REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
1	Pruss-Ustun A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. Am J Ind Med. 2005;48(6):482-490.	Nonexperimental	83,000 infections attributable to percutaneous injuries	n/a	n/a	Occupational infections after a percutaneous injury	Occupational exposures to percutaneous injuries are a source of infections with bloodborne pathogens among health care workers. These infections are preventable.	IIIB
2	Goniewicz M, Wloszczak-Szubzda A, Niemcewicz M, Witt M, Marciniak-Niemcewicz A, Jarosz MJ. Injuries caused by sharp instruments among healthcare workers—international and Polish perspectives. Ann Agric Environ Med. 2012;19(3):523-527.	Expert Opinion	n/a	n/a	n/a	n/a	Exposure to sharp instruments and their consequences is preventable through vaccination, education, and use of sharps containers.	VA
3	Panlilio AL, Orelien JG, Srivastava PU, et al. Estimate of the annual number of percutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998. Infect Control Hosp Epidemiol. 2004;25(7):556-562.	Expert Opinion	n/a	n/a	n/a	n/a	The estimated number of percutaneous injuries sustained annually by health care workers is 384,325.	VA
4	EPINet report for needlestick and sharp object injuries. International Safety Center https://internationalsafetycenter.org/wp-content/uploads/2019/07/Official-2018-US-NeedleSummary-FINAL.pdf. Accessed August 1, 2019.	Organizational Experience	34 Health Systems	n/a	n/a	n/a	EPINet report for needlestick and sharp object injuries provides standardized methods for recording, tracking, and analyzing percutaneous injuries and blood and body fluid contacts.	VA
5	Verbeek J, Basnet P. Incidence of sharps injuries in surgical units, a meta-analysis and meta-regression. Am J Infect Control. 2019;479(4):448-455.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	A surgeon will have a sharps injury in about 1 in 10 operations. Sharps injury reporting should be standardized and assessed in prospective follow-up studies.	IIIA
6	Hofmeister MG, Rosenthal EM, Barker LK, et al. Estimating prevalence of hepatitis C virus infection in the United States, 2013-2016. Hepatology. 2019;69(3):1020-1031.	Nonexperimental	244,869,800 adult population	n/a	n/a	Number of ever and currently infected persons with HCV and the prevalence	In the United States there are an estimated 2.4 million people living with the hepatitis C virus infection.	IIIA
7	HIV and viral hepatitis. Centers for Disease Control and Prevention. https://www.cdc.gov/hiv/pdf/library/factsheets/hiv-viral-hepatitis.pdf. Accessed August 8, 2019.	Expert Opinion	n/a	n/a	n/a	n/a	An estimated 1.2 million persons are living with HIV in the United States. Of people living with HIV in the United States, about 25 percent are coinfected with hepatitis C virus (HCV), and about 10 percent are coinfected with hepatitis B virus (HBV).	VA

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8	Westermann C, Peters C, Lisiak B, Lamberti M, Nienhaus A. The prevalence of hepatitis C among healthcare workers: a systematic review and meta-analysis. Occup Environ Med. 2015;72(12):880-888.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The pooled analysis indicates that the prevalence of HCV is significantly higher in health care workers than the general population.	IIIB
9	Lewis JD, Enfield KB, Sifri CD. Hepatitis B in healthcare workers: transmission events and guidance for management. World J Hepatol. 2015;7(3):488-497.	Literature Review	n/a	n/a	n/a	n/a	HBV infection among health care workers (HCW) is of concern since it is has a high transmissibility relative to other blood borne viruses and there are documented transmissions from infected HCW to patient.	VA
10	Joyce PM, Kuhar D, Brooks JT. Notes from the field: occupationally acquired HIV infection among health care workers—United States, 1985-2013. Am J Transplant. 2015;15(3):841-842.	Expert Opinion	n/a	n/a	n/a	n/a	Documented occupational acquisition of HIV infection in health care workers has become rare in the US. Few confirmed cases have been reported since the late 1990s.	VA
11	Shibuya A, Takeuchi A, Sakurai K, Saigenji K. Hepatitis G virus infection from needle-stick injuries in hospital employees. J Hosp Infect. 1998;40(4):287-290.	Nonexperimental	21 employees exposed to hepatitis G through a needlestick.	n/a	n/a	HGV RNA positive	The findings suggest a low clinical risk of occupational exposure to HGV, but HGV is transmissible by a needle-stick injury.	IIIB
12	Apisarnthanarak A, Mundy LM. Cytomegalovirus mononucleosis after percutaneous injury in a Thai medical student. Am J Infect Control. 2008;36(3):228-229.	Case Report	n/a	n/a	n/a	n/a	First documented case of cytomegalovirus (CMV) mononucleosis after a percutaneous needlestick injury in a Thai medical student.	VB
13	Douglas MW, Walters JL, Currie BJ. Occupational infection with herpes simplex virus type 1 after a needlestick injury. Med J Aust. 2002;176(5):240.	Case Report	n/a	n/a	n/a	n/a	Report of a needlestick injury while the medical officer was deroofing a vesicle in a patient with orolabial herpes simplex. A vesicle appeared at the site of inoculation on the medical officer's hand.	VB
14	Huang D, Yin H. Primary inoculation tuberculosis after an accidental scalpel injury. Infection. 2013;41(4):841-844.	Case Report	n/a	n/a	n/a	n/a	A case report of a surgeon inoculated with TB resulting from an accidental scalpel injury.	VA
15	Belchior I, Seabra B, Duarte R. Primary inoculation skin tuberculosis by accidental needle stick. BMJ Case Rep. 2011;June 15, 2011. doi:10.1136/bcr.11.2010.3496.	Case Report	n/a	n/a	n/a	n/a	Primary inoculation of skin tuberculosis experienced by a lab worker experiencing a finger lesion while handling samples of a cultural exam of M tuberculosis.	VA
16	Tapias L, Tapias-Vargas LF, Tapias-Vargas L. Primary cutaneous inoculation tuberculosis in a healthcare worker as a result of a surgical accident. Int J Dermatol. 2008;47(8):833-835.	Case Report	n/a	n/a	n/a	n/a	A report of a surgeon who developed primary cutaneous inoculation tuberculosis following a superficial scalpel cut. The patient had a tuberculous empyema.	VB

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17	Cone LA, Curry N, Wuestoff MA, O'Connell SJ, Feller JF. Septic synovitis and arthritis due to Corynebacterium striatum following an accidental scalpel injury. Clin Infect Dis. 1998;27(6):1532-1533.	Case Report	n/a	n/a	n/a	n/a	Report of the first case of septic synovitis due to *C. striatum* following an accidental laceration with a scalpel used on a cachetic 80-year old patient.	VB
18	Alweis RL, DiRosario K, Conidi G, Kain KC, Olans R, Tully JL. Serial nosocomial transmission of Plasmodium falciparum malaria from patient to nurse to patient. Infect Control Hosp Epidemiol. 2004;25(1):55-59.	Case Report	n/a	n/a	n/a	n/a	A nurse who acquired *falciparum* malaria via a needlestick subsequently transmitted malaria to another patient via a break in standard precautions.	VB
19	Tarantola AP, Rachline AC, Konto C, et al. Occupational malaria following needlestick injury. Emerg Infect Dis. 2004;10(10):1878-1880.	Case Report	n/a	n/a	n/a	n/a	Malaria transmission following a needlestick injury is not immediately considered. The exposed individual may be too sick to relate the details of this occupational exposure.	VB
20	Tarantola A, Abiteboul D, Rachline A. Infection risks following accidental exposure to blood or body fluids in health care workers: a review of pathogens transmitted in published cases. Am J Infect Control. 2006;34(6):367-375.	Literature Review	n/a	n/a	n/a	n/a	The health care worker's risk of accidental exposure to rare pathogens via a needlestick injury increases with intercontinental travel and migrations.	VA
21	Folin AC, Nordstrom GM. Accidental blood contact during orthopedic surgical procedures. Infect Control Hosp Epidemiol. 1997;18(4):244-246.	Organizational Experience		n/a	n/a	n/a	Blood exposure occurred in 11% of the orthopedic procedures. Contamination of intact skin was the most common incident (79%) and percutaneous injuries occurred in 13%. The majority of incidents were believed to be preventable.	VA
22	Enfield KB, Sharapov U, Hall KK, et al. Transmission of hepatitis B virus from an orthopedic surgeon with a high viral load. Clin Infect Dis. 2013;56(2):218-224.	Nonexperimental	232 potentially HCV exposed patients	n/a	n/a	Transmission of HBV	The researchers documented HBV transmission during orthopedic surgery to 2 patients from a surgeon with HBV>	IIIC
23	Olsen K, Dahl PE, Paulssen EJ, Husebekk A, Widell A, Busund R. Increased risk of transmission of hepatitis C in open heart surgery compared with vascular and pulmonary surgery. Ann Thorac Surg. 2010;90(5):1425-1431.	Case Report	n/a	n/a	n/a	n/a	An HCV infected patient infected a cardiac surgeon. The surgeon subsequently infected 10 patients.	VA
24	Mallolas J, Arnedo M, Pumarola T, et al. Transmission of HIV-1 from an obstetrician to a patient during a caesarean section. AIDS. 2006;20(2):285-287.	Case Report	n/a	n/a	n/a	n/a	Report of HCV-1 transmission during a C section from the obstetrician to the patient.	VB

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25	Lee JM, Botteman MF, Xanthakos N, Nicklasson L. Needlestick injuries in the United States. Epidemiologic, economic, and quality of life issues. AAOHN J. 2005;53(3):117-133.	Systematic Review	n/a	n/a	n/a	n/a	The economic burden of using safety devices to prevent percutaneous injuries may be expensive but cost alone should not be the reason not to use them.	IIIB
26	O'Malley EM, Scott RD 2nd, Gayle J, et al. Costs of management of occupational exposures to blood and body fluids. Infect Control Hosp Epidemiol. 2007;28(7):774-782.	Nonexperimental	4 healthcare facilities	n/a	n/a	Costs of reported occupational exposures to BBP	Management of occupational exposures to BBP is expensive and the best way to avoid these costs is by prevention of an exposure.	IIIB
27	Cooke CE, Stephens JM. Clinical, economic, and humanistic burden of needlestick injuries in healthcare workers. Med Devices (Auck). 2017;10:225-235	Systematic Review	n/a	n/a	n/a	n/a	The clinical, economic, and humanistic burden is substantial for health care workers who experience a needle stick injury(NSI) . Safety engineered devices for injection demonstrate value by reducing NSI risk, the associated direct and indirect costs, psychological stress on health care workers and occupational blood-borne viral infection risk.	IIIB
28	Mannocci A, De Carli G, Di Bari V, et al. How much do needlestick injuries cost? A systematic review of the economic evaluations of needlestick and sharps injuries among healthcare personnel. Infect Control Hosp Epidemiol. 2016;37(6):635-646	Systematic Review	n/a	n/a	n/a	n/a	Needlestick injuries(NSI) generate significant direct, indirect, potential, and intangible costs possibly increasing over time. Economic efforts directed at preventing occupational exposures and infections including safety engineered devices may be offset by the savings from a lower incidence of NSIs.	IIIA
29	Leigh JP, Gillen M, Franks P, et al. Costs of needlestick injuries and subsequent hepatitis and HIV infection. Curr Med Res Opin. 2007;23(9):2093-2105.	Nonexperimental	644963 needlestick injuries	n/a	n/a	Combined cost of needlestick injuries.	the estimated costs of 644,963 needlestick injuries generated $188.5 million for combined costs. The costs included $107.3 million for medical costs and $81.3 million for lost productivity. The combined costs make up approximately 0.1% of all occupational injury and illness costs for all types of jobs in the economy.	IIIA
30	Moayed MS, Mahmoudi H, Ebadi A, Salary MM, Danial Z. Effect of education on stress of exposure to sharps among nurses in emergency and trauma care wards. Trauma Mon. 2015;20(2):17-20.	Quasi-experimental	35 hospital employees	Education and training, universal precautions to prevent injury, proper use of protective coatings and use of equipment and engineering measures.	Stress from sharp instrument exposure before and after the intervention	Stress levels	The stress level induced due to needle stick injuries and exposure and its complications is high and interventions for reduction are essential.	IIC

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31	Moayed MS, Mahmoudi H, Ebadi A, Sharif Nia H. Stress and fear of exposure to sharps in nurses. Iran J Psychiatry Behav Sci. 2016;10(3):e3813.	Qualitative	527 nurses	n/a	n/a	Amount of stress caused by a sharps injury	Results of the study showed that exposure to sharp objects may cause high stress in the nursing staff.	IIIC
32	Naghavi SHR, Shabestari O, Alcolado J. Post-traumatic stress disorder in trainee doctors with previous needlestick injuries. Occup Med (Lond). 2013;63(4):260-265.	Qualitative	147 trainee doctors	n/a	n/a	Prevalence of post-traumatic stress disorder	Needle stick injuries (NSI) were common among doctors in training. 12% of the doctors with a needle stick injury experienced post-traumatic stress reaction. Special attention should be paid to the psychological impact of an NSI.	IIIB
33	Jeong JS, Son HM, Jeong IS, et al. Qualitative content analysis of psychologic discomfort and coping process after needlestick injuries among health care workers. Am J Infect Control. 2016;44(2):183-188.	Qualitative	15 health care workers who experienced a needlestick injury (NSI)	n/a	n/a	Psychological discomfort and coping processes	Types of psychological discomfort after a NSI included anxiety, anger, and feelings of guilt. Coping strategies were either active (eg, seeking first aid) or passive (eg, avoidance of reporting the incident).	IIIB
34	Hambridge K, Nichols A, Endacott R. The impact of sharps injuries on student nurses: a systematic review. Br J Nurs. 2016;25(19):1064-1071.	Literature Review	n/a	n/a	n/a	n/a	The review emphasizes the psychological issues related to sharps injuries, the impact that they can have on individuals, and the support and counselling needed after a sharps injury.	VA
35	Green B, Griffiths EC. Psychiatric consequences of needlestick injury. Occup Med (Oxford). 2013;63(3):183-188.	Nonexperimental	17 needlestick injury (NSI) cases and 125 control cases of psychiatric trauma without a NSI	n/a	n/a	Beck depression Inventory score	Enduring psychiatric illness can result from a needlestick injury with a severity similar to other traumatic events	IIIB
36	Jagger J, Berguer R, Phillips EK, Parker G, Gomaa AE. Increase in sharps injuries in surgical settings versus nonsurgical settings after passage of national needlestick legislation. AORN J. 2011;93(3):322-330.	Nonexperimental	7186 sharps injuries to surgical personnel	n/a	n/a	type of injury and how the injury occurred	Surgical injuries continue to increase while injuries in other area decreased.	IIIB
37	Lu Y, Senthilselvan A, Joffe AM, Beach J. Effectiveness of safety-engineered devices in reducing sharp object injuries. Occup Med (Lond). 2015;65(1):39-44.	Quasi-experimental	4707 sharp object injuries	Introduction of safety-engineered devices	number of injuries before introduction of safety devices, during the introduction period, and after introduction	Frequency and causes of sharp object injuries in hospitals; effectiveness of safety engineered devices	The introduction of safety-engineered devices was associated with a modest reduction in reported injuries but the reduction was not maintained.	IIB

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38	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. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	OSHA's Bloodborne Pathogens standard (29 CFR 1910.1030) as amended pursuant to the Needlestick Safety and Prevention Act of 2000, prescribes safeguards to protect workers against the health hazards caused by bloodborne pathogens. Its requirements address items such as exposure control plans, universal precautions, engineering and work practice controls, personal protective equipment, housekeeping, laboratories, hepatitis B vaccination, post-exposure follow-up, hazard communication and training, and recordkeeping. The standard places requirements on employers whose workers can be reasonably anticipated to contact blood or other potentially infectious materials (OPIM), such as unfixed human tissues and certain body fluids.	n/a
39	Occupational exposure to bloodborne pathogens; needlestick and other sharps injuries; final rule. Fed Regist. 2001;66(12):5318-5325.	Regulatory	n/a	n/a	n/a	n/a	OSHA's final rule for Occupational Exposure to Bloodborne Pathogens: Needlestick and Other Sharps Injuries.	n/a
40	Needlestick Safety and Prevention Act of 2000. PL 106.430. http://www.gpo.gov/fdsys/pkg/PLAW-106publ430/html/PLAW-106publ430.htm. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	A modification of 29 CFR.1910.1030 to provide greater detail for the requirements for employers to identify, evaluate, and make use of effective safer medical devices.	n/a
41	MacCannell T, Laramie AK, Gomaa A, Perz JF. Occupational exposure of health care personnel to hepatitis B and hepatitis C: prevention and surveillance strategies. Clin Liver Dis. 2010;14(1):23-36, vii.	Expert Opinion	n/a	n/a	n/a	n/a	A comprehensive approach to HBV and HCV prevention is needed in all health care settings to assure worker and patient protection.	VA
42	Fairfax RE. Employer's responsibility to re-evaluate engineering controls, i.e., safer needle devices, at least annually. Occupational Safety and Health Administration. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=24780. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	An interpretation letter that outlines the process for annual evaluation technology to reduce sharps injuries.	n/a

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43	Sinnott M, Eley R, Winch S. Introducing the safety score audit for staff member and patient safety. AORN J. 2014;100(1):91-95.	Expert Opinion	n/a	n/a	n/a	n/a	The mandatory introduction of safety score audits will have many benefits for the health care setting. It will facilitate data collection on which subsequent analysis and decision making can be based. It will improve physical staff member safety and have the subsequent effect of improving patient safety. It also will reduce health care costs and improve productivity and efficiency by ensuring a safe workforce that is dedicated to safety for everyone.	VA
44	NIOSH alert: Preventing needlestick injuries in health care settings. NIOSH publication no. 2000-108. National Institute for Occupational Safety and Health (NIOSH). https://www.cdc.gov/niosh/docs/2000-108/pdfs/2000-108.pdf?id=10.26616/NIOSHPUB2000108. Accessed August 1, 2019.	Expert Opinion	n/a	n/a	n/a	n/a	The Alert provides scientific evidence about the risk of needlestick injury and the transmission of BBP to health care workers.	VA
45	Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program. Centers for Disease Control and Prevention. https://www.cdc.gov/sharpssafety/pdf/sharpsworkbook_2008.pdf. Accessed August 1, 2019.	Expert Opinion	n/a	n/a	n/a	n/a	An effective sharps injury prevention program includes several components that must work together to prevent health care workers from experiencing needlesticks and other sharps-related injuries.	VA
46	Guideline for medical device and product evaluation. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2019:715-724.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance to perioperative team members for developing and implementing a process for evaluating US Food and Drug Administration-cleared medical devices and products for use in the perioperative setting. The safety of patients and perioperative team members, optimal patient outcomes, and product quality are the primary concerns of perioperative registered nurses as they participate in product review and evaluation.	IVA
47	Chiarello L. Proactive planning for sharps safety. Mater Manag Health Care. 2008;17(8):26-30.	Expert Opinion	n/a	n/a	n/a	n/a		VA

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48	Tosini W, Ciotti C, Goyer F, et al. Needlestick injury rates according to different types of safety-engineered devices: results of a French multicenter study. Infect Control Hosp Epidemiol. 2010;31(4):402-407.	Nonexperimental	453 safety engineered device-related needlestick injuries	n/a	n/a	Safety engineered device efficacy	Passive safety engineered devices are the most effective for preventing needlestick injuries.	IIIA
49	Fairfax RE. Safer medical devices must be selected based on employee feedback and device effectiveness, not Group Purchasing Organizations. Occupational Safety and Health Administration. https://www.osha.gov/laws-regs/standardinterpretations/2002-11-21. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	An interpretation letter that outlines the requirements to evaluate a wide range of devices, and that the selection can not be based on price alone.	n/a
50	29 CFR 1904.8: Recording criteria for needlestick and sharps injuries. Occupational Safety and Health Administration. https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.8. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	Recording of work-related needlestick injuries in the OSHA 300 log is required.	n/a
51	CPL 02-02-069: Enforcement procedures for the occupational exposure to bloodborne pathogens. Occupational Safety and Health Administration. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=directives&p_id=2570. Accessed August 1, 2019. 01	Regulatory	n/a	n/a	n/a	n/a	This instruction establishes policies and provides clarification to ensure uniform inspection procedures are followed when conducting inspections to enforce the Occupational Exposure to Bloodborne Pathogens Standard.	n/a
52	Makary MA, Pronovost PJ, Weiss ES, et al. Sharpless surgery: a prospective study of the feasibility of performing operations using non-sharp techniques in an urban, university-based surgical practice. World J Surg. 2006;30(7):1224-1229.	Organizational Experience	358 general surgery procedures	n/a	n/a	Ability to complete the operation without the use of a sharp device.	The researchers concluded that select common procedures can be performed entirely with sharpless techniques eliminating the risks of sharps injury to perioperative personnel.	VA
53	Ly J, Mittal A, Windsor J. Systematic review and meta-analysis of cutting diathermy versus scalpel for skin incision. Br J Surg. 2012;99(5):613-620.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Skin incisions made by cutting diathermy are quicker and associated with less blood loss than those made by scalpel, and there are no differences in the rate of wound complications or postoperative pain.	IA
54	Dagi TF, Berguer R, Moore S, Reines HD. Preventable errors in the operating room—part 2: retained foreign objects, sharps injuries, and wrong site surgery. Curr Probl Surg. 2007;44(6):352-381.	Expert Opinion	n/a	n/a	n/a	n/a	Strategies and work practices to reduce sharps injuries in the OR.	VA

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55	Jagger J, Bentley M, Tereskerz P. A study of patterns and prevention of blood exposures in OR personnel. AORN J. 1998;67(5):979-987.	Nonexperimental	7186 percutaneous injuries in surgical setting from 87 hospitals	n/a	n/a	Device causing the percutaneous injury;	Despite legislation and advances in sharps safety technology, surgical injuries continue to increase during the period while nonsurgical injuries decreased.	IIIB
56	Dumville JC, Coulthard P, Worthington HV, et al. Tissue adhesives for closure of surgical incisions. Cochrane Database Syst Rev. 2014;(11):CD004287.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Sutures are significantly better than tissue adhesives for minimizing dehiscence. In some cases tissue adhesives may be quicker to apply than sutures. Surgeons may consider the use of tissue adhesives as an alternative to other methods of surgical site closure.	IB
57	Bhattacharyya M, Bradley H. Intraoperative handling and wound healing of arthroscopic portal wounds: a clinical study comparing nylon suture with wound closure strips. J Perioper Pract. 2008;18(5):194-196.	Quasi-experimental	431 knee arthroscopy patients	Wound closure strips	Conventional nylon sutures/ wound closure strips.	wound healing, surgical site infection, patient satisfaction, pain	The researchers found the surgical wound closure strips are as effective as sutures with comparable wound healing. The wound closure strips are a safe, cosmetically satisfactory, cost-effective, and time sparing alternative to conventional sutures for skin closure after arthroscopy. Eliminating the suture also reduces the possibility of a percutaneous injury.	IIB
58	Revised statement on sharps safety. Bull Am Coll Surg. 2016;101(10):53-55.	Consensus	n/a	n/a	n/a	n/a	The ACS supports work practices that are designed to eliminate, protect, or standardize the use of sharp instruments in the OR.	IVB
59	Beswick A, Robinson E, Evans G, Codling A, eds. An Evaluation of the Efficacy of Safer Sharps Devices: Systematic Review. Derbyshire, UK: HSE: Health and Safety Executive; 2012.	Systematic Review	n/a	n/a	n/a	n/a	The use of safer sharps devices is considered to improve safety and reduce the incidence of needlestick injuries. Appropriate education should accompany the introduction of the safer sharps devices. Health care workers should be involved in the evaluation of products before safer sharps devices are introduced.	IIIA
60	Laramie AK, Pun VC, Fang SC, Kriebel D, Davis L. Sharps injuries among employees of acute care hospitals in Massachusetts, 2002-2007. Infect Control Hosp Epidemiol. 2011;32(6):538-544.	Nonexperimental	16158 sharp injuries	n/a	n/a	Trends in sharps injury rates	Sharps injury rates decreased when safety engineered devices were available and used.	IIIB
61	Fukuda H, Yamanaka N. Reducing needlestick injuries through safety-engineered devices: results of a Japanese multi-centre study. J Hosp Infect. 2016;92(2):147-153.	Nonexperimental	26 hospitals providing sharps injury data	n/a	n/a	Sharps injuries (winged steel needle, IV catheter stylet, suture needle)	Safety engineered device use reduces the incidence of needlestick injuries and is recommended as a means to prevent occupational infections and improve health care safety.	IIIA

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62	Frickmann H, Schmeja W, Reisinger E, et al. Risk reduction of needle stick injuries due to continuous shift from unsafe to safe instruments at a German university hospital. Eur j microbiol immunol. 2016;6(3):227-237.	Nonexperimental	1480 needle stick injuries	n/a	n/a	Adoption of safe instruments	The study suggests a correlation between the implementation and use of safe instruments and the reduction of needle stick injuries during a graduated implementation. The effects are less pronounced than in previous interventional studies.	IIIB
63	Lakbala P, Sobhani G, Lakbala M, Inaloo KD, Mahmoodi H. Sharps injuries in the operating room. Environ Health Prev Med. 2014;19(5):348-353.	Qualitative	250 operating room personnel	n/a	n/a	Needlestick injuries, reporting, reasons for non-compliance	A revision of the reporting protocol to reduce the time it takes to complete may improve compliance. Education is important in making health care workers aware of this issue. The application of safety devices led to a reduction in needlestick injuries and reduces the risk of blood borne infection.	IIIB
64	Hoffmann C, Buchholz L, Schnitzler P. Reduction of needlestick injuries in healthcare personnel at a university hospital using safety devices. J Occup Med Toxicol. 2013;8(1):20-24.	Quasi-experimental	N= 13, 176 (2007-6493 full time health care personnel; 2009-6683 full time health care personnel)	Introduction of safety devices (eg, stapling devices, safety syringes, needles and IV catheters)	Number of needlestick injuries before introduction of safety devices compared to after the introduction	frequency and cause of needlestick injuries	The application of safety devices led to a reduction of needlestick injuries and significantly reduced the risk of bloodborne infections.	IIB
65	Hanmore E, Maclaine G, Garin F, Alonso A, Leroy N, Ruff L. Economic benefits of safety-engineered sharp devices in Belgium—a budget impact model. BMC Health Serv Res. 2013;13(1):489-489.	Nonexperimental	310 needlestick injuries (NSI)	n/a	n/a	Cost savings from managing fewer NSIs	The incidence of NSIs and the costs associated with their management can be reduced through the adoption of safer work practices including investment in SEDs. Incremental costs of SEDs are offset by the savings from fewer NSIs	IIIB
66	Ablett JC, Whitten M, Smith JR. Do blunt tipped needles reduce the risk of glove puncture and needlestick injury in the suture of episiotomy and perineal repair? J Obstet Gynaecol. 1998;18(5):478-479.	RCT	195 surgeons and their paired gloves	Suturing with blunt tipped needles	Control-suturing with sharps needles versus suturing with blunt tipped needles	Number of glove perforations and reported needlesticks	Use of blunt tip needles in conjunction with standard precautions, wearing protective eyewear and impermeable gowns and drapes should reduce the risk of needlestick injury in perineal repair.	IB
67	Mornar SJ, Perlow JH. Blunt suture needle use in laceration and episiotomy repair at vaginal delivery. Am J Obstet Gynecol . 2008;198(5):e14 –e15	Qualitative	80 surveys completed by attending and resident physicians	n/a	n/a	Blunt suture needle rating, and personal history of a needlestick injury	To reduce needlestick injuries, the use of blunt suture needles is safe and effective for repairs at vaginal delivery.	IIIB
68	#5 Sharps safety. Council on Surgical & Perioperative Safety. http://www.cspsteam.org/5-sharps-safety/. Accessed August 1, 2019.	Position Statement	n/a	n/a	n/a	n/a	Sharps safety measures to prevent injury during perioperative care should include double-gloving, blunt suture needles for fascial closure, and the neutral zone when appropriate to avoid hand to hand passage of sharps.	IVB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
69	Parantainen A, Verbeek JH, Lavoie MC, Pahwa M. Blunt versus sharp suture needles for preventing percutaneous exposure incidents in surgical staff. Cochrane Database Syst Rev. 2011;(11):CD009170.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	There is high quality evidence that the use of blunt needles reduces the risk of exposure to blood and body fluids for surgeons and their assistants over a range of operations It is unlikely that future research will change this conclusion.	IA
70	Nordkam RA, Bluyssen SJ, van Goor H. Randomized clinical trial comparing blunt tapered and standard needles in closing abdominal fascia. World J Surg. 2005;29(4):441-445.	RCT	200 laparotomy patients	Blunt-tip suture needle for fascial closure	Sharp-tip suture needle for fascial closure	Glove perforations and surgeon ease of use	Use of blunt -tip suture needles for suturing abdominal fascia reduces the incidence of glove perforations.	IA
71	FDA, NIOSH & OSHA joint safety communication: Blunt-tip surgical suture needles reduce needlestick injuries and the risk of subsequent bloodborne pathogen transmission to surgical personnel. US Food and Drug Administration. https://www.fda.gov/media/83834/download. Published May 30, 2012. Accessed August 1, 2019.	Expert Opinion	FALSE	n/a	n/a	n/a	The FDA, OSHA, and NIOSH strongly encourage health care providers in surgical settings to use blunt-tip suture needles to suture muscle and fascia when clinically appropriate to reduce the risk of needlestick injury and BBP transmission to surgical personnel.	VA
72	Edlich RF, Wind TC, Hill LG, Thacker JG, McGregor W. Reducing accidental injuries during surgery. J Long Term Eff Med. 2003;13(1):1-10.	Quasi-experimental	8 gloving samples	Punctures with 3 types of suture needles-taper point, blunt taper point and blunt point	Single gloves compared to indicator gloving systems	Measurement of puncture resistance	Blunting the sharp end of a taper point needles increased the resistance to glove puncture in the five single gloves an and three double glove systems.	IIB
73	Stafford MK, Pitman MC, Nanthakumaran N, Smith JR. Blunt-tipped versus sharp-tipped needles: wound morbidity. J Obstet Gynaecol. 1998;18(1):18-19.	RCT	204 women undergoing C section	Blunt-tipped suture needles	Sharp-tipped suture needles	Incisional inflammation or infection	Blunt-tip needles are safe in terms of patient morbidity	IB
74	Wilson LK, Sullivan S, Goodnight W, Chang EY, Soper D. The use of blunt needles does not reduce glove perforations during obstetrical laceration repair. Am J Obstet Gynecol. 2008;199(6):641.e1-641.e3.	RCT	438 obstetric patients with lacerations	Use of blunt suture needles to repair lacerations	Blunt versus sharp suture needles	Rate of glove perforations and physician satisfaction	There was no difference in the rate of surgical glove perforation for blunt versus sharp suture needles during vaginal laceration repair. Physicians reported increased difficulty performing the repair with blunt needles.	IB
75	Stitely ML, Close J, Ferda A, Mehra S, Malson B, Hembree W. Glove perforations with blunt versus sharp surgical needles in caesarean delivery: a randomized trial. W V Med J. 2013;109(5):32-36.	RCT	240 C section patients	Blunt surgical needles	Blunt versus conventional suture needles	Rate of glove perforations and surgeon satisfaction when utilizing blunt surgical needles	There was no statistical difference in the rate of glove perforation between blunt and sharp surgical needles during C sections. Overall the surgeons were more satisfied with the sharp surgical needles.	IA

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76	Sullivan S, Williamson B, Wilson LK, Korte JE, Soper D. Blunt needles for the reduction of needlestick injuries during cesarean delivery: a randomized controlled trial. Obstet Gynecol. 2009;114(2 Pt 1):211-216.	RCT	194 patients	Closure with a blunt tip suture needles	Closure with a sharp suture needle	Glover perforations	When using the blunt suture needles there was a significant decrease in glove perforation, but surgeons reported decreased satisfaction while performing surgery.	IA
77	Fairfax RE. Limiting factors for implementing the use of engineering controls, i.e., safety scalpels, under the Bloodborne Pathogens standard. Occupational Safety and Health Administration. https://www.osha.gov/laws-regs/standardinterpretations/2004-09-01. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	An interpretation letter that outlines the evaluation, use, and exceptions for using safety scalpels.	n/a
78	Selecting, evaluating, and using sharps disposal containers. DHHS (NIOSH) publication no. 97-111. Centers for Disease Control and Prevention. https://www.cdc.gov/niosh/docs/97-111/default.html. Accessed August 1, 2019.	Expert Opinion	n/a	n/a	n/a	n/a	The document presents a comprehensive framework for selecting sharps disposal containers and evaluating their efficacy as part of a needlestick injury prevention plan.	VA
79	Degirolamo KM, Courtemanche DJ, Hill WD, Kennedy A, Skarsgard ED. Use of safety scalpels and other safety practices to reduce sharps injury in the operating room: what is the evidence? Can J Surg. 2013;56(4):263-269.	Systematic Review	n/a	n/a	n/a	n/a	There is insufficient evidence to support the regulated use of safety scalpels. Injury-reduction strategies should emphasize proven methods including double-gloving, blunt suture needles and use of hands-free sharps transfer.	IIIA
80	Fuentes H, Collier J, Sinnott M, Whitby M. Scalpel safety: modeling the effectiveness of different safety devices' ability to reduce scalpel blade injuries. Intern J Risk Safety Med. 2008;20(1-2):83-89.	Nonexperimental	137 scalpel injuries	n/a	n/a	Preventable and non-preventable injuries	Use of the hands-free techniques and a scalpel blade removers can potentially reduce scalpel blade injuries.	IIIC
81	Guide to best practice for safe handling of surgical sharps. J Perioper Pract. 2013;23(6):19-19.	Expert Opinion	n/a	n/a	n/a	n/a	Details are outlined of how to safely load and unload the scalpel blade	VB
82	Fairfax RE. Use of passing trays and single-handed scalpel blade remover in a surgical setting. Occupational Safety and Health Administration. https://www.osha.gov/laws-regs/standardinterpretations/2005-12-22-0. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	An interpretation letter that outlines the use of single-handled blade removers to reduce sharps injuries.	n/a
83	AST Guidelines for Best Practices for Sharps Safety and Use o the Neutral Zone. Littleton, CO: Association of Surgical Technologists; 2017.	Guideline	n/a	n/a	n/a	n/a	The guideline provides guidance for the safe handling of sharps in the OR, including implementation of a hands free technique to prevent sharps injuries and reduce blood borne pathogen exposure of health care workers and patients.	IVB

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
84	WHO Guideline on the Use of Safety-Engineered Syringes for Intramuscular, Intradermal and Subcutaneous Injections in Health Care Settings. Geneva, Switzerland: World Health Organization; 2016.	Guideline	n/a	n/a	n/a	n/a	Injection practices include multiple, avoidable unsafe practices that ultimately lead to the large-scale transmission of bloodborne viruses among patients, health care providers and the community at large.	IVA
85	Reddy VK, Lavoie MC, Verbeek JH, Pahwa M. Devices for preventing percutaneous exposure injuries caused by needles in healthcare personnel. Cochrane Database Syst Rev. 2017;(11):CD009740.	Systematic Review	n/a	n/a	n/a	n/a	The evidence on safety devices preventing needlestick injuries is of low quality and inconsistent. This does not mean that these devices are not effective.	IIA
86	Sossai D, Di Guardo M, Foscoli R, et al. Efficacy of safety catheter devices in the prevention of occupational needlestick injuries: applied research in the Liguria region (Italy). J Prev Med Hyg. 2016;57(2):E110-E114.	Quasi-experimental	122,464 person years at risk	Introduction of safety devices	Type of device involved in needle stick injuries- Conventional versus safety devices	Number of needlestick injuries	There is convincing evidence of a causal connection between the introduction of safety devices and the reduction in needlestick injuries. This consideration should prompt the introduction of safety devices into daily clinical practice.	IIB
87	Azar-Cavanagh M, Burdt P, Green-McKenzie J. Effect of the introduction of an engineered sharps injury prevention device on the percutaneous injury rate in healthcare workers. Infect Control Hosp Epidemiol. 2007;28(2):165-170.	Quasi-experimental	11,161 health care workers pre-intervention; 12,851 health care workers post-intervention	Safer needle devices (eg, IV catheter, insulin needles) & training on the device use	Percutaneous injuries before and after the intervention	Percutaneous injuries	Use of safety engineered devices lead to a reduction in percutaneous injuries in health care workers decreasing the risk of exposure to bloodborne pathogens.	IIB
88	Dolan SA, Arias KM, Felizardo G, et al. APIC position paper: Safe injection, infusion, and medication vial practices in health care. Am J Infect Control. 2016;44(7):750-757.	Position Statement	n/a	n/a	n/a	n/a	Programs for providing and documenting training and competency evaluations for health care providers who prepare, handle, and administer injectable and parenteral medications should be implemented in all health care settings.	IVB
89	Tuma S, Sepkowitz KA. Efficacy of safety-engineered device implementation in the prevention of percutaneous injuries: a review of published studies. Clin Infect Dis. 2006;42(8):1159-1170.	Systematic Review	n/a	n/a	n/a	n/a	All the studies that were reviewed showed decreases in percutaneous injuries rates after the introduction of safety engineered devices.	IIIA
90	Whitby M, McLaws ML, Slater K. Needlestick injuries in a major teaching hospital: the worthwhile effect of hospital-wide replacement of conventional hollow-bore needles. Am J Infect Control. 2008;36(3):180-186.	Nonexperimental	Needlestick injuries pre-intervention 542; needlestick injuries post-intervention 127	n/a	n/a	needle stick injuries	There was a large fall in needlestick injuries after the introduction of safety engineered devices.	IIIB

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91	Information statement: Preventing the transmission of bloodborne pathogens. American Academy of Orthopaedic Surgeons. https://www.aaos.org/uploadedFiles/PreProduction/About/Opinion_Statements/advistmt/1018%20Preventing%20the%20Transmission%20of%20Bloodborne%20Pathogens.pdf. Accessed August 1, 2019.]	Expert Opinion	n/a	n/a	n/a	n/a	The statement provides an overview of strategies to reduce the risk of transmitting BBPs in orthopedic settings.	VA
92	Fairfax RE. The use of safety-engineered devices and work practice controls in operating rooms; hospital responsibility to protect independent practitioners under BBP standard. Occupational Safety and Health Administration. https://www.osha.gov/laws-regs/standardinterpretations/2007-01-18. Accessed August 1, 2019.	Regulatory	n/a	n/a	n/a	n/a	An interpretation letter that explains use of the neutral zone and documentation in the exposure control plan.	n/a
93	Folin A, Nyberg B, Nordstrom G. Reducing blood exposures during orthopedic surgical procedures. AORN J. 2000;71(3):573-576.	Quasi-experimental	740 orthopedic procedures with 2126 staff members	Neutral zone and No-touch technique	Injuries before and after introduction of the neutral zone and no-touch technique	Number of injuries and contaminations	Changing surgical working methods decreased the number of incidents.	IIC
94	Cunningham TR, Austin J. Using goal setting, task clarification, and feedback to increase the use of the hands-free technique by hospital operating room staff. J Appl Behav Anal. 2007;40(4):673-677.	Quasi-experimental	78 30 minute sessions during surgical procedures	Combination of goal setting, task clarification, and feedback.	Baseline data of use of the hands-free technique before the intervention compared to after the intervention	Use of the hands-free technique	The intervention resulted in immediate and sizeable improvements in the use of the hands-free technique	IIC
95	Stringer B, Haines T, Goldsmith CH, et al. Hands-free technique in the operating room: reduction in body fluid exposure and the value of a training video. Public Health Rep. 2009;124(Suppl 1):169-179.	Quasi-experimental	10596 surgeries	Training video on the hands-free technique;	Surgeries before the training video compared to surgeries after the video using the hands-free technique	Number of sharps injuries, contaminations, and glove tears	The use of the hands-free technique and the hands-free video were both effective in reducing injuries, contaminations, and glove tears.	IIB

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96	Stringer B, Haines T. The hands-free technique: an effective and easily implemented work practice. Perioper Nurs Clin. 2010;5(1):45-58.	Expert Opinion	n/a	n/a	n/a	n/a	The hands-free technique, whereby no two people touch the same sharp item simultaneously during surgery, is an effective work practice recommended to reduce the risk of blood-borne exposure. This technique can be implemented using receptacles, tables, or the surgical field. Compliance with the technique can be increased using a newly developed video/DVD available for viewing on the Internet.	VC
97	Stringer B, Infante-Rivard C, Hanley JA. Effectiveness of the hands-free technique in reducing operating theatre injuries. Occup Environ Med. 2002;59(10):703-707.	Nonexperimental	3765 surgeries	n/a	n/a	relative rate of percutaneous injuries	The use of the hands-free technique was effective in surgeries with blood loss over 100ml.	IIIB
98	Linzer PB, Clarke SP. An integrative review of the hands-free technique in the OR. AORN J. 2017;106(3):211-218.	Systematic Review	n/a	n/a	n/a	n/a	Hands free technique is a safe and inexpensive, evidence-based technique that has not been achieved in most ORs.	IIIA
99	Raahave D, Bremmelgaard A. New operative technique to reduce surgeons' risk of HIV infection. J Hosp Infect. 1991;18(Suppl A):177-183.	Expert Opinion	n/a	n/a	n/a	n/a	Implementing no touch techniques will reduce the risk of accidental injuries.	VA
100	Ghauri AJ, Amissah-Arthur KN, Rashid A, Mushtaq B, Nessim M, Elsherbiny S. Sharps injuries in ophthalmic practice. Eye. 2011;25(4):443-448.	Nonexperimental	68 sharps injuries	n/a	n/a	Sharps injuries circumstances (ie, where, how, who)	There is a need to raise awareness of the unique risks of sharps injuries during ophthalmic procedures.	IIIC
101	Bessinger CD Jr. Preventing transmission of human immunodeficiency virus during operations. Surg Gynecol Obstet. 1988;167(4):287-289.	Expert Opinion	n/a	n/a	n/a	n/a	Preventing the transmission of blood borne pathogens requires use of the neutral zone and no-touch techniques.	VA
102	Rizk C, Monroe H, Orengo I, Rosen T. Needlestick and sharps injuries in dermatologic surgery: a review of preventative techniques and post-exposure protocols. J Clin Aesthetic Dermatol. 2016;9(10):41-49.	Literature Review	n/a	n/a	n/a	n/a	The elimination of needlestick injuries (NSI) begins with the documentation of how and why NSIs are occurring	VA
103	Williams GJ, Nicolaou M, Athanasiou T, Coleman D. Suture needle handling in the operating theatre: what is the safest method? A survey of surgical nursing opinion. Inj Prev. 2016;22(2):135-139.	Qualitative	107 scrub nurses	n/a	n/a	Preferred method of suture needle handling (ie, protected, unprotected, either)	Protected needle transfer seems safer than the unprotected method. Needle-handling guidelines and appropriate training are required to help prevent the occurrence of NSIs in the OR.	IIIC

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104	Lopez RA, Rayan GM, Monlux R. Hand injuries during hand surgery: a survey of intraoperative sharp injuries of the hand among hand surgeons. J Hand Surg Eur Vol. 2008;33(5):661-666.	Qualitative	200 hand surgeons	n/a	n/a	Number of sharps injuries, site of injury, how injury occurred	Most injuries were self-inflicted (88%) with the index finger of the left hand the most common site (87%). The suture needle was the cause in 91% of cases. Awareness of the risks and factors associated with hand injuries during hand surgery and adopting intraoperative measures are important strategies for preventing these potentially serious and life-threatening accidents.	IIIB
105	Safe Injection Guidelines for Needle and Syringe Use. Park Ridge, IL: American Association of Nurse Anesthetists; 2014.	Guideline	n/a	n/a	n/a	n/a	Syringes and needles are single-use items that must only be used once.	IVB
106	Infection Prevention and Control Guidelines for Anesthesia Care. Park Ridge, IL: American Association of Nurse Anesthetists; 2015.	Guideline	n/a	n/a	n/a	n/a	Patients and health care workers are at risk of infection from BBP when unsafe or improper injection practices are used. Following safe injection practices can prevent the spread of disease.	IVB
107	Committee on Occupational Health Task Force on Infection Control. Recommendations for Infection Control for the Practice of Anesthesiology. 3rd ed. American Society of Anesthesiologists. https://www.asahq.org/-/media/sites/asahq/files/public/resources/asa-committees/recommendations-for-infection-control-for-the-practice-of-anesthesiology.pdf?la=en&hash=B1C94D3009D3D19C301C72B7ECE74CA325FE15F4. Accessed August 1, 2019.	Guideline	n/a	n/a	n/a	n/a	The recommendations are designed to encourage quality patient care and safety in the workplace, but cannot guarantee a specific outcome.	IVB
108	WHO Best Practices for Injections and Related Procedures Toolkit. Geneva, Switzerland: World Health Organization, Safe Injection Global Network; 2010.	Expert Opinion	n/a	n/a	n/a	n/a	The toolkit covers elements of standard precautions relevant to the transmission of bloodborne pathogens through unsafe injection practices in health-care settings. The document will help to increase health workers' awareness of the importance of standard precautions relevant to injection safety. Its main target is health workers actively engaged in the administration of the various types of injections in all health and related care services, particularly at the peripheral level. However, other people administering injections may find the toolkit useful.	VA

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109	Siegel JD, Rhinehart E, Jackson M, Chiarello L; Health Care Infection Control Poractices 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.	Guideline	n/a	n/a	n/a	n/a	This document is intended for use by infection control staff, health care epidemiologists, health care administrators, nurses, other health care providers, and persons responsible for developing, implementing, and evaluating infection control programs for health care settings across the continuum of care.	IVA
110	Xiong P, Zhang J, Wang X, Wu TL, Hall BJ. Effects of a mixed media education intervention program on increasing knowledge, attitude, and compliance with standard precautions among nursing students: a randomized controlled trial. Am J Infect Control. 2017;45(4):389-395.	RCT	84 nursing students	Mixed media education sessions consisting of lectures, videos, role-playing, and feedback.	Control group learning material through self-directed readings, and pre- and post-assessments	Performance on the Knowledge with Standard Precautions Questionnaire, Attitude with Standard Precautions Scale, and Compliance with Standard Precautions Scale	A mixed media education intervention is effective in improving knowledge, attitude, and compliance with standard precautions.	IB
111	Rajkumari N, Mathur P, Gunjiyal J, Misra MC. Effectiveness of intensive interactive classes and hands on practice to increase awareness about sharps injuries and splashes among health care workers. J Clin Diagn Res. 2015;9(7):DC17-DC21.	Quasi-experimental	3935	Classes and workshops	Knowledge of what to do after an exposure before and after the training.	Assessment and observation on the improvement in the management of needlesticks, sharps, and splashes exposure.	Awareness classes along with hands on experience has provided an encouraging improvement in the needlesticks and sharps exposure management. It must be incorporated into routine practice supplemented with timely incentives.	IIB
112	Reid MJ, Biller N, Lyon SM, et al. Reducing risk and enhancing education: US medical students on global health electives. Am J Infect Control. 2014;42(12):1319-1321.	Quasi-experimental	180 medical students in global health elective	Predeparture simulation training and procedure logs	NSI incident reports before and after introduction of interventions	Incidence of needlestick injuries (NSI)	The incident reports demonstrated a reduction in the number of splash and body fluid exposure. Simple predeparture training is highly effective in reducing NSIs among students participating in global health electives.	IIB
113	Hassan ZM. Improving knowledge and compliance with infection control standard precautions among undergraduate nursing students in Jordan. Am J Infect Control. 2018;46(3):297-302.	Quasi-experimental	256 undergraduate nursing students	Online education modules in infection control and standard precautions.	Pre-test/post-test design	Knowledge and compliance with standard precautions practices	Online instruction offers a consistent and effective method to include standard precautions in the nursing curriculum	IIB

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114	Froom P, Kristal-Boneh E, Melamed S, Shalom A, Ribak J. Prevention of needle-stick injury by the scooping-resheathing method. Am J Ind Med. 1998;34(1):15-19.	Quasi-experimental	167 medical students	15 minute lecture on the incidence of needlestick injuries and a demonstration of the scooping-resheathing method	Control- previous class of medical students who did not have the education intervention to the class who did have the intervention	Number of needle stick injuries.	A lecture recommending the scooping-resheathing method is effective in reducing the risk of needle-stick injuries in medical students during their first rotation..	IIB
115	Yang YH, Liou SH, Chen CJ, et al. The effectiveness of a training program on reducing needlestick injuries/sharp object injuries among soon graduate vocational nursing school students in southern Taiwan. J Occup Health. 2007;49(5):424-429.	Qualitative	569 nursing students	n/a	n/a	Incidence of needlestick injury	The education intervention reduced the incidence of needlestick injuries and increased the reporting of the injuries	IIIB
116	Elliott SK, Keeton A, Holt A. Medical students' knowledge of sharps injuries. J Hosp Infect. 2005;60(4):374-377.	Qualitative	256 medical students	n/a	n/a	Knowledge of needlestick injury, prevention, and management	Intense teaching and self-learning programs can improve the knowledge of health care workers and educe the number of needlestick injuries.	IIIB
117	Cheung K, Chan CK, Chang MY, et al. Predictors for compliance of standard precautions among nursing students. Am J Infect Control. 2015;43(7):729-734.	Nonexperimental	678 nursing students	n/a	n/a	Compliance with standard precautions, knowledge of standard precautions;, interaction affects and factors associated with standard precautions compliance, and predictors for compliance with standard precautions.	Nursing students from various years of study have a high compliance rate with using standard precautions. Knowledge, training, management support, barriers, and nursing staff influence were predictors for compliance with standard precautions.	IIIA
118	Jeong IS, Park S. Use of hands-free technique among operating room nurses in the Republic of Korea. Am J Infect Control. 2009;37(2):131-135.	Qualitative	158 OR nurses	n/a	n/a	Use of hands-free technique (HFT) and education on HFT.	Increasing education about HFT is important to increasing the use of HFT among OR nurses.	IIIB

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119	Hasak JM, Novak CB, Patterson JMM, Mackinnon SE. Prevalence of needlestick injuries, attitude changes, and prevention practices over 12 years in an urban academic hospital surgery department. Ann Surg. 2018;267(2):291-296.	Qualitative	358 medical students	n/a	n/a	Number of needlestick injuries causes, and reporting	Needlestick injury and occupational exposure to BBP are significant hazards for surgeons and nurses. Attitudes towards risk are changing and the true seroconversion risk is underestimated.	IIIB
120	Vaughn TE, McCoy KD, Beekmann SE, Woolson RE, Torner JC, Doebbeling BN. Factors promoting consistent adherence to safe needle precautions among hospital workers. Infect Control Hosp Epidemiol. 2004;25(7):548-555.	Qualitative	1454 health care workers	n/a	n/a	Consistent adherence to sharps safety precautions	Health care paganizations can improve staff safety by investing in educational programs to minimize risks of percutaneous injuries and providing protective equipment.	IIIA
121	Lauer A, Reddemann A, Meier-Wronski C, et al. Needlestick and sharps injuries among medical undergraduate students. Am J Infect Control. 2014;42(3):235-239.	Qualitative	2131 medical students (n=1214 in 2009, n=917 in 2010	n/a	n/a	Injury rates and causes of injuries	The comprehensive introduction of safety instruments was an effective measure to lower the rate of needle stick injuries among undergraduate medical students by as much as 50%.	IIIB
122	Tarigan LH, Cifuentes M, Quinn M, Kriebel D. Prevention of needle-stick injuries in healthcare facilities: a meta-analysis. Infect Control Hosp Epidemiol. 2015;36(7):823-829.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Training combined with safety engineered devices can substantially reduce the risk of a needlestick injury.	IIA
123	Green-McKenzie J, McCarthy RB, Shofer FS. Characterisation of occupational blood and body fluid exposures beyond the needlestick safety and prevention act. J Infect Prev. 2016;17(5):226-232.	Qualitative	498 health care workers who had sustained a body fluid exposure	n/a	n/a	Number of sharps injuries, number of safety engineered devices (SEDS) used, activation rate of SEDS, and prior training on the use of SEDS	Targeted, systematic efforts towards training, ensuring PPE availability and iteratively providing the safest SEDS will reduce injuries.	IIIB
124	Makary MA, Al-Attar A, Holzmueller CG, et al. Needlestick injuries among surgeons in training. N Engl J Med. 2007;356(26):2693-2699.	Qualitative	699 surgeons in training	n/a	n/a	Reporting of recent injuries, type of patient (ie, high risk), perceived cause of the injury and circumstances	Needlestick injuries are common among surgeons in training and are often not reported. Improved prevention and reporting strategies are needed to increase occupational safety for surgical providers.	IIIA

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125	Dorgahm SR, Obied HK. Factors affecting nurse interns' compliance with standard precautions for preventing stick injury. J Nurs Educ Pract. 2016;6(12):121-130.	Nonexperimental	110 nurse interns	n/a	n/a	Frequency of needle stick injury (NSI), reporting of NSI, HBV vaccination, compliance with standard precautions, and knowledge and skills.	Nurse interns are at risk of needle stick injuries as they lack knowledge and skills regarding standard precautions. Lack of supplies and training programs regarding standard precautions contribute to their noncompliance with standard precautions placing them at risk for a blood transmitted disease.	IIIA
126	Mohammad A. Needlestick and sharps injuries among resident physicians: an institutional review. Conn Med. 2014;78(1):9-15.	Nonexperimental	378 percutaneous injuries reported by resident physicians	n/a	n/a	Types of needlestick and sharps injuries	Percutaneous injuries among nonsurgical residents are as common as among surgical residents. The findings underscore the need for developing an active needlestick and sharps injury surveillance program in teaching hospitals.	IIIB
127	Salzer HJ, Hoenigl M, Kessler HH, et al. Lack of risk-awareness and reporting behavior towards HIV infection through needlestick injury among European medical students. Int J Hyg Environ Health. 2011;214(5):407-410.	Qualitative	674 medical students	n/a	n/a	Needlestick injury, risk awareness and reporting behaviors	Medical students are at high risk to sustain an needlestick injury during medical school. The rate of non-reporting is very high.	IIIB
128	Bernard JA, Dattilo JR, LaPorte DM. The incidence and reporting of sharps exposure among medical students, orthopedic residents, and faculty at one institution. J Surg Educ. 2013;70(5):660-668.	Qualitative	96 residents, medical students, and faculty members	n/a	n/a	Sharps injuries, device causing injury, and reasons for non-reporting	Sharps exposures occur among orthopedic surgeons and their trainees. Interventions are needed to increase safety among residents and medical students. Further research should evaluate factors suppressing medical student reporting of sharps exposures	IIIB
129	Weber DJ, Rutala WA. Occupational health update: focus on preventing the acquisition of infections with pre-exposure prophylaxis and postexposure prophylaxis. Infect Dis Clin North Am. 2016;30(3):729-757.	Literature Review	n/a	n/a	n/a	n/a	Healthcare Personnel (HC)P-to-patient transmission has been well documented for HIV, HBV, and HCV but has most commonly been reported with HBV. For this reason, infected HCP who perform invasive procedures should be evaluated by a special panel for the need for education, additional engineering controls, and/or work restrictions per current guidelines from the Society for Healthcare Epidemiology of America and CDC.	VA

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130	Schillie S, Murphy TV, Sawyer M, et al. CDC guidance for evaluating health-care personnel for hepatitis B virus protection and for administering postexposure management. MMWR Recomm Rep. 2013;62(RR-10):1-19.	Guideline	n/a	n/a	n/a	n/a	This report contains CDC guidance that augments the 2011 recommendations of the Advisory Committee on Immunization Practices (ACIP) for evaluating hepatitis B protection among health-care personnel (HCP) and administering post-exposure prophylaxis. Explicit guidance is provided for persons working, training, or volunteering in health-care settings who have documented hepatitis B (HepB) vaccination years before hire or matriculation (e.g., when HepB vaccination was received as part of routine infant [recommended since 1991] or catch-up adolescent [recommended since 1995] vaccination).	IVA
131	Riddell A, Kennedy I, Tong CY. Management of sharps injuries in the healthcare setting. BMJ. 2015;351:h3733.	Literature Review	n/a	n/a	n/a	n/a	This review presents a summary of the immediate management of sharps injuries and outlines the risk assessment and management strategies to prevent transmission of HIV,HBV, and HCV.	VA
132	Bush C, Schmid K, Rupp ME, Watanabe-Galloway S, Wolford B, Sandkovsky U. Bloodborne pathogen exposures: difference in reporting rates and individual predictors among health care personnel. Am J Infect Control. 2017;45(4):372-376.	Nonexperimental	1105 health care practitioners at a large university hospital	n/a	n/a	Blood borne pathogens exposures; reported and unreported BBP exposures	Risk and reporting behaviors of BBP exposures vary widely across different disciplines. Training and education to prevent BBP exposures may need to be customized to different provider types.	IIIB
133	Vijendren A, Sanchez J, Yung M. Incidence and reporting of sharps injuries amongst ENT surgeons. J Laryngol Otol. 2016;130(6):581-586.	Qualitative	323 ENT surgeons	n/a	n/a	Incidence of sharps injury	The study found poor evidence on sharps injuries amongst ENT surgeons, and low reporting rates that were comparable to other studies conducted in the UK. This highlights the need for further research and increasing awareness on sharps injuries regulations within the specialty.	IIIC
134	Kerr HL, Stewart N, Pace A, Elsayed S. Sharps injury reporting amongst surgeons. Ann R Coll Surg Engl. 2009;91(5):430-432.	Qualitative	164 surgeons	n/a	n/a	Number of sharps injuries, number of sharps injuries reported, reasons for not reporting injuries	Sharps injury reporting rates are inadequate. Education and facilitation of the process of reporting may improves reporting rates.	IIIB

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135	Boden LI, Petrofsky YV, Hopcia K, Wagner GR, Hashimoto D. Understanding the hospital sharps injury reporting pathway. Am J Ind Med. 2015;58(3):282-289.	Qualitative	1572 patient care workers	n/a	n/a	The number of sharps injuries experienced by the workers, the number of injuries reported, and the Occupational Health Services data of recorded sharps injuries	Administrators should consider creating simpler and more direct reporting mechanisms. Also, administrators and researchers should attempt to understand how incidents might be lost before they are recorded.	IIIA
136	Kessler CS, McGuinn M, Spec A, Christensen J, Baragi R, Hershow RC. Underreporting of blood and body fluid exposures among health care students and trainees in the acute care setting: a 2007 survey. Am J Infect Control. 2011;39(2):129-134.	Qualitative	455 healthcare workers	n/a	n/a	Blood and body fluid exposure and reasons for not reporting	Underreporting of needlesticks and blood and body fluid exposures is common due to the belief that most of the exposures are not significant. More education of the health care workers is needed to change this perspective.	IIIB
137	Cutter J, Jordan S. The systems approach to error reduction: factors influencing inoculation injury reporting in the operating theatre. J Nurs Manag. 2013;21(8):989-1000.	Qualitative	315 surgeons and perioperative nurses	n/a	n/a	Number of percutaneous injuries and reporting frequency	Injuries are often under-reported possibly compromising safety in the OR.	IIIB
138	Choi LY, Torres R, Syed S, et al. Sharps and needlestick injuries among medical students, surgical residents, faculty, and operating room staff at a single academic institution. J Surg Educ. 2017;74(1):131-136.	Nonexperimental	195 surgical personnel (ie, medical students, surgical residents, general surgery attendings, surgical technicians, and OR nurses) in a single academic institution	n/a	n/a	Sharps and needlestick injury by group, reporting rate, and reasons for not reporting	The two most common reasons for not reporting an injury are the amount of time to complete the time consuming reporting process and fear of embarrassment or punitive response.	IIIA
139	Kennedy R, Kelly S, Gonsalves S, Mc Cann PA. Barriers to the reporting and management of needlestick injuries among surgeons. Ir J Med Sci. 2009;178(3):297-299.	Qualitative	52 surgeons and trainees	n/a	n/a	Reasons for not reporting sharps injuries	Most surgeons and trainees do not report all their needlestick injuries to occupational health despite many reporting injury related anxiety. The process is felt to take too long and the perceived risk of viral transmission is low.	IIIC
140	Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection. Cochrane Database Syst Rev. 2009;(3):CD003087.	Systematic Review	n/a	n/a	n/a	n/a	The addition of a second pair of surgical gloves reduces perforations to the innermost gloves. Perforation indicator systems detect more innermost glove perforations.	IA

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141	Guo YP, Wong PM, Li Y, Or PP. Is double-gloving really protective? A comparison between the glove perforation rate among perioperative nurses with single and double gloves during surgery. Am J Surg. 2012;204(2):210-215.	RCT	63 perioperative nurses	Double gloving	Single gloving	Glove perforations	Double-gloving is effective in protecting OR nurses against blood-borne pathogen exposure and should be routine practice.	IB
142	Wittmann A, Kralj N, Kover J, Gasthaus K, Lerch H, Hofmann F. Comparison of 4 different types of surgical gloves used for preventing blood contact. Infect Control Hosp Epidemiol. 2010;31(5):498-502.	Quasi-experimental	4 glove combinations-single, double, indicator glove system, and gloves with integrated disinfectant on the inside	Simulated surgical needlestick injuries	Single gloves, double gloves , indicator glove system, and gloves with integrated disinfectant on the inside	Mean volume of blood transfer	Double gloving or the use of the glove with the disinfectant can result in a decrease in the volume of blood transferred. The use of either of these gloving systems is recommended to minimize the risk of bloodborne infections for medical staff.	IIA
143	Wittmann A, Kralj N, Kover J, Gasthaus K, Hofmann F. Study of blood contact in simulated surgical needlestick injuries with single or double latex gloving. Infect Control Hosp Epidemiol. 2009;30(1):53-56.	Quasi-experimental	Single gloving-40; double gloving-40	Simulated surgical needlestick injuries	Single versus double-gloving	Mean volume of blood transfer	Double gloving leads to a significant reduction in the quantity of blood transferred during a needlestick injury.	IIA
144	Guideline for transmission-based precautions. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2019:1093-1120.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance to perioperative RNs for implementing standard precautions and transmission-based precautions (ie, contact, droplet, airborne) to prevent pathogen transmission in the perioperative practice setting. Additional guidance is provided for personal protective equipment (PPE); bloodborne pathogens; immunization; and activities of health care workers with infections, exudative lesions, and nonintact skin.	IVA
145	Guideline for sterile technique. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2019:931-972.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance on the principles and processes of sterile technique. Sterile technique involves the use of specific actions and activities to maintain sterility and prevent contamination of the sterile field and sterile items during operative and other invasive procedures. Thoughtful and diligent implementation of sterile technique is a cornerstone of perioperative nursing practice and a key strategy in the prevention of surgical site infections (SSIs).	IVA

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146	Mischke C, Verbeek JH, Saarto A, Lavoie M, Pahwa M, Ijaz S. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. Cochrane Database Syst Rev. 2014;(3):CD009573.	Systematic Review	n/a	n/a	n/a	n/a	Surgeons and surgical staff can educe their risk of contracting a serious viral infection by wearing 2 pairs of gloves instead of one pair of gloves.	IA
147	Laine T, Aarnio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. Am J Surg. 2001;181(6):564-566.	RCT	Gloves from 885 surgical procedures	Double gloving	Single gloving	Perforations	In operations with a high risk of glove perforation, double gloving with an indicator system should be used.	IB
148	Caillot JL, Paparel P, Arnal E, Schreiber V, Voiglio EJ. Anticipated detection of imminent surgeon-patient barrier breaches. A prospective randomized controlled trial using an indicator underglove system. World J Surg. 2006;30(1):134-138.	RCT	99 procedures	Use of indicator glove system	Single glove system	Number of perforations and detections of the perforations	In addition to the protective qualities of double gloving, the indicator system allows detection of a perforation before the surgeon-patient barrier is breached.	IB
149	Florman S, Burgdorf M, Finigan K, Slakey D, Hewitt R, Nichols RL. Efficacy of double gloving with an intrinsic indicator system. Surg Infect (Larchmt). 2005;6(4):385-395.	Quasi-experimental	25 participants wearing 20 configurations of surgical gloves	laser generated hole in the glove	Single versus double-gloving	Speed of detection of a hole in the glove	Double gloving with an indicator system provides the best protection and the timeliest identification of a perforation. Participants failed to identify most of the holes in the non-indicator gloves.	IIB
150	Edlich RF, Wind TC, Hill LG, Thacker JG. Resistance of double-glove hole puncture indication systems to surgical needle puncture. J Long Term Eff Med. 2003;13(2):85-90.	Quasi-experimental	10 puncture resistance measurements from 8 gloving samples	Glove membrane punctures	Single gloving to double gloving and indicator gloving systems	Resistance to needle puncture	Double-glove indicator systems are recommended for all surgical procedures due to the accuracy in detecting a glove puncture and superior resistance to needle puncture	IIB
151	Lefebvre DR, Strande LF, Hewitt CW. An enzyme-mediated assay to quantify inoculation volume delivered by suture needlestick injury: two gloves are better than one. J Am Coll Surg. 2008;206(1):113-122.	Quasi-experimental	5 types of gloves singly, double, and triple	Inoculation with 2 types of suture needles	Single, double, and triple gloving	Inoculation volumes for each glove combination and needle size	For cutting needles, double-glove layering offers superior protection. There is no advantage to triple gloving.	IIB
152	Makama JG, Okeme IM, Makama EJ, Ameh EA. Glove perforation rate in surgery: a randomized, controlled study to evaluate the efficacy of double gloving. Surg Infect. 2016;17(4):436-442.	RCT	1916 gloves worn by the surgical team	wear either single or double gloves	Control-unused gloves; single gloves to double gloves	Rate of perforation	The use of double gloves has more than 90% protection to the patient and the surgeon. Therefore wearing double gloves should be encouraged in surgery.	IB
153	Hardison SA, Pyon G, Le A, Wan W, Coelho DH. The effects of double gloving on microsurgical skills. Otolaryngol Head Neck Surg. 2017;157(3):419-423.	RCT	41 medical school students	Wearing one pair or two pairs of gloves to perform a simulated piston insertion	Performing task without gloves, single gloves, and double gloves	Total time to perform task	There was no difference in the time to accomplish the task between the single and double gloved groups. Wearing two pairs of surgical gloves does not negatively affect the time to perform a microsurgical procedure.	IB

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154	ASTM D3577-09(2015). Standard Specification for Rubber Surgical Gloves. West Conshohocken, PA: ASTM International; 2015.	Expert Opinion	n/a	n/a	n/a	n/a	This standard specification covers certain requirements for packaged sterile rubber surgical gloves of the natural rubber latex type (Type 1) and of the synthetic rubber latex type (Type 2).	VA
155	Thomas S, Agarwal M, Mehta G. Intraoperative glove perforation—single versus double gloving in protection against skin contamination. Postgrad Med J. 2001;77(909):458-460.	RCT	66 consecutive surgical procedures	Double gloving	Single gloving	Frequency of glove perforations and subsequent blood and body fluids contact.	Double gloving offers better protection than single gloving. When the outer glove is perforated the inner glove will protect the surgeon's hands	IB
156	Grimmond T, Bylund S, Anglea C, et al. Sharps injury reduction using a sharps container with enhanced engineering: a 28 hospital nonrandomized intervention and cohort study. Am J Infect Control. 2010;38(10):799-805.	Quasi-experimental	14 hospitals	Use of a sharps container with enhanced engineering features	Control was a single use sharps container compared to a reusable sharps container.	Number of sharps injuries	Enhanced aperture design can significantly reduce container-associated sharps injuries.	IIB
157	Ream PSF, Tipple AFV, Salgado TA, et al. Hospital housekeepers: victims of ineffective hospital waste management. Archiv Environ Occup Health. 2016;71(5):273-280.	Nonexperimental	938 hospital housekeepers reporting 996 injuries	n/a	n/a	Frequency and profile of exposure incidents, role of sharps waste	Most incidents among hospital housekeepers were percutaneous with hypodermic needles and involved blood from an unknown source. Improper sharps disposal by the patient care staff was a contributing factor in the majority of injuries.	IIIC
158	Grimmond T, Naisoro W. Sharps injury reduction: a six-year, three-phase study comparing use of a small patient-room sharps disposal container with a larger engineered container. J Infect Prev. 2014;15(5):170-174.	Nonexperimental	12 sharps injuries	n/a	n/a	Number of sharps injuries sustained while depositing sharps into or during the handling of the sharps container.	The study validates the necessity of the international recommendations that sharps be placed immediately after use into a well-engineered, safe sharps container placed close to the point of sharps generation.	IIIA
159	Guideline for prevention of retained surgical items. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2019:765-814.	Guideline	n/a	n/a	n/a	n/a	The guideline provides guidance to perioperative registered nurses (RNs) in preventing retained surgical items (RSIs) in patients undergoing surgical and other invasive procedures.	IVA
160	Guideline for cleaning and care of surgical instruments. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2019:401-440.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance for cleaning surgical instruments, including point-of-use cleaning, selecting cleaning chemicals, and determining water quality. Guidance is also provided for decontaminating, transporting, inspecting, and care of surgical instruments.	IVA