained, the best removal method is unknown.	VC
14	Pala G, Moscato G. Allergy to ortho-phthalaldehyde in the healthcare setting: advice for clinicians. Expert Rev Clin Immunol. 2013;9(3):227–234.	Literature Review	n/a	n/a	n/a	n/a	OPA is a dermal and respiratory sensitizer.	VA
15	Anderson SE, Umbright C, Sellamuthu R et al. Irritancy and allergic responses induced by topical application of ortho-phthalaldehyde. Toxicol Sci. 2010;115(2):435–443.	Nonexperimental	EpiDerm inserts, laboratory, United States	n/a	OPA and glutaraldehyde	Skin irritancy and allergic responses.	The dermal irritancy and allergic potential of OPA raise concerns about the proposed or intended use of OPA as a safe alternative to glutaraldehyde.	IIIA

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16	Suneja T, Belsito DV. Occupational dermatoses in health care workers evaluated for suspected allergic contact dermatitis. Contact Derm. 2008;58(5):285-290.	Quasi-experimental	1434 patients who underwent patch testing, United States	Patch testing for allergic contact dermatitis	Health care workers compared with non-health care workers	Common allergens among health care workers with allergic contact dermatitis and allergic contact urticaria.	Health care workers with symptoms should be evaluated using patch testing.	IIB
17	Warshaw EM, Schram SE, Maibach HI, et al. Occupation-related contact dermatitis in North American health care workers referred for patch testing: cross-sectional data, 1998 to 2004. Dermatitis. 2008;19(5):261-274.	Nonexperimental	15,896 patients, North American Contact Dermatitis Group	n/a	n/a	Prevalence of occupational allergic contact dermatitis.	One of the most common allergens among health care workers was glutaraldehyde.	IIIB
18	Fujita H, Ogawa M, Endo Y. A case of occupational bronchial asthma and contact dermatitis caused by ortho-phthalaldehyde exposure in a medical worker. J Occup Health. 2006;48(6):413-416.	Case Report	n/a	n/a	n/a	n/a	OPA can be a powerful sensitizer, suggesting that widespread use of OPA as a substitute for glutaraldehyde may result in serious health risks for health care workers.	VB
19	Weber DJ, Consoli SA, Rutala WA. Occupational health risks associated with the use of germicides in health care. Am J Infect Control. 2016;44(5):e85-e89.	Nonexperimental	128 health care personnel seen for injuries or illnesses related to chemical exposures between 2003 and 2012	n/a	n/a	Causative agents; Causative factors.	Engineering controls and PPE should be used to minimize personnel exposure to high-level disinfectants.	IIIB
20	Arif AA, Delclos GL. Association between cleaning-related chemicals and work-related asthma and asthma symptoms among healthcare professionals. Occup Environ Med. 2012;69(1):35-40.	Nonexperimental	3650 health care professionals, Texas, United States	n/a	n/a	Self-reported exposure to cleaning chemicals, disinfectants, and sterilants; Self-reported symptoms of work-related asthma.	Workplace exposures to cleaning-related chemicals were associated with the development of work-related asthma symptoms, work-exacerbated asthma, and occupational asthma among health care professionals.	IIIB
21	Robitaille C, Boulet LP. Occupational asthma after exposure to ortho-phthalaldehyde (OPA). Occup Environ Med. 2015;72(5):381.	Case Report	n/a	n/a	n/a	n/a	The possibility of occupational asthma should be considered in health care workers experiencing respiratory symptoms when exposed to OPA.	VB
22	Walters GI, Moore VC, McGrath EE, Burge PS, Henneberger PK. Agents and trends in health care workers' occupational asthma. Occup Med (Lond). 2013;63(7):513-516.	Nonexperimental	182 health care workers with occupational asthma, SHIELD, United Kingdom	n/a	n/a	Causative agents.	Continuing efforts are necessary to reduce the incidence of occupational asthma.	IIIB

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23	Bakerly ND, Moore VC, Vellore AD, Jaakkola MS, Robertson AS, Burge PS. Fifteen-year trends in occupational asthma: data from the shield surveillance scheme. Occup Med (Lond). 2008;58(3):169-174.	Nonexperimental	1461 cases of occupational asthma, SHIELD, United Kingdom	n/a	n/a	Trends in occupational asthma.	The incidence of occupational asthma is high. Occupations related to health care was one of the most frequently reported occupations.	IIIB
24	Copeland S, Nugent K. Persistent and unusual respiratory findings after prolonged glutaraldehyde exposure. Int J Occup Environ Med. 2015;6(3):177-183.	Case Report	n/a	n/a	n/a	n/a	The distribution of inflammation and bronchial responsiveness can vary in a single patient with glutaraldehyde-induced occupational asthma.	VB
25	Donnay C, Denis MA, Magis R, et al. Under-estimation of self-reported occupational exposure by questionnaire in hospital workers. Occup Environ Med. 2011;68(8):611-617.	Nonexperimental	1571 adults with self-reported asthma, EGEA participants, France	n/a	n/a	Consistency of self-report with expert report.	There was an underestimation of self-reported asthma compared with expert assessment.	IIIB
26	Ryu M, Kobayashi T, Kawamukai E, Quan G, Furuta T. Cytotoxicity assessment of residual high-level disinfectants. Biocontrol Sci. 2013;18(4):217-220.	Nonexperimental	Nutrient medium, laboratory, Japan	n/a	0.3% peracetic acid, 0.55% OPA, 2% glutaraldehyde	Cytotoxicity of residual disinfectant.	Toxicity can result from insufficient rinsing, but also from release of absorbed disinfectant.	IIIB
27	Suzukawa M, Yamaguchi M, Komiya A, Kimura M, Nito T, Yamamoto K. Ortho-phthalaldehyde-induced anaphylaxis after laryngoscopy. J Allergy Clin Immunol. 2006;117(6):1500-1501.	Case Report	n/a	n/a	n/a	n/a	The present case demonstrates that repeated exposure to OPA can sensitize some patients. Extensive rinsing decreased the amount of residual OPA below the threshold level.	VB
28	Rideout K, Teschke K, DimichWard H, Kennedy SM. Considering risks to healthcare workers from glutaraldehyde alternatives in high-level disinfection. J Hosp Infect. 2005;59(1):4-11.	Nonexperimental	64 hospitals, Canada	n/a	n/a	Current practices; Product toxicities.	The potential risks of all high-level disinfectants are serious.	IIIB
29	Spaulding EH, Lawrence CA, Block SS, Reddish GF. Chemical disinfection of medical and surgical materials. In: Lawrence CA, Block SS, Reddish GF, eds. Disinfection, Sterilization, and Preservation. Philadelphia, PA: Lea & Febiger; 1968:517-531.	Expert Opinion	n/a	n/a	n/a	n/a	There are three categories of materials: critical items, semicritical items, and noncritical items. Critical items should be sterile. Semicritical items should be sterile or high-level disinfected. Noncritical items should be clean or low-level disinfected.	VA
30	Burgess W, Margolis A, Gibbs S, Duarte RS, Jackson M. Disinfectant susceptibility profiling of glutaraldehyde-resistant nontuberculous mycobacteria. Infect Control Hosp Epidemiol. 2017;38(7):784–791.	Quasi-experimental	10 Mycobacterial strains (fast and slow growing, susceptible and resistant to glutaraldehyde), laboratory, Brazil	Glutaraldehyde-based HLDs, OPA, peracetic acid-based HLDs, hydrogen peroxide-based HLD, quat disinfectant	Sterile water; different temperatures	Mycobacterial growth (CFU)	Glutaraldehyde and OPA-based products had variable efficacy against glutaraldehyde-resistant strains, especially when temperature was increased. Peracetic acid and hydrogen peroxide-based HLDs effectively killed all Mycobacterium isolates.	IIB

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31	Guimarães T, Chimara E, do Prado, Gladys Villas Boas, et al. Pseudooutbreak of rapidly growing mycobacteria due to mycobacterium abscessus subsp bolletii in a digestive and respiratory endoscopy unit caused by the same clone as that of a countrywide outbreak. Am J Infect Control. 2016;44(11):e221-e226.	Organizational Experience	3 patients in the same week with positive bronchoalveolar lavage cultures for M abscessus subspecies bolletti.	n/a	n/a	n/a	The patients had no symptoms/signs of mycobacterial infection; thus, contamination of bronchoscopes was suspected. The investigation demonstrated a contamination of bronchoscopes, digestive endoscopes, and disinfection machines. Molecular typing demonstrated that all strains belonged to the same clone (MAB01), identical to clone BRA100.	VA
32	Meyers J, Ryndock E, Conway MJ, Meyers C, Robison R. Susceptibility of high-risk human papillomavirus type 16 to clinical disinfectants. J Antimicrob Chemother. 2014;69(6):1546-1550.	Nonexperimental	Strains of HPV16, laboratory, United States	n/a	11 common clinical disinfectants (ethanol, isopropanol, glutaraldehyde, OPA, phenol, peracetic acid, hypochlorite)	Susceptibility of high-risk HPV16.	Commonly used disinfectants have no effect on HPV16 infectivity.	IIIB
33	Ryndock E, Robison R, Meyers C. Susceptibility of HPV16 and 18 to high level disinfectants indicated for semi-critical ultrasound probes. J Med Virol. 2016;88(6):1076-1080.	Nonexperimental	Strains of HPV16 and HPV18, laboratory, United States	n/a	OPA and Trophon	Infectivity of HPV16 and HPV18.	HPV is highly resistant to OPA. Sonicated hydrogen peroxide offers an effective disinfection solution for ultrasound probes.	IIIB
34	Ozbun MA, Bondu V, Patterson NA et al. Infectious titres of human papillomaviruses (HPVs) in patient lesions, methodological considerations in evaluating HPV infectivity and implications for the efficacy of high-level disinfectants. EBioMedicine. 2021;63:103165.	Quasi-experimental	14 patient HPV samples from 7 recurrent respiratory papillomas and 7 anal wart lesions, HPV stock preparations, laboratory, United States	80% Cidex OPA, 10% hypochlorite	n/a	HPV DNA load and titers or clinical samples and stock preparations, antibody neutralization efficacy, log reduction	High-level disinfectants such as ortho-phthalaldehyde and hypochlorite are effective at inactivating HPV. The reports that have called the efficacy of these disinfectants into question have methodologic limitations with respect to the virus isolation process, assay fidelity, and infection controls that likely confounded their results and interpretations.	IIA
35	Egawa N, Shiraz A, Crawford R et al. Dynamics of papillomavirus in vivo disease formation & susceptibility to high-level disinfection—implications for transmission in clinical settings. EBioMedicine. 2021;63:103177.	Quasi-experimental	40 patient HPV samples from cervical lesions, HPV16 and 18 surrogates, and animal samples, laboratory, United Kingdom	0.55% OPA, 30% hydrogen peroxide, 70% ethanol	Neutralized OPA	HPV DNA presence, virus titers, log reduction, in vitro and in vivo assays	High level disinfectants such as ortho-phthalaldehyde and hydrogen peroxide are effective at inactivating HPV on fomite surfaces that are representative of surfaces on medical devices. The publications that called this into question had methodologic issues related to their neutralizing agent that may have confounded their results.	IIB
36	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.	Literature Review	n/a	n/a	n/a	n/a	For biofilm (traditional, buildup biofilm, dry surface), there is a need for appropriate testing methods to more stringently assess the efficacy of manufacturer's reprocessing instructions and efficacy of environmental disinfection, as well as medical device high-level disinfection and sterilization methods.	VA

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37	Akinbobola AB, Amaeze NJ, Mackay WG, Ramage G, Williams C. "Secondary biofilms" could cause failure of peracetic acid high-level disinfection of endoscopes. J Hosp Infect. 2021;107:67–75.	Quasi-experimental	P aeruginosa biofilms in a 24-well plate, laboratory	Exposure to peracetic acid	Untreated control	Peracetic acid tolerance (biofilm biomass, polysaccharide, protein), Confocal microscopy	Under certain circumstances, recolonization of residual extracellular polymeric substance of P aeruginosa biofilm can cause failure of disinfection of endoscopes, and emphasizes the importance of cleaning endoscopes prior to disinfection.	IIB
38	Akinbobola AB, Sherry L, Mckay WG, Ramage G, Williams C. Tolerance of Pseudomonas aeruginosa in in-vitro biofilms to high-level peracetic acid disinfection. J Hosp Infect. 2017;97(2):162–168.	Quasi-experimental	P. aeruginosa PA14 planktonic cells, laboratory, UK	Different concentrations of peracetic acid	n/a	Viability (resazurin viability, plate count) and biomass of the P. aeruginosa biofilms (Crystal Violet assay)	Ninety-six-hour P. aeruginosa biofilm survives 5 min treatment with 2000 ppm of peracetic acid, which is the working concentration used in some endoscope washer disinfectors. This implies that disinfection failure of flexible endoscopes might occur when biofilms build up in the lumens of endoscopes.	IIB
39	Cholley AC, Traoré O, Hennequin C, Aumeran C. Klebsiella pneumoniae survival and regrowth in endoscope channel biofilm exposed to glutaraldehyde and desiccation. Eur J Clin Microbiol Infect Dis. 2020;39(6):1129–1136.	Quasi-experimental	Teflon tubing simulating insertion tube of flexible endoscopes, laboratory, France	Soiled with test suspension of Klebsiella pneumoniae, allowed to dry, and exposed to glutaraldehyde	n/a	Bacterial culture	Guidelines on endoscope reprocessing should be strictly followed but once constituted the biofilm in endoscope tubing will be very difficult to eradicate with present practices. Biofilm prevention and thorough mechanical cleaning is important. Contaminated endoscopes should be returned to the manufacturer to remove the biofilm before reuse of the device.	IIB
40	Chino T, Nukui Y, Morishita Y, Moriya K. Morphological bactericidal fast-acting effects of peracetic acid, a high-level disinfectant, against Staphylococcus aureus and Pseudomonas aeruginosa biofilms in tubing. Antimicrob Resist Infect Control. 2017;6:122.	Quasi-experimental	S aureus and P aeruginosa biofilms, laboratory, Japan	Biofilms were exposed to 3 HLD agents for 1–60 min	0.3% PAA, 0.55% ortho-phthalaldehyde (OPA), and 2.0% alkaline-buffered glutaraldehyde (GA)	Scanning electron microscopy	PAA and GA were active within 1 min and 5 min, respectively, against S. aureus and P. aeruginosa biofilms. OPA took longer than 10 min and 30 min to act against S. aureus and P. aeruginosa biofilms, respectively.	IIC
41	Alfa MJ, Singh H, Nugent Z et al. Simulated-use polytetrafluorethylene biofilm model: repeated rounds of complete reprocessing lead to accumulation of organic debris and viable bacteria. Infect Control Hosp Epidemiol. 2017;38(11):1284–1290.	Quasi-experimental	5 new endoscope channels made of PTFE material, laboratory, Canada	Soiled overnight on 5 successive days with artificial test soil (E faecalis, P aeruginosa). Each day, cleaning assisted with a pump using a brush or pull-through cleaner and detergent, then AER with peracetic acid.	Enzymatic or nonenzymatic detergents; bristle brush or pull-through cleaner; positive control	Residuals visualized by scanning electron microscopy, ATP, protein, viable bacteria count	Surviving E faecalis and P aeruginosa were only detected when the non-enzymatic detergent was used, emphasizing the importance of the detergent used for endoscope channel reprocessing. Preventing biofilm formation is critical because not all current reprocessing methods can reliably eliminate viable bacteria within the biofilm matrix.	IIC

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42	ANSI/AAMI ST91:2021. Comprehensive Guide to Flexible and Semi-Rigid Endoscope Processing in Health Care Facilities. Arlington, VA: Association for the Advancement of Medical Instrumentation; 2021.	Consensus	United States	n/a	n/a	n/a	The objective of this standard is to provide guidelines for precleaning, transport, leak testing, cleaning, high-level disinfection, liquid chemical sterilization, packaging, sterilization, and storage of flexible and semi-rigid endoscopes.	IVC
43	Ofstead CL, Wetzler HP, Snyder AK, Horton RA. Endoscope reprocessing methods: a prospective study on the impact of human factors and automation. Gastroenterol Nurs. 2010;33(4):304-311.	Nonexperimental	5 endoscopy centers, United States	n/a	n/a	Compliance with guidelines for processing.	Enhanced training and accountability, combined with increased automation, may help to ensure patient safety.	IIIA
44	M'Zali F, Bounizra C, Leroy S, Mekki Y, Quentin-Noury C, Kann M. Persistence of microbial contamination on transvaginal ultrasound probes despite low-level disinfection procedure. PLoS One. 2014;9(4):e93368.	Nonexperimental	300 samples from endovaginal ultrasound probes, France	n/a	n/a	Presence of HPV DNA; Presence of *Chlamydia trachomatis* and mycoplasma DNA; Number of bacterial CFUs.	The findings of the study raise concerns about the efficacy of impregnated towels for disinfection of ultrasound probes.	IIIB
45	Westerway SC, Basseal JM, Brockway A, Hyett JA, Carter DA. Potential infection control risks associated with ultrasound equipment—a bacterial perspective. Ultrasound Med Biol. 2017;43(2):421-426.	Nonexperimental	171 cultures from ultrasound probes, public hospital and private clinic, Australia	n/a	n/a	Prevalence of bacterial contamination.	60% of transabdominal probes and 14% of transvaginal probes had bacterial contamination.	IIIB
46	de Souza Hajar K, de Moraes Bruna CQ, Uchikawa Graziano K. Infection transmission associated with contaminated ultrasound probes: a systematic review. AORN J. 2022;115(1):42–51.	Systematic Review	n/a	n/a	n/a	n/a	When personnel addressed the deficiencies (eg, improving the disinfection process, cleaning the probes immediately after use, inspecting the probes for defects), infections ceased. Personnel involved with the reprocessing of ultrasound probes should clean, disinfect, inspect, and store ultrasound probes in a manner that maintains device integrity and prevents contamination.	IIIB

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47	Kanamori H, Rutala WA, Weber DJ. The role of patient care items as a fomite in healthcare-associated outbreaks and infection prevention. Clin Infect Dis. 2017;65(8):1412–1419.	Literature Review	n/a	n/a	n/a	n/a	Contaminated ultrasound gels led to B. cepacia infection and bacteremia, S. aureus pyoderma, or Mycobacterium massiliense surgical site infections in neonates, children, or ICU patients. Contamination of TEE probes was involved in outbreaks of E. cloacae, S. marcescens, or MDR P. aeruginosa in cardiac surgical patients and an outbreak of ESBL-producing Salmonella enterica among surgical patients for transplant. Legionella pneumophila pneumonia cases were also associated with contaminated water to rinse TEE probes.	VA
48	Hudson MJ, Park SC, Mathers A et al. Outbreak of Burkholderia stabilis infections associated with contaminated nonsterile, multiuse ultrasound gel: 10 states, May–September 2021. MMWR Morb Mortal Wkly Rep. 2022;71(48):1517–1521.	Case Report	n/a	n/a	n/a	n/a	In 2021, a total of 119 Burkholderia cepacia complex infections were associated with multiple lots of nonsterile ultrasound gel contaminated with these organisms. Health care personnel should be trained for the appropriate use of ultrasound gel associated with ultrasounds and ultrasound-associated procedures, including that only sterile, single-use ultrasound gel should be used before and during invasive percutaneous procedures to prevent additional outbreaks of serious patient infections.	VA
49	Angrup A, Kanaujia R, Biswal M, Ray P. Systematic review of ultrasound gel associated Burkholderia cepacia complex outbreaks: clinical presentation, sources and control of outbreak. Am J Infect Control. 2022;S0196-6553(22)00078-5.	Systematic Review	n/a	n/a	n/a	n/a	This review highlights the importance of appropriate surveillance of outbreaks in controlling Burkholderia cepacia complex infection caused by contaminated ultrasound gel. Ensuring the sterility of US gel and strategies in order to prevent such outbreaks should be made in institutions.	IIIA
50	Shokoohi H, Armstrong P, Tansek R. Emergency department ultrasound probe infection control: challenges and solutions. Open Access Emerg Med. 2015;7:1-9.	Literature Review	n/a	n/a	n/a	n/a	Repeated use of ultrasound probes in the Emergency Department poses a risk for pathogen transmission.	VB
51	Guideline for design and maintenance of the surgical suite. In: Guidelines for Perioperative Practice. Denver, CO: AORN Inc; 2023:87–118.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance on the design layout and equipment used in the surgical suite and maintenance of these spaces.	IVA

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52	Hota S, Hirji Z, Stockton K, et al. Outbreak of multidrug-resistant Pseudomonas aeruginosa colonization and infection secondary to imperfect intensive care unit room design. Infect Control Hosp Epidemiol. 2009;30(1):25-33.	Case Report	n/a	n/a	n/a	n/a	This report highlights the importance of biofilm and of sink and patient room design in the propagation of an outbreak and suggests strategies to reduce the risks associated with hospital sinks.	VB
53	Ofstead CL, Hopkins KM, Daniels FE, Smart AG, Wetzler HP. Splash generation and droplet dispersal in a well-designed, centralized high-level disinfection unit. Am J Infect Control. 2022;S0196-6553(22)00629-0.	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
54	29 CFR 1910.1030 – Bloodborne Pathogens. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	OSHA bloodborne pathogens standard	n/a
55	29 CFR 1910.132 – Personal Protective Equipment: General Requirements. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	PPE requirements.	n/a
56	Guideline for transmission-based precautions. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:1185–1214.	Guideline	n/a	n/a	n/a	n/a	Guidance is provided for perioperative RNs in implementing standard precautions and transmission-based precautions (ie, contact, droplet, airborne) to prevent infection in the perioperative practice setting. Additional guidance is provided for bloodborne pathogens and PPE.	IVA
57	Guideline for hand hygiene. In: Guidelines for Perioperative Practice. Denver, CO: AORN Inc; 2023:267–308.	Guideline	n/a	n/a	n/a	n/a	This document provides perioperative team members with evidence-based practice guidance for performing hand hygiene and surgical hand antisepsis to promote patient and personnel safety and reduce the risk for health care–associated infections, especially surgical site infections.	IVA
58	Guideline for a safe environment of care. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:145–178.	Guideline	n/a	n/a	n/a	n/a	Guidance is provided on musculoskeletal injury, fire safety, electrical equipment, clinical and alert alarms, blanket- and solution-warming cabinets, medical gas cylinders, waste anesthesia gases, latex, chemicals including methyl methacrylate bone cement, and hazardous waste.	IVA
59	29 CFR 1910.151 – Medical Services and First Aid. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	First aid	n/a

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60	29 CFR 1910.134 – Respiratory Protection. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	n/a	n/a
61	Guidelines for Design and Construction of Outpatient Facilities. 2022 ed. St Louis, MO: Facility Guidelines Institute; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidance is provided for design and construction of hospitals and outpatient facilities, facilities where inpatient care is provided, and facilities where outpatient care is provided.	IVC
62	Guidelines for Design and Construction of Hospitals and Outpatient Facilities. 2022 ed. St Louis, MO: Facility Guidelines Institute; 2022.	Guideline	n/a	n/a	n/a	n/a	Provides guidelines for construction including: minimum recommended program, space, risk assessment, infection prevention, architectural detail, and surface and built-in furnishing needs for clinical and support areas of hospitals, rehabilitation facilities, and ambulatory care facilities. It also addresses minimum engineering design criteria for plumbing, electrical, and heating, ventilation, and air-conditioning (HVAC) systems.	IVC
63	TLV/BEI Guidelines: Overview. American Conference of Governmental Industrial Hygienists.	Guideline	n/a	n/a	n/a	n/a	Defines occupational exposure limits for chemicals, including high-level disinfectants.	IVB
64	Occupational Chemical Database. Occupational Safety and Health Administration.	Regulatory	n/a	n/a	n/a	n/a	Chemical database.	n/a
65	Best Practices for the Safe Use of Glutaraldehyde in Health Care. OSHA 3258-08N-2006. Occupational Safety and Health Administration	Expert Opinion	n/a	n/a	n/a	n/a	The most serious health effect associated with exposure to glutaraldehyde is occupational asthma.	VA
66	Resource Conservation and Recovery Act (RCRA) laws and regulations. US Environmental Protection Agency.	Regulatory	n/a	n/a	n/a	n/a	n/a	n/a
67	Loyola M, Babb E, Bocian S et al. Standards of infection prevention in reprocessing flexible gastrointestinal endoscopes. Gastroenterol Nurs. 2020;43(3):E142–E158.	Guideline	United States	n/a	n/a	n/a	Proper reprocessing of endoscopes and accessories is critical to the safe and successful treatment of patients.	IVB
68	Day LW, Muthusamy VR, Collins J et al. Multisociety guideline on reprocessing flexible GI endoscopes and accessories. Gastrointest Endosc. 2021;93(1):11–33.e6.	Guideline	United States	n/a	n/a	n/a	This guideline contains expanded details related to the critical reprocessing steps of cleaning and drying and incorporates recent evidence as it pertains to improving the reprocessing of GI endoscopes.	IVA

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69	Kampf G, Bloss R, Martiny H. Surface fixation of dried blood by glutaraldehyde and peracetic acid. J Hosp Infect. 2004;57(2):139-143.	Nonexperimental	Metal test soil carriers, laboratory, Germany	n/a	Phenol-based disinfectant, glutaraldehyde, peracetic acid	Fixation of dried blood after disinfectant exposure.	There is a potential for blood fixation by both glutaraldehyde and peracetic acid, which supports the need for effective cleaning before disinfection.	IIIB
70	Federal Insecticide, Fungicide, and Rodenticide Act [as amended through P.L. 112–177, effective Sept. 28, 2012]. US Environmental Protection Agency. US Senate Committee on Agriculture, Nutrition & Forestry.	Regulatory	n/a	n/a	n/a	n/a	n/a	n/a
71	Howie R, Alfa MJ, Coombs K. Survival of enveloped and non-enveloped viruses on surfaces compared with other micro-organisms and impact of suboptimal disinfectant exposure. J Hosp Infect. 2008;69(4):368-376.	Nonexperimental	Test microorganisms (bacteria, yeast, viruses), laboratory, Canada	n/a	Glutaraldehyde, accelerated hydrogen peroxide	Survival of microorganisms; Killing efficacy of disinfectants.	Effective cleaning and disinfection is essential for preventing pathogen transmission.	IIIB
72	Ofstead CL, Hopkins KM, Buro BL, Eiland JE, Wetzler HP. Challenges in achieving effective high-level disinfection in endoscope reprocessing. Am J Infect Control. 2020;48(3):309–315.	Mixed-methods	n/a	n/a	n/a	n/a	Reusable HLDs commonly failed tests for minimum effective concentration (MEC) before their maximum usage periods. MEC tests also detected failures associated with single-use HLDs that did not fully deploy. These failures were due to product issues, process complexities, and personnel non-adherence with guidelines and manufacturer instructions.	VA
73	Rutala WA, Gergen MF, Weber DJ. Disinfection of a probe used in ultrasound-guided prostate biopsy. Infect Control Hosp Epidemiol. 2007;28(8):916-919.	Nonexperimental	Prostate biopsy probes inoculated with P aeruginosa, United States	n/a	Immersion in 2% glutaraldehyde	Level of microbial contamination.	Disinfection can only be achieved if the needle guide is removed from the prostate biopsy probe.	IIIB
74	Alfa MJ. Intra-cavitary ultrasound probes: cleaning and high-level disinfection are necessary for both the probe head and handle to reduce the risk of infection transmission. Infect Control Hosp Epidemiol. 2015;36(5):585-586.	Expert Opinion	n/a	n/a	n/a	n/a	Guidelines for processing vaginal ultrasound probes should ensure that the handle as well as the probe head are adequately cleaned and disinfected after each use.	VA
75	Ngu A, McNally G, Patel D, Gorgis V, Leroy S, Burdach J. Reducing transmission risk through high-level disinfection of transvaginal ultrasound transducer handles. Infect Control Hosp Epidemiol. 2015;36(5):581-584.	Nonexperimental	152 samples from ultrasound handles, public hospital and clinic, Australia	n/a	n/a	Contamination levels.	Residual bacteria persist on more than 80% of handles that are not disinfected, whereas use of an automated device reduces contamination to background levels.	IIIB

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76	Kac G, Podglajen I, Si-Mohamed A, Rodi A, Grataloup C, Meyer G. Evaluation of ultraviolet C for disinfection of endocavitary ultrasound transducers persistently contaminated despite probe covers. Infect Control Hosp Epidemiol. 2010;31(2):165-170.	Nonexperimental	440 patients undergoing vaginal or rectal ultrasound examinations, 3 institutions, France	n/a	UV-C disinfection	Number of CFUs; Number of targeted viruses.	A disinfection procedure consisting of cleaning with a disinfected-impregnated towel followed by disinfection with ultraviolet C light may be effective for disinfection of endocavitary ultrasound probes.	IIIB
77	Bloc S, Mercadal L, Garnier T, et al. Evaluation of a new disinfection method for ultrasound probes used for regional anesthesia: ultraviolet C light. J Ultrasound Med. 2011;30(6):785-788.	Nonexperimental	15 ultrasound probes inoculated with 3 bacteria, France	n/a	UV-C disinfection	Number of CFUs.	Ultraviolet C light may be effective for disinfection of probes used for ultrasound-guided regional anesthesia.	IIIC
78	Vickery K, Gorgis VZ, Burdach J, Patel D. Evaluation of an automated high-level disinfection technology for ultrasound transducers. J Infect Public Health. 2014;7(2):153-160.	Nonexperimental	Carrier tests with 21 species of bacteria, fungi, and viruses; laboratory, Australia	n/a	Trophon	35% hydrogen peroxide disinfection efficacy.	The device satisfied criteria for high-level disinfection and sporicidal disinfection efficacy under all standards tested.	IIIB
79	Rutala WA, Gergen MF, Sickbert-Bennett E. Effectiveness of a hydrogen peroxide mist (trophon) system in inactivating healthcare pathogens on surface and endocavitary probes. Infect Control Hosp Epidemiol. 2016;37(5):613-614.	Nonexperimental	5 ultrasound probes inoculated with test soil, academic medical center, United States	n/a	Trophon	Inactivation of test organisms.	The nebulized hydrogen peroxide system is an effective method of high-level disinfection.	IIIB
80	Johnson S, Proctor M, Bluth E, et al. Evaluation of a hydrogen peroxide-based system for high-level disinfection of vaginal ultrasound probes. J Ultrasound Med. 2013;32(10):1799-1804.	Nonexperimental	13 Sonographers, United States	n/a	n/a	Efficacy of hydrogen peroxide-based system; Time to use; Costs of use.	The hydrogen peroxide-based system was efficient, easy and safe to use. The system saved approximately 7.5 hours per week and allowed 1.5 more ultrasound examinations to be performed per week.	IIIB
81	Combs CA, Fishman A. A proposal to reduce the risk of transmission of human papilloma virus via transvaginal ultrasound. Am J Obstet Gynecol. 2016;215(1):63-67.	Expert Opinion	n/a	n/a	n/a	n/a	Disinfection of internal-use ultrasound probes with sonicated hydrogen peroxide and covering them with sheaths during examinations will greatly reduce the potential for human papilloma virus transmission.	VA
82	Rutala WA, Gergen MF, Bringhurst J, Weber DJ. Effective high-level disinfection of cystoscopes: is perfusion of channels required? Infect Control Hosp Epidemiol. 2016;37(2):228-231.	Quasi-experimental	Cystoscope inoculated with VRE and K pneumoniae, academic medical center, United States	Cystoscope immersed and lumen flushed and filled with high-level disinfectant	Immersion only	CFUs in lumen of cystoscope	Disinfection does not occur unless the channel of the cystoscope has been actively perfused with the disinfectant. Failing to perfuse the channel leads to minimal reduction in bacterial contamination.	IIB
83	Unal M, Yucel I, Akar Y, Oner A, Altin M. Outbreak of toxic anterior segment syndrome associated with glutaraldehyde after cataract surgery. J Cataract Refract Surg. 2006;32(10):1696-1701.	Case Report	n/a	n/a	n/a	n/a	Glutaraldehyde is highly toxic to the corneal endothelium.	VA

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84	Karpelowsky JS, Maske CP, Sinclair-Smith C, Rode H. Glutaraldehyde-induced bowel injury after laparoscopy. J Pediatr Surg. 2006;41(6):e23-e25.	Case Report	n/a	n/a	n/a	n/a	The injury was likely caused by the inadvertent deposition of a few milliliters of glutaraldehyde solution left behind in insufflation tubing and introduced into the patient's body during insufflation.	VB
85	Nazik H, Bodur S, Api M, Aytan H, Narin R. Glutaraldehyde-induced bowel injury during gynecologic laparoscopy. J Minim Invasive Gynecol. 2012;19(6):756-757.	Case Report	n/a	n/a	n/a	n/a	Even very small amounts of residual glutaraldehyde on laparoscopic instruments can cause chemical burns.	VB
86	AAMI TIR34: 2014 (R2017). Water for the Reprocessing of Medical Devices. Arlington, VA: Association for the Advancement of Medical Instrumentation; 2017.	Consensus	n/a	n/a	n/a	n/a	This technical information report covers the selection and maintenance of effective water quality suitable for reprocessing medical devices.	IVC
87	Gillespie JL, Arnold KE, Noble-Wang J, et al. Outbreak of Pseudomonas aeruginosa infections after transrectal ultrasound-guided prostate biopsy. Urology. 2007;69(5):912-914.	Case Report	n/a	n/a	n/a	n/a	Needle guide reprocessing procedures were inadequate. Potential causes of patient infection included lack of adequate manual cleaning, failure to sterilize the needle guide, and use of utility water for rinsing.	VB
88	Wendelboe AM, Baumbach J, Blossom DB, Frank P, Srinivasan A, Sewell CM. Outbreak of cystoscopy related infections with Pseudomonas aeruginosa: New Mexico, 2007. J Urol. 2008;180(2):588-592.	Nonexperimental	23 patients with blood or urine cultures positive for *Pseudomonas aeruginosa* , New Mexico, United States	n/a	n/a	Risk factors for becoming a case.	One cause of the outbreak was rinsing the devices with unsterile water.	IIIB
89	Alfa MJ. Medical instrument reprocessing: current issues with cleaning and cleaning monitoring. Am J Infect Control. 2019;47S:A10–A16.	Literature Review	n/a	n/a	n/a	n/a	There has been a paradigm shift in reprocessing of medical devices, with increased emphasis on a quality management systems approach that requires validated cleaning instructions from manufacturers and ongoing monitoring by reprocessing personnel to ensure adequacy of cleaning.	VA
90	Barakat MT, Banerjee S. Novel algorithms for reprocessing, drying and storing endoscopes. Gastrointest Endosc Clin N Am. 2020;30(4):677–691.	Literature Review	n/a	n/a	n/a	n/a	Discusses multiple approaches to enhance and optimize reprocessing, drying, and storage of standard duodenoscopes.	VA

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91	Alfa MJ, Singh H. Impact of wet storage and other factors on biofilm formation and contamination of patient-ready endoscopes: a narrative review. Gastrointest Endosc. 2020;91(2):236–247.	Literature Review	n/a	n/a	n/a	n/a	There is an immediate need to focus attention on the issue of moisture in endoscope channels during storage (including the potential role of simethicone and other off-label products in preventing cleaning and drying adequacy). Unless a quality systems approach is implemented, accumulation of biofilm in endoscope channels will continue to result in contamination of flexible endoscopes that protects embedded microbes against HLD and low temperature sterilization, which could result in infection transmission.	VA
92	Barakat MT, Huang RJ, Banerjee S. Comparison of automated and manual drying in the elimination of residual endoscope working channel fluid after reprocessing (with video). Gastrointest Endosc. 2019;89(1):124–132.e2.	Quasi-experimental	6 gastroscopes, 6 colonoscopes, 5 linear echoendoscopes, 6 duodenoscopes, United States	Automated device-facilitated drying for 5 minutes and 10 minutes	Manual drying with a forced air gun	Borescope inspection for retained fluid, ATP	Significantly fewer water droplets and delayed ATP bioluminescence values within endoscope working channels after automated drying compared with manual drying. In particular, virtually no retained fluid was evident within endoscope working channels after automated drying for 10 minutes.	IIB
93	Ofstead CL, Heymann OL, Quick MR, Eiland JE, Wetzler HP. Residual moisture and waterborne pathogens inside flexible endoscopes: evidence from a multisite study of endoscope drying effectiveness. Am J Infect Control. 2018;46(6):689–696.	Organizational Experience	45 endoscopes, 3 multispecialty hospitals, United States	n/a	n/a	Visual examination with borescopes; reprocessing, drying, and storage practices; ATP; microbial cultures	Fluid was detected in 49% of endoscopes. Prevalence of moisture varied significantly by site. High ATP levels were found in 22% of endoscopes, and microbial growth was detected in 71% of endoscopes. Retained fluid was associated with significantly higher ATP levels. Damaged endoscopes were in use at all sites.	VA
94	Guideline for sterile technique. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:1015–1056.	Guideline	n/a	n/a	n/a	n/a	Implementing sterile technique when preparing, performing, or assisting with surgical and other invasive procedures is the cornerstone of maintaining sterility and preventing microbial contamination.	IVA
95	Kenters N, Tartari E, Hopman J et al. Worldwide practices on flexible endoscope reprocessing. Antimicrob Resist Infect Control. 2018;7:153.	Nonexperimental	165 respondents from 39 countries	n/a	n/a	50 question survey assessing stakeholder involvement, assessment of perceived risks, and processing process	Most facilities 82% have a standard operating procedure. There is, however a lot of variation within the flexible endoscope reprocessing practices observed. The need for regular training and education of reprocessing practitioners were identified by 50% of the respondents as main concerns. A standardized education and training program with a competency assessment is essential to prevent reprocessing lapses and improve patient safety.	IIIB

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96	Suresh S, Pande M, Patel K et al. Education, training, and knowledge of infection control among endoscopy technicians and nurses. Am J Infect Control. 2021;49(6):836–839.	Qualitative	88 endoscopy technicians and nurses, United States	n/a	n/a	Survey of experience, training, and knowledge in infection control	While self-reported confidence in endoscope reprocessing was high (9 out of 10), knowledge of best practices in this regard lagged (average assessment score of 62%).	IIIB
97	Henn SA, Boiano JM, Steege AL. Precautionary practices of healthcare workers who disinfect medical and dental devices using high-level disinfectants. Infect Control Hosp Epidemiol. 2015;36(2):180-185.	Nonexperimental	4657 members of professional practice organizations, United States	n/a	n/a	Information on current usage; Information on precautionary practices; Information on barriers to use of personal protective equipment.	Precautionary practices are not always followed, which underscores the importance of ongoing education and competency verification.	IIIB
98	State Operations Manual Appendix A: Survey Protocol, Regulations and Interpretive Guidelines for Hospitals. Rev 216, 07-21-23. Centers for Medicare & Medicaid Services.	Regulatory	n/a	n/a	n/a	n/a	n/a	n/a
99	State Operations Manual Appendix L: Guidance for Surveyors: Ambulatory Surgical Centers. Rev. 215, 07-21-23. Centers for Medicare & Medicaid Services.	Regulatory	n/a	n/a	n/a	n/a	n/a	n/a
100	Pynnonen MA, Whelan J. Reprocessing flexible endoscopes in the otolaryngology clinic. Otolaryngol Clin North Am. 2019;52(3):391–402.	Literature Review	n/a	n/a	n/a	n/a	Important aspects and current best practices for flexible endoscope cleaning and high-level disinfection in the otolaryngology clinic.	VB
101	MAUDE: Manufacturer and User Facility Device Experience. US Food and Drug Administration.	Regulatory	n/a	n/a	n/a	n/a	FDA MAUDE (Manufacturer and User Facility Device Experience) Database	n/a
102	Reporting problems with reusable medical devices or reprocessing. US Food and Drug Administration.	Regulatory	n/a	n/a	n/a	n/a	Prompt reporting of adverse events can help the FDA identify and better understand the risks associated with medical devices.	n/a