REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
1	deKay K. Guideline for environmental cleaning. In: Wood A, ed. *Guidelines for perioperative practice.* Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidelines for environmental cleaning.	IVA
2	Cahn JA, Wood A. Guideline for sterile technique. In: Wood A, ed. Guidelines for perioperative practice. Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Recommendations for sterile technique.	IVA
3	Burlingame BL, Connor R. Guideline for prevention of unplanned patient hypothermia. In: Connor R, ed. *Guidelines for perioperative practice.* Denver, CO: AORN Inc.; 2018. Accessed 2/12/2018. 10.6015/psrp.15.01.e35.	Guideline	n/a	n/a	n/a	n/a	Guidelines for preventing hypothermia in perioperative patients.	IVA
4	Jones E. Guideline for surgical smoke safety. In: Kyle E, ed. *Guidelines for perioperative practice.* Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidelines for surgical smoke safety.	IVA
5	Anderson MA, Giarrizzo-Wilson S. Guideline for patient information management. In: Kyle E, ed. Guidelines for perioperative practice. Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidelines for perioperative patient information management.	IVA
6	Pelly N, Zeallear B, Reed M, Martin L. Utilizing integrated facility design to improve the quality of a pediatric ambulatory surgery center. Paediatr Anaesth. 2013;23(7):634–638.	Nonexperimental	One pediatric ambulatory surgery center.	n/a	n/a	Patient, family, and provider flow.	The use of integrated facility design improved patient, family, and provider flow, and reduced surgical and PACU times.	IIIB
7	Security design guidelines for healthcare facilities. Glendale Heights, IL: International Association for Healthcare Security and Safety (IAHSS); 2016.	Guideline	n/a	n/a	n/a	n/a	Recommendations for security deisgn.	IVC
8	Al-Benna S. Infection control in operating theatres. J Perioper Pract. 2012;22(10):318–322	Expert Opinion	n/a	n/a	n/a	n/a	Infection control practitioners should be involved in all phases of the construction process and infection control measures should be designed-in at all planning and design phases of the project.	VB

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9	Devine DA, Wenger B, Krugman M et al. Part 1: Evidence-based facility design using transforming care at the bedside principles. J Nurs Adm. 2015;45(2):74–83.	Organizational Experience	One academic hospital.	n/a	n/a	n/a	Recommends an interdisciplinary team and evidence-based design philosophy for facility construction.	VA
10	Guidelines for design and construction of hospitals. Facility guidelines institute. includes ANSI/ ASHRAE/ ASHE standard 170-2017: Ventilation of health care facilities. Chicago, IL: American Society for Healthcare Engineering of the American Hospital Association; 2018.	Consensus	n/a	n/a	n/a	n/a	Recommendations for the design of hospitals.	IVC
11	Guidelines for design and construction of outpatient facilities. Facility guidelines institute. includes ANSI/ ASHRAE/ ASHE standard 170-2017: Ventilation of health care facilities. Chicago, IL: American Society for Healthcare Engineering of the American Hospital Association; 2018.	Consensus	n/a	n/a	n/a	n/a	Recommendations for the design of outpatient facilities.	IVC
12	Criscitelli T, Goodwin W. Applying human-centered design thinking to enhance safety in the OR. AORN J. 2017;105(4):408–412	Case Report	n/a	n/a	n/a	n/a	Recommends using a human-centered design process.	VC
13	Stichler JF. Using consultants in the design, construction, and occupancy of new healthcare facilities. J Nurs Adm. 2015;45(11):537–539	Expert Opinion	n/a	n/a	n/a	n/a	Hire consultants when there is no internal expert or personnel are unable to manage any or all aspects of a construction project.	VB
14	Gharaveis A, Hamilton DK, Pati D. The impact of environmental design on teamwork and communication in healthcare facilities: A systematic literature review. HERD. 2018;11(1):119-137.	Systematic Review	n/a	n/a	n/a	n/a	18 studies found that layout design, visibility, and accessibility levels are critical to communication and teamwork.	IIIB

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15	Creekmore S. An efficient method for high-performing healthcare facilities. AAH Academy Journal. 2017;19:46–51	Expert Opinion	n/a	n/a	n/a	n/a	An interdisciplinary team can provide expertise on functional design, the functional needs of the users, infection prevention, sustainability, and regulatory requirements from a variety of viewpoints.	VB
16	Nino V, Claudio D, Valladares L, Harris S. An enhanced kaizen event in a sterile processing department of a rural hospital: A case study. Int J Environ Res Public Health. 2020;17(23).	Nonexperimental	One hospital and sterile processing department.	n/a	n/a	Workflow and SPD outcomes.	Using the Enhanced Kaizen Event cycles, travel distance was reduced leading to streamlined processes and less errors.	IIIB
17	Fearon MC, ed. Hybrid operating room design basics. Facility Guidelines Institute (FGI); 2018.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for hybrid OR design.	VB
18	Schaadt J, Landau B. Hybrid OR 101: a primer for the OR nurse. AORN J. 2013;97(1):81–100	Expert Opinion	n/a	n/a	n/a	n/a	Considerations for construction of a hybrid OR.	VC
19	Olmsted RN. Prevention by design: construction and renovation of health care facilities for patient safety and infection prevention. Infect Dis Clin North Am. 2016;30(3):713–728.	Expert Opinion	n/a	n/a	n/a	n/a	AN ICRA assessment should be completed.	VA
20	Calvert W, Hopkins G, Platt C. Patient shadowing as an ethnographic study of staff and patient experience to influence daycase surgery outcomes. The Journal of Health Design;. 2018;3(4).	Qualitative	Over 1,000 patient shadowing events	n/a	n/a	Thematic analysis; event repetition; event positivity	Shadowing specific patient populations can increase patient satisfaction.	IIIC
21	Memari S, Kocaturk T, Lozanovska M, Andrews F, Tucker R. The interdisciplinary conceptualization of future proofing in the context of hospital buildings. Build Res Inf. 2022:1-17.	Literature Review	n/a	n/a	n/a	n/a	Interdisciplinary teams are essential for understanding future needs.	VB

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22	Kanamori H, Rutala WA, Sickbert-Bennett EE, Weber DJ. Review of fungal outbreaks and infection prevention in healthcare settings during construction and renovation. Clin Infect Dis. 2015;61(3):433–444.	Systematic Review	n/a	n/a	n/a	n/a	Conduct an ICRA assessment to determine protective measures and provide education to construction workers to prevent contamination during construction projects.	IIIB
23	5 key considerations during renovation: focus on efficiency, optimization of resources, and sustainability. Same-Day Surgery. 2019;43(5). Accessed April 21, 2023. https://www.reliasmedia.com/articles/144252-key-considerations-during-renovation	Expert Opinion	n/a	n/a	n/a	n/a	Optimizing efficiency, effectiveness, clinical outcomes, positive experience for all users, sustainable practices, and the ability to change over time are important for healthcare renovation projects.	VB
24	RIPCHD.OR study group. Safe OR design tool. http://ordesign.clemson.edu/roadmap. Updated 2019. Accessed 5/16, 2022.	Expert Opinion	n/a	n/a	n/a	n/a	Instructions for the Safe OR Design Tool by Clemson University.	VA
25	Clark E. Bedside to blueprints: The role of nurses in hospital design. HERD. 2014;7(4):100-107.	Qualitative	13 personnel in healthcare design	n/a	n/a	The role of nurses in the design team.	Themes include nurses as an integral part of the team.	IIIB
26	Stichler JF. Healthy work environments for the ageing nursing workforce. J Nurs Manag. 2013;21(7):956-963. Accessed 6 September 2017. doi: 10.1111/jonm.12174.	Systematic Review	n/a	n/a	n/a	n/a	Consider older nurses during design.	IIIB
27	ANA's principles of environmental health for nursing practice with implementation strategies. Silver Spring, MD: American Nurses Association (ANA); 2007.	Position Statement	n/a	n/a	n/a	n/a	Statement regarding implementation of environmental health.	IVB
28	Title 42, Chapter IV, Subchapter G, Part 482 (Conditions of Participation for Hospitals). Code of Federal Regulations. Accessed April 25, 2023. https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-G/part-482#part-482	Regulatory	n/a	n/a	n/a	n/a	Requirements for emergency electrical safeguards.	n/a

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29	*State Operations Manual Appendix L – Guidance for Surveyors: Ambulatory Surgical Centers.* Rev. 206. 06-17-22. Centers for Medicare & Medicaid Services. Accessed April 25, 2023. https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/som107ap_l_ambulatory.pdf	Regulatory	n/a	n/a	n/a	n/a	ASCs must follow the NFPA 101 Life Safety Code.	n/a
30	Anesthetic gases: Guidelines for workplace exposures. http://osha.gov/dts/osta/anestheticgases/index.html ed. U.S. Department of Labor,Occupational Safety & Health Administration; 1999. Rev. 2000.	Guideline	n/a	n/a	n/a	n/a	Guideline for preventing exposure to waste anesthesia gases.	IVB
31	Facilities management: Asbestos exposure. Hospitals eTool Web site. https://www.osha.gov/etools/hospitals/facilities-management/asbestos-exposure. Accessed 3/1, 2022.	Regulatory	n/a	n/a	n/a	n/a	Take precautions to limit exposure to asbestos during renovation projects.	n/a
32	Facilities management: Electrical safety. Hospitals eTool Web site. https://www.osha.gov/etools/hospitals/facilities-management/electrical-safety. Accessed 3/1, 2022.	Regulatory	n/a	n/a	n/a	n/a	Take precautions to limit electrical hazards during construction.	n/a
33	Facilities management: Lockout/tagout. Hospitals eTool Web site. https://www.osha.gov/etools/hospitals/facilities-management/lockout-tagout. Accessed 3/1, 2022.	Regulatory	n/a	n/a	n/a	n/a	Lockout procedures when servicing equipment.	n/a
34	NFPA 101: Life safety code. 2021 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2021. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=101.	Consensus	n/a	n/a	n/a	n/a	Recommendations for fire prevention.	IVB

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35	NFPA 99 : Health care facilities code. 2021 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2021. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=99.	Consensus	n/a	n/a	n/a	n/a	Recommendations for medical gases, security, and fire.	IVB
36	NFPA 13: Standard for the installation of sprinkler systems. 2022 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2022. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=13.	Consensus	n/a	n/a	n/a	n/a	Recommendations for sprinkler systems.	IVB
37	NFPA 110: Standard for emergency and standby power systems. 2022 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2022. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=110.	Consensus	n/a	n/a	n/a	n/a	Recommendations for emeregency and standby power systems.	IVB
38	NFPA 72: National fire alarm and signaling code. 2022 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2022. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=72.	Consensus	n/a	n/a	n/a	n/a	Recommendations for the fire alarm and signaling code.	IVB
39	National Fire Protection Association.,. NFPA 70: National electrical code. ; 2017. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70.	Consensus	n/a	n/a	n/a	n/a	Recommendations for electrical systems.	IVC

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40	Infection Control Risk Assessment 2.0: Matrix of Precautions for Construction, Renovation and Operations. American Society for Health Care Engineering. 2021. Accessed April 25, 2023. https://www.ashe.org/system/files/media/file/2022/06/ICRA-2-recent-edits.pdf	Guideline	n/a	n/a	n/a	n/a	Recommendations for ICRA implementation.	IVA
41	Using the health care physical environment to prevent and control infection: A best practice guide to help health care organizations create safe, healing environments. Chicago, IL: American Society for Health Care Engineering (ASHE); 2018.	Guideline	n/a	n/a	n/a	n/a	Guide to using the physical environment to prevent and control for infections in the healthcare setting.	IVB
42	Brooks K, Dahl PK, Ollie RW, Brackett J, eds. Reducing operational costs through energy efficiency. American Society for Health Care Engineering (ASHE); 2018.	Position Statement	n/a	n/a	n/a	n/a	ASHE position on using energy efficiency to reduce operational costs.	VB
43	Ventilation management plans. American Society for Health Care Engineering (ASHE); 2021.	Consensus	n/a	n/a	n/a	n/a	Recommends a comprehensive strategy to test and maintain areas that require ventilation management.	IVB
44	NFPA 99-2012 risk assessment tool. American Society for Health Care Engineering (ASHE); 2015.	Consensus	n/a	n/a	n/a	n/a	ASHE NFPA 99-2012 Risk Assessment Tool guide.	IVB
45	Infection control guide on heating, ventilation and air conditioning (HVAC) for nurse managers and clinicians. Chicago, IL: American Society for Health Care Engineering (ASHE).	Consensus	n/a	n/a	n/a	n/a	Recommendations for infection controls related to the HVAC system.	IVB
46	2010 Operations and Maintenance Benchmarks for Health Care Facilities Report. American Society for Health Care Engineering. Accessed April 25, 2023. https://www.ashe.org/system/files/ashe/reportombenchmarks.pdf	Expert Opinion	n/a	n/a	n/a	n/a	Benchmarks for operations and maintenance.	VB

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47	Love C, ed. Operating room HVAC setback strategies. Chicago, IL: American Society for Health Care Engineering (ASHE); 2011.	Expert Opinion	n/a	n/a	n/a	n/a	Strategies for a ventilation setback system.	VB
48	Stymiest DL, ed. Managing hospital emergency power systems: Testing, operation, maintenance, vulnerability mitigation, and power failure planning. Chicago, IL: American Society for Health Care Engineering (ASHE); 2014.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for managing hospital emergency power systems.	VB
49	Knudsen R.J., Knudsen S.M.N., Nymark T., et al. Laminar airflow decreases microbial air contamination compared with turbulent ventilated operating theatres during live total joint arthroplasty: A nationwide survey. J Hosp Infect. 2021;113:65-70.	Quasi-experimental	51 procedures in 17 ORs.	Laminar airflow.	Turbulent airflow.	Active air sampling and passive sedimented bacterial load.	Laminar airflow significantly decreased the cfu count, as well as increasing the volume and total air change per hour, but door openings and number of personnel did not.	IIB
50	Marsault L.V., Ravn C., Overgaard A., et al. Laminar airflow versus turbulent airflow in simulated total hip arthroplasty: Measurements of colony-forming units, particles, and energy consumption. J Hosp Infect. 2021;115:117-123.	Quasi-experimental	2 ORs used for 32 simulations.	Laminar airflow.	Turbulent airflow.	Cfu and particles at 4 points 3 times in each room; energy consumption.	Cfu were significantly lower even when 50% reduced.	IIB
51	ANSI/ ASHRAE/ ASHE Standard 170-2021: Ventilation of Health Care Facilities American Society for Healthcare Engineering of the . American Hospital Association. Accessed April 21, 2023. https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_170_2021	Consensus	n/a	n/a	n/a	n/a	Recommendations for the HVAC system.	IVC
52	Pilosof NP. Building for change: Comparative case study of hospital architecture. HERD. 2021;14(1):47-60.	Nonexperimental	2 different facility designs.	n/a	n/a	Design strategy, planning, process, construction, and changes in practice over 12 years.	Architectural design strategies had a major impact on the future evolution of the facility.	IIIB
53	Nisly NL, Imborek KL, Miller ML, et al. Developing an inclusive and welcoming LGBTQ clinic. Clin Obstet Gynecol. 2018;61(4):646-662.	Expert Opinion	n/a	n/a	n/a	n/a	Convene an interdisciplinary team including LGBTQ-identified persons to determine ways to be more inclusive of this patient population.	VB

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54	Optimal resources for geriatric surgery. American College of Surgeons (ACS); 2019.	Guideline	n/a	n/a	n/a	n/a	Recommendations for geriatric rooms.	IVA
55	Wingler D, Hector R. Demonstrating the effect of the built environment on staff health-related quality of life in ambulatory care environments. *HERD* . 2015;8(4):25-40	Organizational Experience	75 staff at 3 sites at a federally qualified health center.	n/a	n/a	n/a	More enhancements to the indoor environment were associated with higher staff well-being.	VB
56	Simonsen T, Sturge J, Duff C. Healing architecture in healthcare: A scoping review. HERD. 2022:19375867211072513.	Systematic Review	n/a	n/a	n/a	n/a	Healing architecture is not defined and ill-studied.	IIIB
57	Torres-Landa S, Neylan C, Quinlan K, et al. Interprofessional simulations to inform perioperative facility planning and design. J Surg Educ. 2019;76(1):223-233.	Nonexperimental	193 healthcare workers round 1; 134 round 2.	n/a	n/a	Feedback on styrofoam, life-sized perioperative suite model.	Simulations can elicit valuable end-user feedback to inform design of the space.	IIIB
58	Machry H, Joseph A, Wingler D. The fit between spatial configuration and idealized flows: Mapping flows in surgical facilities as part of case study visits. HERD. 2021;14(1):237-250.	Nonexperimental	4 surgery centers.	n/a	n/a	Idealized flow.	Flow mapping provides structure for design teams to observe workflow.	IIIB
59	Chbaly H, Brunet M. Enhancing healthcare project definition with lean-led design. Sustainability. 2022;14(3).	Expert Opinion	n/a	n/a	n/a	n/a	Construction projects can benefit from the use of lean-led design.	VB
60	Dench B, Barwick S, Barlow M. It's time for the mandatory use of simulation and human factors in hospital design. Aust Health Rev. 2020;44(4):547-549.	Expert Opinion	n/a	n/a	n/a	n/a	Concluded that the use of human factors/ergonomics and simulation throughout design projects was beneficial.	VB
61	Lin Q, Wang D. Facility layout planning with SHELL and fuzzy AHP method based on human reliability for operating theatre. J Healthc Eng. 2019;2019:8563528.	Expert Opinion	n/a	n/a	n/a	n/a	The authors concluded that suitable layouts meet strategies and goals of the system as well as the safety, security, and reliability of the system.	VB
62	Renner K, Badlato K. Big growth needs big data. AAH Academy Journal. 2017;19:4/8/2022. https://www.aia.org/resources/21501-aah-academy-journal;;.	Expert Opinion	n/a	n/a	n/a	n/a	Postoccupany evaluations measure the influence of the design on the patient, provider, and organizational outcomes.	VB

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63	Parikh A. Using choice-based design to improve health. AAH Academy Journal. 2020;22:4/8/2022. https://www.aia.org/resources/21501-aah-academy-journal.	Expert Opinion	n/a	n/a	n/a	n/a	Concluded that thinking outside the box in healthcare design can lead users to make healthier choices.	VB
64	Brambilla A, Rebecchi A, Capolongo S. Evidence based hospital design. A literature review of the recent publications about the EBD impact of built environment on hospital occupants' and organizational outcomes. Ann Ig. 2019;31(2):165-180.	Literature Review	n/a	n/a	n/a	n/a	Researchers found that the visual, audio, and patient room design affected 69% of the staff and patient outcomes.	VB
65	Wazalwa S. Sound and space: Acoustical design strategies for health care staff spaces . AAH Academy Journal. 2019;21:4/8/2022. https://www.aia.org/resources/21501-aah-academy-journal.	Expert Opinion	n/a	n/a	n/a	n/a	Acoustic needs and strategies for the healthcare setting.	VB
66	Cubukcuoglu C, Nourian P, Sariyildiz IS, Tasgetiren MF. Optimal design of new hospitals: A computational workflow for stacking, zoning, and routing. Autom Constr. 2022;134:104102.	Expert Opinion	n/a	n/a	n/a	n/a	Computational workflow can help design healthcare facilities.	VB
67	Zadeh R, Sadatsafavi H, Xue R. Evidence-based and value-based decision making about healthcare design: An economic evaluation of the safety and quality outcomes. HERD. 2015;8(4):58-76.	Organizational Experience	6 case reports of evidence-based designs.	n/a	n/a	n/a	Long-term benefits and some costs related to evidence-based designs substaintially proved themselves.	VB
68	Jurewicz K.A., Neyens D.M., Catchpole K., Joseph A., Reeves S.T., Abernathy J.H. Observational study of anaesthesia workflow to evaluate physical workspace design and layout. Br J Anaesth. 2021;126(3):633-641.	Nonexperimental	6 videos of anesthesia providers at one facility.	n/a	n/a	Task analysis of workflow during the maintenance phase of anesthesia.	Better layout can reduce anesthesia workload and increase efficiency.	IIIB
69	Luo N, Nara A, Izumi K. An interaction-based Bayesian network framework for surgical workflow segmentation. Int J Environ Res Public Health. 2021;18(12).	Nonexperimental	One neurosurgical operation.	n/a	n/a	Real-time location of all staff.	Available and empty areas and times during the procedure in the OR to increase efficiency.	IIIB

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70	Cofran L, Cohen T, Alfred M, et al. Barriers to safety and efficiency in robotic surgery docking. Surg Endosc. 2022;36(1):206-215.	Nonexperimental	45 different robotics procedures at 3 hospitals.	n/a	n/a	Disruptions during the docking process.	Challenges discovered were used to update the docking procedure.	IIIB
71	Jafarifiroozabadi R, Joseph A, Joshi R, Wingler D. Evaluating care partner preferences for seating in an outpatient surgery waiting area using virtual reality. HERD. 2021;14(1):210-223.	Nonexperimental	92 healthcare personnel.	n/a	n/a	Tasks performed and perspective of virtual reality waiting room.	Products used and layout of waiting room design is important to staff.	IIIB
72	Shultz J, Borkenhagen D, Rose E, et al. Simulation-based mock-up evaluation of a universal operating room. HERD. 2020;13(1):68-80.	Nonexperimental	14 scenarios in mockup ORs.	n/a	n/a	Bumps and congestions during mockup procedures.	Design changes based on simulations created better room utilization.	IIIB
73	Sotto K.T., Hedli L.C., Sie L., et al. Single-center task analysis and user-centered assessment of physical space impacts on emergency cesarean delivery. PLoS ONE. 2021;16(6):e0252888.	Quasi-experimental	34 multidisciplinary obstetric teams.	Emergency procedure.	Elective procedure.	Task and euqipment analysis.	30 task groupings requiring 20 pieces of equipment.	IIB
74	Zook J, Spence TJ, Joy T. Balancing support for staff and patient centeredness through the design of immediate and relational space: A case study of ambulatory care center layouts. HERD. 2021;14(1):224-236.	Nonexperimental	2 ambulatory care centers in 2 layout variations.	n/a	n/a	Space syntax and visual exposure.	Decoupling design of visual and relational layout can make layouts more efficiaous.	IIIB
75	Dube M, Laberge J, Sigalet E, et al. Evaluations for new healthcare environment commissioning and operational decision making using simulation and human factors: A case study of an interventional trauma operating room. HERD. 2021;14(4):442-456.	Nonexperimental	24 stakeholder groups.	n/a	n/a	Commissioning and operational decisions for an interventional trauma OR.	Using simulation with systems-focused debriefing and human factors methodology designed a safer surgical suite.	IIIB
76	Taaffe K, Joseph A, Khoshkenar A, et al. Proactive evaluation of an operating room prototype: A simulation-based modeling approach. J Patient Saf. 2021;17(8):e1833-e1839.	Quasi-experimental	23 video recordings of surgical flow data during procedures at one facility.	Different layout changes.	Historic data using one OR layout.	Simulation-based model for the optimal size and shape of the OR and position of the OR table.	Medium-sized rooms with the circulator RN workstation angled at the foot of the OR bed is optimal.	IIB

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77	Cohen TN, Boquet AJ. The effects of flow disruptions on RN circulators. AORN J. 2021;113(4):351-358.	Nonexperimental	24 cardiac procedures.	n/a	n/a	Type and duration of workflow disruption.	1,470 events were categorized and researchers concluded that leaders can support staff in minimizing workflow disruptions.	IIIB
78	Rapport F, Francis-Auton E, Cartmill J, Ryder T, Braithwaite J, Clay-Williams R. A mobile methods pilot study of surgical spaces: 'Fit for purpose? organisational productivity and workforce wellbeing in workspaces in hospital' (FLOURISH). BMC Health Serv Res. 2020;20(1):78-020-4938-8.	Nonexperimental	50 hours of observation, informal conversation; 5 architectural plans; 45 photographs of one gastroenterological surgical unit.	n/a	n/a	Effect of workspace-use on staff.	Workarounds for using unfit-for-purpose workspaces created unexpected consequences.	IIIB
79	Neyens DM, Bayramzadeh S, Catchpole K, et al. Using a systems approach to evaluate a circulating nurse's work patterns and workflow disruptions. Appl Ergon. 2019;78:293-300.	Nonexperimental	25 procedures in 3 ORs including 37 hours of observation.	n/a	n/a	RN circulator's type and time on tasks, disruptions, and where in the OR.	RN circulators moved less during informtaion tasks; all other tasks increased layout and environmental hazard flow disruptions.	IIIB
80	Palmer G 2nd, Abernathy JH 3rd, Swinton G et al. Realizing improved patient care through human-centered operating room design: a human factors methodology for observing flow disruptions in the cardiothoracic operating room. Anesthesiology. 2013;119(5):1066–1077	Nonexperimental	1,080 observations during 10 cardiac procedures.	n/a	n/a	Workflow disruptions.	33% of disturbances were related to OR layout and design.	IIIB
81	Joseph A, Mihandoust S, Wingler D, Machry H, Allison D, Reeves ST. Comparing user perceptions of surgical environments: Simulations in a high-fidelity physical mock-up versus a postoccupancy evaluation. HERD. 2022;15(2):116-133.	Nonexperimental	17 OR high-fidelity survey and 6 focus group participants; 11 OR post-occupancy survey and 12 focus group participants.	n/a	n/a	Perception and behaviors of end users in OR.	Valuable input can address issues in workflow and safety before construction.	IIIB

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82	Joseph A, Khoshkenar A, Taaffe KM, et al. Minor flow disruptions, traffic-related factors and their effect on major flow disruptions in the operating room. BMJ Qual Saf. 2019;28(4):276-283.	Nonexperimental	28 video recordings of surgical procedures.	n/a	n/a	Flow disruptions by role and OR zone.	OR room layout can create barriers during tasks that increases flow disruptions.	IIIB
83	Bayramzadeh S, Joseph A, San D, et al. The impact of operating room layout on circulating nurse's work patterns and flow disruptions: A behavioral mapping study. HERD. 2018;11(3):124-138.	Nonexperimental	3 ORs with 25 adult and pediatric procedures.	n/a	n/a	RN circulator's activities, location, and flow disruptions.	Regardless of OR layout, RN circulators had a majority of workflow disruptions in the transitional zone and around the OR bed.	IIIB
84	Joseph A, Neyens D, Mihandoust S, et al. Impact of surgical table orientation on flow disruptions and movement patterns during pediatric outpatient surgeries. Int J Environ Res Public Health. 2021;18(15).	Nonexperimental	38 videos of pediatric outpatient surgeries.	n/a	n/a	Flow disruptions; contacts between team members; distance traveled.	An angled orientation of the surgical table significantly improved staff workflow and movement in the OR.	IIIB
85	Water T, Wrapson J, Tokolahi E, Payam S, Reay S. Participatory art-based research with children to gain their perspectives on designing healthcare environments. Contemporary Nurse. 2017;53(4):456-473.	Nonexperimental	175 children ages 5-16 years old.	n/a	n/a	Descriptive and thematic analysis of drawings and letters.	Participatory art based approaches can show that children appreciate child-friendly environments and personnel.	IIIB
86	Scholz R, HÃ¶nning A, Seifert J, Spranger N, Stengel D. Effectiveness of architectural separation of septic and aseptic operating theatres for improving process quality and patient outcomes: A systematic review. Systematic Reviews. 2019;8(1):16.	Systematic Review	n/a	n/a	n/a	n/a	Further research is needed regarding architectural separation of septic and aseptic ORs to improve process quality and patient outcomes.	IIIC
87	Shamir MY, Weissman C. Electricity: how much for the contemporary tertiary care operating room? A case report. A A Pract. 2019;12(2):47–50	Case Report	n/a	n/a	n/a	n/a	The authors concluded that an analysis of the electrical demands should be conducted for new complex surgeries and when new construction or renovations are planned.	VB
88	Ogg MJ. Guideline for safe patient handling and movement. In: Connor R, ed. Guidelines for perioperative practice. 2018th ed. Denver, CO: AORN Inc.; 2018.	Guideline	n/a	n/a	n/a	n/a	Recommendations for safe patient handling and movement.	IVA

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89	Burlingame BL, Conner R. Guideline for medication safety. In: Conner R, ed. *Guidelines for perioperative practice.* Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidelines for medication safety.	IVA
90	Chang CC, Ananda-Rajah M, Belcastro A et al. Consensus guidelines for implementation of quality processes to prevent invasive fungal disease and enhanced surveillance measures during hospital building works, 2014. Intern Med J. 2014;44(12b):1389–1397.	Consensus	n/a	n/a	n/a	n/a	Recommendations for meaures during construction to prevent airborne fungi from entering an existing facility.	IVC
91	Collinge WH. Infection control in design and construction work. HERD. 2015;8(3):68-79.	Qualitative	21 personnel in healthcare design	n/a	n/a	Contruction project resources.	Themes include identifying issues and sharing knowledge.	IIIB
92	Guidelines for environmental infection control in health-care facilities: Recommendations of CDC and the healthcare infection control practices advisory committee (HICPAC). Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC); 2003.	Regulatory	n/a	n/a	n/a	n/a	Recommendations for environmental infection control measures.	
93	Apisarnthanarak A, Mundy LM, Khawcharoenporn T, Mayhall CG. Hospital infection prevention and control issues relevant to extensive floods. Infection Control and Hospital Epidemiology. 2013;34(2):200-206. Accessed 6 September 2017. doi: 10.1086/669094.	Expert Opinion	n/a	n/a	n/a	n/a	Precautions to take before reopening a building after flooding.	VA
94	Scarlett HP, Postlethwait E, Delzell E, Sathiakumar N, Oestenstad RK. Asbestos in public hospitals: are employees at risk? J Environ Health. 2012;74(6):22–26.	Nonexperimental	152 samples from 26 facilities.	n/a	n/a	Presence of asbestos.	Develop a plan to contain asbestos during construction.	IIIB
95	Centers for Disease Control and Prevention and American Water Works Association, ed. Emergency water supply planning guide for hospitals and health care facilities. Atlanta, GA: U.S. Department of Health and Human Services; 2012.	Guideline	n/a	n/a	n/a	n/a	A plan should be developed for an outage of the water supply.	IVC

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96	Loschi M, Thill C, Gray C et al. Invasive aspergillosis in neutropenic patients during hospital renovation: effectiveness of mechanical preventive measures in a prospective cohort of 438 patients. Mycopathologia. 2015;179(5-6):337–345	Nonexperimental	438 patients with 705 hospitalizations over 5 years.	n/a	n/a	Incidence of invasive pulmonary aspergillosis.	Precautions taken were able to mitigate the indidence of infection.	IIIB
97	Lee L. Clean construction. infection control during building and renovation projects. *Health Facil Manage* . 2010;23(4):36-8; quiz 39	Expert Opinion	n/a	n/a	n/a	n/a	Steps to conducting a pre-construction risk assessment.	VB
98	Clair JD, Colatrella S. Opening pandora's (tool) box: Health care construction and associated risk for nosocomial infection. *Infectious Disorders - Drug Targets* . 2013;13(3):177-183. Accessed 5 September 2017	Expert Opinion	n/a	n/a	n/a	n/a	An infection control risk assessment should be performed by the interdisciplinary team.	VC
99	Boix-Palop L, Nicolás C, Xercavins M, et al. Bacillus species pseudo-outbreak: Construction works and collateral damage. J Hosp Infect. 2017;95(1):118-122. doi: 10.1016/j.jhin.2016.10.013.	Organizational Experience	Cultures of materials, surfaces, and air of the room: during construction n = 56; one month after cleaning n = 45; and two months after cleaning n = 37.	n/a	n/a	n/a	The application of an infection control bundle (including a barrier between the facility and construction zone) decreased the rate of positive cultures.	VB
100	Semchuk P. Breathing easy during building projects. Health Estate. 2015;69(2):17-20.	Case Report	n/a	n/a	n/a	n/a	Performing various infection control and internal air quality measures resulted in fewer material rejections from the site, less shrinkage of gypsum wallboard and flooring installations, a cleaner site with easier turnover and improved serviceability.	VC

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101	Cao G, Storas MCA, Aganovic A, Stenstad L, Skogas JG. Do surgeons and surgical facilities disturb the clean air distribution close to a surgical patient in an orthopedic operating room with laminar airflow? Am J Infect Control. 2018;46(10):1115-1122.	Quasi-experimental	3 procedures with volunteer and 1 with a thermal manikin.	Disruption sources.	Heat loads by surgical staff and lighting.	5 anemometers for air velocity above the OR table.	Higher clean airflow rate may be needed to reduce airflow disturbances from surgical lamps, the patient, surgical staff, and monitors.	IIB
102	Cao G, Nilssen AM, Cheng Z, Stenstad L, Radtke A, Skogas JG. Laminar airflow and mixing ventilation: Which is better for operating room airflow distribution near an orthopedic surgical patient? Am J Infect Control. 2019;47(7):737-743.	Quasi-experimental	2 ORs.	Laminar airflow.	Mixing ventilation airflow.	Airflow distribution and velocity.	Thermal plumes generated above patients can disrupt laminar airflow.	IIB
103	Mohammadi Gorji S, Bosch SJ, Valipoor S, De Portu G. Investigating the impact of healthcare environmental design on staff security: A systematic review. HERD. 2021;14(1):251-272.	Systematic Review	n/a	n/a	n/a	n/a	11 studies for environmental design for staff safey.	IIIA
104	Brands CK, Hernandez RG, Stenberg A, et al. Complete self-sufficiency planning: Designing and building disaster-ready hospitals. South Med J. 2013;106(1):63-68.	Organizational Experience	One pediatric hospital.	n/a	n/a	n/a	The self-sufficiency design process permits the interdisciplinary design team to adapt for optimal disaster functionality.	VB
105	Denny NA, Guyer JM, Schroeder DR, Marienau MS. Operating room waste reduction. AANA J. 2019;87(6):477-482.	Quasi-experimental	37 ORs.	Education for core anesthesia staff.	Pre-education timeframe.	Weekly waste of endotracheal tubes, laryngoscope handles and blades.	Education significantly reduced the waste of all items.	IIB
106	Petre M, Bahrey L, Levine M, van Rensburg A, Crawford M, Matava C. A national survey on attitudes and barriers on recycling and environmental sustainability efforts among Canadian anesthesiologists: An opportunity for knowledge translation. Can J Anaesth. 2019;66(3):272-286.	Qualitative	426 Canadian Anestheisologists' Society members.	n/a	n/a	Current environmentally sustainable practices and feelings on the topic.	Significant barriers were perceived, though willingness to participate existsed.	IIIB

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107	Amariglio A, Depaoli D. Waste management in an Italian hospital's operating theatres: An observational study. Am J Infect Control. 2021;49(2):184-187.	Nonexperimental	88 surgeries and 21,169 observed disposals.	n/a	n/a	Type of waste, bin of correct disposal, bin of improper disposal, surgical phase.	Better variety of waste bins and classification can decrease improper waste disposal.	IIIB
108	Vacharathit V, Walsh RM, Utech J, Asfaw SH. Action in healthcare sustainability is a surgical imperative: This is a novel way to do it. J Surg Educ. 2022;79(2):275-278.	Quasi-experimental	One surgical residency over 5 years.	Fellowship program in healthcare sustainability.	Prior to the program.	Hospital's collective carbon footprint.	Quantifiable changes in waste and water usage, recycling and landfill diversions.	IIB
109	Skowno J., Weatherall A. Lighting a candle, or cursing the darkness? delivering a climate friendly anaesthetic. J Paediatr Child Health. 2021;57(11):1781-1784.	Expert Opinion	n/a	n/a	n/a	n/a	Coherence, cognitive participation, collective action, and reflexive monitoring that can achieve buy-in for interventions.	VB
110	Wu S, Cerceo E. Sustainability initiatives in the operating room. JOINT COMM J QUAL PATIENT SAF. 2021;47(10):663-672.	Literature Review	n/a	n/a	n/a	n/a	The researchers concluded that optimizing efficiency and decreasing waste generation positively impacts the environment and cost reduction.	VB
111	Design, construction, and operation of sustainable high-performance health care facilities. ANSI/ASHRAE/ASHE standard 189.3-2021. Peachtree Corners, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE); 2021.	Consensus	n/a	n/a	n/a	n/a	Recommendations for design, construction, and operation of sustainable high-performance health care facilities.	IVB
112	WHO guidance for climate resilient and environmentally sustainable health care facilities. World Health Organization (WHO); 2020.	Guideline	n/a	n/a	n/a	n/a	Guidance for climate-resilient and environmentally sustainable health care facilities.	IVB
113	EESCC standardization roadmap: Energy efficiency in the built environment. Energy Efficiency Standardization Coordination Collaborative of the American National Standards Institute (ANSI); 2014.	Guideline	n/a	n/a	n/a	n/a	Recommendations for energy efficiency.	IVB

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114	*ANSI/IESNA RP-29-06: Lighting for hospitals and health care facilities.* New York, NY: Illuminating Engineering Society of North America (IESNA); 2006:79.	Guideline	n/a	n/a	n/a	n/a	Recommendations for lighting.	IVC
115	ASHRAE position document on energy efficiency in buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); 2019 Position Documents.	Position Statement	n/a	n/a	n/a	n/a	Recommendations for increased building sustainability.	VB
116	Horn M, Patel N, MacLellan DM, Millard N. Traditional canister-based open waste management system versus closed system: hazardous exposure prevention and operating theatre staff satisfaction. ORNAC J. 2016;34(2):36–50	Nonexperimental	15 procedures using open- and 15 procedures using closed-waste management systems.	n/a	n/a	Ease of use; number of potential exposure to hazardous material; time for set-up; maintenance during procedures; time for post-procedure disposal.	The closed waste disposal system was easier to use with less environmental impact, but no cost comparison was conducted.	IIIB
117	ASHRAE and CIBSE position document on resiliency in the built environment. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) ed. ; 2019 Position Documents.	Position Statement	n/a	n/a	n/a	n/a	Recommend technical solutions, policies, and innovative actions to develop built environments and engineered systems in buildings that are sustainable and resilient to societal, economic, and technical impacts.	VB
118	Rizan C, Steinbach I, Nicholson R, Lillywhite R, Reed M, Bhutta MF. The carbon footprint of surgical operations: A systematic review. Ann Surg. 2020;272(6):986-995.	Systematic Review	n/a	n/a	n/a	n/a	The researchers found that electricity use and procurement of consumables were the major carbon hotspots.	IIIA
119	Worden K, Hazer M, Pyke C, Trowbridge M. Using LEED green rating systems to promote population health. Build Environ. 2020;172:106550.	Expert Opinion	n/a	n/a	n/a	n/a	Benefits of facilities achieving Leadership in Energy and Environmental Design certification.	VB
120	ENERGY STAR score for hospitals in the united states. ; 2021Technical Reference.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for lighting.	

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121	ANSI/AAMI ST79:Comprehensive guide to steam sterilization and sterility assurance in health care facilities. AAMI; 2017.	Guideline	n/a	n/a	n/a	n/a	Guideline for sterilization and building of sterile processing areas.	IVB
122	Whitson BA. The 50 percent solution to reducing energy costs. Healthc Financ Manage. 2012;66(11):132–138	Case Report	n/a	n/a	n/a	n/a	Various energy-saving devices resulted in financial savings in the first year.	VC
123	Joseph A, Bayramzadeh S, Zamani Z, Rostenberg B. Safety, performance, and satisfaction outcomes in the operating room: A literature review. HERD. 2018;11(2):137-150.	Literature Review	n/a	n/a	n/a	n/a	OR layout, equipment, and furniture ergonomics affected staff performance and satisfaction.	VB
124	NFPA 241: Standard for safeguarding construction, alteration, and demolition operations. 2022 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2022. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=241.	Guideline	n/a	n/a	n/a	n/a	Recommendations for safeguarding construction and renovation projects.	IVA
125	Bennett TL, ed. Testing sustainable flooring: A Johns Hopkins health system report. Facility Guidelines Institute (FGI); 2016.	Organizational Experience	n/a	n/a	n/a	n/a	Recommendations for flooring material.	VB
126	State operations manual appendix A: Survey protocol, regulations and interpretive guidelines for hospitals. Rev. 151, 11-20-15 ed. Centers for Medicare & Medicaid Services; 2015.	Regulatory	n/a	n/a	n/a	n/a	CMS requirements for hospital buildings.	n/a
127	Johnstone EM, Burlingame BL, Conner R. Guideline for a safe environment of care. In: Conner R, ed. Guidelines for perioperative practice. Denver, CO: AORN Inc.; 2022	Guideline	n/a	n/a	n/a	n/a	Guidelines for a safe perioperative environment of care.	IVA

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128	American Society of Heating, Refrigerating and Air-Conditioning Engineers.,. Chapter 2. infection control. In: HVAC design manual for hospitals and clinics. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE); 2013:19-34.	Guideline	n/a	n/a	n/a	n/a	Guideline for HVAC systems.	IVC
129	21 CFR 878.5070-5080. Subpart F: Therapeutic devices. US Food & Drug Administration. Accessed April 25, 2023. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=878&showFR=1&subpartNode=21:8.0.1.1.26.6	Regulatory	n/a	n/a	n/a	n/a	Statement that forced air warming devices do not increase surgical site infection risk.	
130	Whyte W., Lytsy B. Ultraclean air systems and the claim that laminar airflow systems fail to prevent deep infections after total joint arthroplasty. J Hosp Infect. 2019;103(1):e9-e15.	Expert Opinion	n/a	n/a	n/a	n/a	Rebuttal response that LAF can reduce the particles in the room, compared with conventional ventilation, to a consistently lower average that decreases the risk for SSIs.	VB
131	Aganovic A, Cao G, Fecer T, et al. Ventilation design conditions associated with airborne bacteria levels within the wound area during surgical procedures: A systematic review. J Hosp Infect. 2021;113:85-95.	Systematic Review	n/a	n/a	n/a	n/a	Researchers found that regardless of surgical attire type (one of the multiple other factors that may contribute to SSIs), UDAF maintained the air quality in 2021 and that UDAF was more efficacious.	IIIA

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132	Romano F, Milani S, Ricci R, Joppolo CM. Operating theatre ventilation systems and their performance in contamination control: "At rest" and "in operation" particle and microbial measurements made in an italian large and multi-year inspection campaign. Int J Environ Res Public Health. 2020;17(19).	Quasi-experimental	1228 observations from 175 ORs in 31 Italian hospitals over 8 years.	Partial unidirectional airflow at ISO 5 cleanliness.	Partial unidirectional airflow at ISO 7 cleanliness, mixing air flow at ISO 7 cleanliness with high-wall supply grilles, mixing air flow at ISO 7 cleanliness with ceiling air diffusers.	Suface microbiological and airbone particles sampling and recovery time at rest; microbioligical air sampling at rest and operational (ie, close to the surgical wound).	Partial unidirectional airflow at ISO 5 cleanliness seemed to be more effective and stable for low airborne contamination.	IIA
133	Romano F., Milani S., Gusten J., Joppolo C.M. Surgical smoke and airborne microbial contamination in operating theatres: Influence of ventilation and surgical phases. Int J Environ Res Public Health. 2020;17(15):1-13.	Quasi-experimental	2 ORs.	Upward displacement.	Hybrid ventilation (unidirectional over the sterile field and peripheral mixing airflow).	Air contamination during 4 different surgical phases and places in the room.	Hybrid ventilation used more energy and decreased air contamination quickly.	IIB
134	Wagner JA, Greeley DG, Gormley TC, Markel TA. Comparison of operating room air distribution systems using the environmental quality indicator method of dynamic simulated surgical procedures. Am J Infect Control. 2019;47(1):e1-e6.	Quasi-experimental	3 OR air delivery configurations.	4-way throw diffusers.	Single large diffuser or multidiffuser array.	Air velocity, temperature, pressuraization, airborne microbial load, CO^2 levels, and airborne particles at the sterile field and outside the back instrument table.	Single large diffusers performed better within the sterile field and were more consistent than the other configurations.	IIB

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135	Wagner JA, Dexter F, Greeley DG, Schreiber K. Operating room air delivery design to protect patient and surgical site results in particles released at surgical table having greater concentration along walls of the room than at the instrument tray. Am J Infect Control. 2021;49(5):593-596.	Quasi-experimental	15 mock procedures.	2 modern ORs, one with a single large diffuser system above the surgical table and one with multiple diffuser array design.	1 old OR with 4-way diffuser system.	Air contamination at the sterile field and at the HVAC return grilles.	The 2 modern ORs were able to reduce the particle concentration near the center of the room regardless of diffuser configuration.	IIB
136	Kirschbaum S, Hommel H, Strache P, Horn R, Falk R, Perka C. Laminar air flow reduces particle load in TKA-even outside the LAF panel: A prospective, randomized cohort study. Knee surgery, sports traumatology, arthroscopy. 2021;29(11):3641.	RCT	12 total knee arthoplasties.	6 laminar airflow.	6 non-laminar airflow.	Absorption and scattering of laser light particles at 3 time-points and 3 places.	Laminar airflow significantly reduced the praticle load.	IB
137	Bischoff P, Kubilay NZ, Allegranzi B, Egger M, Gastmeier P. Effect of laminar airflow ventilation on surgical site infections: A systematic review and meta-analysis. Lancet Infect Dis. 2017;17(5):553-561. doi: S1473-3099(17)30059-2 [pii].	Systematic Review	n/a	n/a	n/a	n/a	Laminar airflow is not necesssary for high air quality.	IIIB
138	Bao J, Li J. The effect of type of ventilation used in the operating room and surgical site infection: A meta-analysis. Infect Control Hosp Epidemiol. 2021;42(8):931-936.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The researchers found no significant difference and concluded that the cost of laminar airflow does not outweigh its benefits.	IIIA
139	Lv Q., Lu Y., Wang H., et al. The possible effect of different types of ventilation on reducing operation theatre infections: A meta-analysis. Ann R Coll Surg Engl. 2021;103(3):145-150.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Researchers determined that the cost of LAF compared with the relate benefits to reduce SSI were not found, though there are multiple confounding variables.	IIB
140	D'Amico A., Montagna M.T., Caggiano G., et al. Observational study on hospital building heritage and microbiological air quality in the orthopedic operating theater: The IM.PA.C.T. project. Ann Ig. 2019;31(5):482-495.	Quasi-experimental	35 orthopedic ORs.	17 mixed flow.	18 turbulent flow.	Active microbial air contamination.	There was no significant different in total viable count or cfu count; the number of people were significantly higher in turbulent airflow rooms.	IIB

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141	Montagna M.T., Rutigliano S., Trerotoli P., et al. Evaluation of air contamination in orthopaedic operating theatres in hospitals in southern italy: The IMPACT project. Int J Environ Res Public Health. 2019;16(19):3581.	Nonexperimental	30 hospitals, 35 ORs	n/a	n/a	Mixed or turbulent airflow.	There was no difference in the bacterial loads during the procedures.	IIIB
142	Pasquarella C., Barchitta M., D'Alessandro D., et al. Heating, ventilation and air conditioning (HVAC) system, microbial air contamination and surgical site infection in hip and knee arthroplasties: The GISIO-SItI ischia study. Ann Ig. 2018;30:22-35.	Quasi-experimental	1,285 elective prosthesis procedures in 28 ORs at 14 hospitals.	16 vertical unidirectional airflow.	6 mixed airflow, and 6 turulent airflow.	Passive and active microbial air sampling; SSI surveillance.	No significant differences; however, loewr SSI rates in compliant versus non-compliant unidirectional airflow rooms requires more research.	IIB
143	Sabherwal S, Chaku D, Mathur U, et al. Are high-efficiency particulate air (HEPA) filters and laminar air flow necessary in operating rooms to control acute post-operative endophthalmitis? Indian J Ophthalmol. 2020;68(6):1120-1125.	Nonexperimental	36 cases of endophthalmitis out of 88.297 cataract surgeries.	n/a	n/a	Type of airflow ventiation and high-efficiency particulate air (HEPA) use.	No significant difference except patient risk factors.	IIIA
144	Langvatn H, Schrama JC, Cao G, et al. Operating room ventilation and the risk of revision due to infection after total hip arthroplasty: Assessment of validated data in the norwegian arthroplasty register. J Hosp Infect. 2020;105(2):216-224.	Quasi-experimental	51,292 primary total hip artoplasties (THA) from 40 orthopedic units over 10 years.	Unidirection airflow - small, low-volume; large, high-volume; hoizontal airflow.	Conventional, turbulent mixing ventilation.	End-point and time to revision due to infection.	Large, high-volume unidirectional vertical flow systems were significantly lower risk for SSI than conventional airflow.	IIA
145	Langvatn H, Bartz-Johannessen C, Schrama JC, et al. Operating room ventilation-validation of reported data on 108 067 primary total hip arthroplasties in the norwegian arthroplasty register. J Eval Clin Pract. 2020;26(3):1022-1029.	Quasi-experimental	108,067 THAs at 40 units.	Laminar airflow.	Conventional, turbulent ventilation.	Reported versus actual HVAC system.	12% of HVAC systems were misreported; retrospective analysis may not be reliable.	IIC
146	Pereira M, Tribess A, Buonanno G, Stabile L, Scungio M, Baffo I. Particle and carbon dioxide concentration levels in a surgical room conditioned with a window/wall air-conditioning system. Int J Environ Res Public Health. 2020;17(4).	Nonexperimental	1 OR and corridor during 2 cases with window/wall air conditioning system.	n/a	n/a	Particle number concentration and CO^2 concentration; ventilation level required.	The window/wall AC system was inadequate to provide suitable parameters, increasing as the day progressed, with high risk of cross-contamination between cases.	IIIB

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147	Stauning MA, Bediako-Bowan A, Bjerrum S, et al. Genetic relationship between bacteria isolated from intraoperative air samples and surgical site infections at a major teaching hospital in ghana. J Hosp Infect. 2020;104(3):309-320.	Nonexperimental	116 patients with follow-up data; 11 SSIs.	n/a	n/a	SSI and air isolates.	9.5% SSI rate after clean and clean-contaminated surgeries; significant association between air contamination and SSI risk.	IIIB
148	Popp W, Alefelder C, Bauer S, et al. Air quality in the operating room: Surgical site infections, HVAC systems and discipline - position paper of the German Society of Hospital Hygiene (DGKH). GMS Hyg Infect Control. 2019;14:Doc20.	Position Statement	n/a	n/a	n/a	n/a	LAF is beneficial and necessary for specific surgical procedures.	VB
149	Wang Q, Xu C, Goswami K, Tan TL, Parvizi J. Association of laminar airflow during primary total joint arthroplasty with periprosthetic joint infection. JAMA Network Open. 2020;3(10):e2021194-e2021194.	Nonexperimental	6,972 total knee or hip arthroplasy at 2 facilities, one with and without laminar airflow.	n/a	n/a	Patient characteristics; periprosthetic joint infection; presence of laminar airflow.	No significant difference in infections between the facilities.	IIIA
150	Teo BJX, Woo YL, Phua JKS, Chong H, Yeo W, Tan AHC. Laminar flow does not affect risk of prosthetic joint infection after primary total knee replacement in asian patients. J Hosp Infect. 2020;104(3):305-308.	Nonexperimental	Total knee replacements (TKR), 453 in laminar airflow and 575 in non-laminar airflow.	n/a	n/a	Rate of prosthetic joint infections.	There was no significant difference in infection rate and the cost of laminar airflow may not outweigh the risks.	IIIB
151	Alsved M, Civilis A, Ekolind P, et al. Temperature-controlled airflow ventilation in operating rooms compared with laminar airflow and turbulent mixed airflow. J Hosp Infect. 2018;98(2):181-190.	Quasi-experimental	3 ORs during 15 orthopedic operations in each.	Temperature-controlled airflow.	Laminar and turbulent airflow.	Airborne cfu, energy consumption, comfort of working environment.	Temperature-controlled airflow used less energy and was more comfortable to work in, though it and laminar airflow were more efficient at removing bacteria than turbulent airflow.	IIB
152	ASHRAE position document on indoor air quality. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); 2020 Position Documents.	Position Statement	n/a	n/a	n/a	n/a	Recommendations for indoor air quality includes sustainable and resilient buildings.	VB

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153	ASHRAE position document on filtration and air cleaning. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); 2015 Position Documents.	Position Statement	n/a	n/a	n/a	n/a	Recommendations for facility energy efficiency, sustainability, and resiliency.	VB
154	ANSI/ASHRAE Standard 52.2-2017: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2017. Accessed April 25, 2023. https://www.ashrae.org/File%20Library/Technical%20Resources/COVID-19/52_2_2017_COVID-19_20200401.pdf	Consensus	n/a	n/a	n/a	n/a	Recommendations for testing the HVAC system.	IVB
155	Bartley J, Olmsted RN. 116. heating, ventilation, and air conditioning. In: *APIC text.* Association for Professionals in Infection Control and Epidemiology, Inc. (APIC); 2014.	Consensus	n/a	n/a	n/a	n/a	Recommendations for the HVAC system.	IVC
156	Johnson L. 118. construction and renovation. In: APIC text. Association for Professionals in Infection Control and Epidemiology, Inc. (APIC); [2019].	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for infection control during construction and renovation.	IVC
157	ASHRAE positions on limiting indoor mold and dampness in buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) ed. ; 2021 Position Documents.	Position Statement	n/a	n/a	n/a	n/a	Reviewing early warning signs and risk reduction measures can reduce dampness.	VB
160	Dagli R, Çelik F, Özden H, Şahin S. Does the laminar airflow system affect the development of perioperative hypothermia? A randomized clinical trial. HERD. 2021;14(3):202-214.	RCT	200 patients.	Laminar airflow HVAC.	Conventional turbulent airflow HVAC.	Body temperature.	Neither HVAC airflow caused hypothermia.	IA
158	P100 Facilities standards for the public buildings service with 2022 addendum. U.S. General Services Administration (GSA); 2021.	Regulatory	n/a	n/a	n/a	n/a	Standards for service public buildings.	

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161	Usuki H, Kitamura H, Ando Y, et al. New concept air conditioning system for the operating room to minimize patient cooling and surgeon heating: A historical control cohort study. World J Surg. 2020;44(1):45-52.	Quasi-experimental	160 gastric cancer patients; 316 colorectal cancer patients.	HVAC system with central flow at 23.5 Celsius and lateral flow at 22.	HVAC system set at same temperature.	Patient hypothermia events.	Significantly lower rates of hypothermia in the new HVAC system.	IIB
159	Fact sheet: Departments and agencies commit to cleaner indoor air across the nation. The White House. December 8 , 2022. Accessed April 25, 2023. https://www.whitehouse.gov/ostp/news-updates/2022/12/08/fact-sheet-departments-and-agencies-commit-to-cleaner-indoor-air-across-the-nation/	Regulatory	n/a	n/a	n/a	n/a	Facts related to MERV filtration in federal buildings.	
162	Armit D, Vickers M, Parr A, et al. Humidity a potential risk factor for prosthetic joint infection in a tropical australian hospital. ANZ J Surg. 2018;88(12):1298-1301.	Quasi-experimental	1058 total knee arthroplasties (TKA).	Variations in HVAC parameters.	HVAC parameters within recommendations.	Deep prosthetic joint infection incidence.	Humidity and apparent temperature may influence infection rates.	IIB
163	Vonci N, De Marco M,F., Grasso A, Spataro G, Cevenini G, Messina G. Association between air changes and airborne microbial contamination in operating rooms. J Infect Public Health. 2019;12(6):827-830.	Nonexperimental	19 ORs in 59 procedures with 14 = tubulent and 5 = laminar airflow in one hospital.	n/a	n/a	Regression model between air changes per hour (ACH) and cfus by active and passive air samples.	Guidelines for ACH should be dependent on the type of airflow ventilation used.	IIIB
164	Fu Shaw L, Chen IH, Chen CS, et al. Factors influencing microbial colonies in the air of operating rooms. BMC Infect Dis. 2018;18(1):4.	Nonexperimental	28 ORs in one medical center.	n/a	n/a	Active sampling for cfu count, procedural characteristics.	Both ventilation and infection control procedures are important to improving air quality.	IIIB
165	Gormley T, Wagner J. Studying AIRFLOW in the OR: Measuring the environmental quality indicators in a dynamic hospital operating room setting. *Health Facil Manage* . 2018;31(1):32-36.	Organizational Experience	n/a	n/a	n/a	n/a	air flow at the back table (instrument table) was consistently lower than expected. Additional study is needed to correlate OR air flow and quality with patient outcomes (SSI incidence).	VC

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166	Wan, Gwo-Hwa, Chung, Feng-Fang and Tang, Chin-Sheng. Long-term surveillance of air quality in medical center operating rooms	Nonexperimental	33 air samples in each of the five OR types.	n/a	n/a	Particulate matter in the air and microorganisms.	Increased air changes per hour (20 versus 15) decreased the particulate count and the airborne bacterial concentrations.	IIIB
167	Tan H, Wong KY, Nyakuma BB, et al. Systematic study on the relationship between particulate matter and microbial counts in hospital operating rooms. Environ Sci Pollut Res Int. 2022;29(5):6710-6721.	Quasi-experimental	4 ORs in one facility.	Microbial count.	Particle count and size.	Correlation of microbial count and size.	Particles under 0.5 microns were not correlated with microbial count; however, both 5 and 10 were and could be used for monitoring prior to each procedure.	IIB
168	Albertini R., Colucci M.E., Turchi S., Vitali P. The management of air contamination control in operating theaters: The experience of the parma university hospital (IT). Aerobiologia. 2020;36(1):119-123.	Organizational Experience	One university hospital.	n/a	n/a	n/a	Air quality monitoring indicates the quality of the facility's infrastructure and cleaning practices.	VB
169	Karigoudar R.M., Wavare S.M., Kakhandki L., Bagali S., Kumar I.H. Comparison of active and passive methods of air sampling to evaluate the microbial contamination of air in operation theaters. J Pure Appl Microbiol. 2020;14(4):2691-2697.	Nonexperimental	15 ORs	n/a	n/a	Active versus passive air sampling methodology and results.	Passive air sampling methods monitored the risk of potential hospital-acquired infections better than active air sampling instruments.	IIIB
170	Barnes S, Twomey C, Carrico R, Murphy C, Warye K. OR air quality: Is it time to consider adjunctive air cleaning technology?: 1.3 www.aornjournal.org/content/cme. AORN J. 2018;108(5):503-515.	Expert Opinion	n/a	n/a	n/a	n/a	Discussed the benefits of using adjunct technology and advocated for a regulatory mandate for measuring air quality in Ors.	VB
171	Whyte W, Lidwell OM, Lowbury EJ, Blowers R. Suggested bacteriological standards for air in ultraclean operating rooms. *J Hosp Infect* . 1983;4(2):133-139.	Expert Opinion	n/a	n/a	n/a	n/a	Argument and methods for bacteriologic testing for air quality.	VC
172	Berrios-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for disease control and prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg. 2017;152(8):784-791.	Guideline	n/a	n/a	n/a	n/a	Recommends maintaining positive pressure and FGI HVAC settings.	IVB

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173	Berrios-Torres SI, Umscheid CA, Leas B, et al, eds. *Supplementary online content.* Atlanta, GA: Healthcare Infection Control Practices Advisory Committee, Centers for Disease Control and Prevention; 2017.	Consensus	n/a	n/a	n/a	n/a	Additional information regarding infection control recommendations.	IVA
174	Pasquarella C., Balocco C., Colucci M.E., et al. The influence of surgical staff behavior on air quality in a conventionally ventilated operating theatre during a simulated arthroplasty: A case study at the university hospital of parma. Int J Environ Res Public Health. 2020;17(2):452.	Quasi-experimental	2 simulated hip arthoplasty procedures.	Correct staff behavior.	Incorrect staff behavior.	Passive and active microbiological contamination; air velocity, humidity, and CO^2 concentration.	Turbulent airflow ventilation had low contamination when behavior was correct.	IIB
175	Kai T, Ayagaki N, Setoguchi H. Influence of the arrangement of surgical light axes on the air environment in operating rooms. J healthc eng. 2019;2019:4861273.	Nonexperimental	2 Ors with single or double-axis surgical lights.	n/a	n/a	Air current; cleanliness.	Double-axis surgical lights allowed uniform downward airflow, less dust, and quicker dispursion of smoke.	IIIB
176	Kauffman RE. Study degradation of typical HVAC materials, filters and components irradiated by UVC energy (1509-RP). 2010;1509-RP.	Nonexperimental	65 hours under ultraviolet cleaning (UVC) light.	n/a	n/a	Degradation of typical HVAC materials, filters, and components.	Aluminum foil and glass fibers were resistant to photodegradation caused by the UVC.	IIIB
177	Health care facilities and medical gas and medical vacuum systems. In: 2021 Uniform Plumbing Code An American National Standard IAPMO/ ANSI UPC 1-2021. Ontario, CA: International Association of Plumbing and Mechanical Officials (IAPMO); 2020:220–222.	Consensus	n/a	n/a	n/a	n/a	Uniform plumbing guidelines.	IVB
178	Kyle E, Wood A. Guideline for care and cleaning of surgical instruments. In: Kyle E, ed. *Guidelines for perioperative practice.* Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Guidelines for the care and cleaning of surgical instruments.	IVA
179	Wood A. Guideline for processing flexible endoscopes. In: Kyle E, ed. Guidelines for perioperative practice. Denver, CO: AORN Inc.; 2023	Guideline	n/a	n/a	n/a	n/a	Guidelines for processing flexible endoscopes.	IVA

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180	NFPA 1: Fire code. 2021 Electronic edition ed. Quincy, Massachusetts: National Fire Protection Association (NFPA); 2021. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1.	Guideline	n/a	n/a	n/a	n/a	Recommendations for the fire code.	IVA
181	Stymiest DL. Power up: Best practices for hospital power system reliability. advice for planning, design, installation, inspection, maintenance and more. Health Facil Manage. 2016;29(3):25-29. http://www.hfmmagazine.com/articles/2089-best-practices-for-hospital-power-system-reliability. Accessed 18 September 2017	Expert Opinion	n/a	n/a	n/a	n/a	Steps for setting up a hospital power system.	VC
182	Dianat I, Sedghi A, Bagherzade J, Jafarabadi MA, Stedmon AW. Objective and subjective assessments of lighting in a hospital setting: implications for health, safety and performance. Ergonomics. 2013;56(10):1535–1545	Qualitative	208 employees.	n/a	n/a	Employee satisfaction, job performance, safety and health.	Lighting levels influence employee satisfaction, job performance, safety and health.	IIIA
183	Ikner LA, Torrey JR, Gundy PM, Gerba CP. Efficacy of an antimicrobial surface coating against human coronavirus 229E and SARS-CoV-2. Am J Infect Control. 2021;49(12):1569-1571.	Quasi-experimental	2 stainless steel coupons (25,81 cm2)	Reformulated quaternary ammonium coating.	No coating.	Reduction in SARS-CoV-2 and HVoV-229E.	2 hours of exposure to coating reduced >99.9% of both; surfaces do not replace regular cleaning and disinfection practices.	IIB
184	Harris D, Taylor KP, Napierkowski K, Zechmann B. Indoor finish material influence on contamination, transmission, and eradication of methicillin-resistant staphylococcus aureus (MRSA). HERD. 2021;14(1):118-129.	Quasi-experimental	150 samples.	4 surface types (solid surface with cupric oxide, stainless steal Grade 304, high-pressure laminate, antimicrobial copper sheet); novel disinfectant.	Acrylic polymer solid surface; bleach disinfectant.	MRSA-contamination of new and worn environmental surface materials; efficacy of different disinfectants.	Copper sheet and cupric oxide solid surfaces reduced MRSA contamination at 24 hours and bleach and a novel disinfectant were equally effective at disinfecting all surface types.	IIB

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185	Hinsa-Leasure SM, Nartey Q, Vaverka J, Schmidt MG. Copper alloy surfaces sustain terminal cleaning levels in a rural hospital. Am J Infect Control. 2016;44(11):e195–e203	Quasi-experimental	18 surfaces with and without copper alloy.	Surfaces of copper alloy.	Surfaces without copper alloy.	Bacterial concentration on surfaces after terminal cleaning.	Copper alloys reduced bacterial concentration of surfaces.	IIC
186	Karpanen TJ, Casey AL, Lambert PA et al. The antimicrobial efficacy of copper alloy furnishing in the clinical environment: a crossover study. Infect Control Hosp Epidemiol. 2012;33(1):3–9	Nonexperimental	14 high touch surfaces cultured once a week for 24 weeks.	n/a	n/a	Microbial counts.	Use of copper and optimal infection prevention strategies can reduce the risk of infection.	IIIB
187	O'Gorman J, Humphreys H. Application of copper to prevent and control infection. where are we now? J Hosp Infect. 2012;81(4):217-223. Accessed 8 September 2017. doi: 10.1016/j.jhin.2012.05.009.	Systematic Review	n/a	n/a	n/a	n/a	Results inconclusive; more research is needed to recommend copper contact surface use.	IIIB
188	Barzoloski-O'Connor, Barbara. Preventing infections during construction in the perioperative area 2013	Expert Opinion	n/a	n/a	n/a	n/a	Conduct an ICRA before beginning the project and create traffic plans for the construction workers and the personnel	VC
189	Bingham E, Whitaker D, Farnsworth C, Smith J. Evidence-based design in hospital renovation projects: Design implementation for patient privacy and comfort. J Archit Eng. 2022;28(2):04022002.	Literature Review	n/a	n/a	n/a	n/a	Evidence-based design can facilitate the best healthcare flow.	VA
190	Wirmann L, Ross B, Reimann O, Steinmann J, Rath PM. Airborne aspergillus fumigatus spore concentration during demolition of a building on a hospital site, and patient risk determination for invasive aspergillosis including azole resistance. J Hosp Infect. 2018;100(3):e91-e97.	Quasi-experimental	200 air samples.	During and after demolition.	Before demolition.	Mean concentration of *A. fumigatus* spores; invasive aspergillosis cases.	No significant difference in concentration or cases.	IIB

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191	West GF, Rose TJ. Ensuring capability to provide safe patient care prior to occupying renovated clinical area. *HERD*. 2018;11(4):111–115	Organizational Experience	New 11-bed unit simulated emergency scenarios	emergency scenario simulations in newly constructed space	n/a	clinician's ability to function effectively in emergency scenarios in new unit	simulating emergency scenarios enabled the staff to identify equipment and flow issues that could be addressed before occupying the new space and performing patient care in it.	IIIC
192	Nguyen DB, Gupta N, Abou-Daoud A et al. A polymicrobial outbreak of surgical site infections following cardiac surgery at a community hospital in Florida, 2011-2012. Am J Infect Control. 2014;42(4):432–435	Case Report	n/a	n/a	n/a	n/a	Lack of correct air pressure gradient, high humidity levels, and lack of barriers between the OR and construction site caused a surgical site infection outbreak.	VB
193	Brun CP, Miron D, Silla LMR, Pasqualotto AC. Fungal spore concentrations in two haematopoietic stem cell transplantation (HSCT) units containing distinct air control systems. Epidemiol Infect. 2013;141(4):875-879. Accessed 6 September 2017. doi: 10.1017/S0950268812001124.	Nonexperimental	117 air samples from patient rooms, corridors, and toilets in two hospitals.	n/a	n/a	Presence of fungi.	HEPA filtration decreased the fungi present in the air.	IIIB
194	Barreiros G, Akiti T, Magalhães ACG, Nouér SA, Nucci M. Effect of the implosion and demolition of a hospital building on the concentration of fungi in the air. Mycoses. 2015;58(12):707-713. Accessed 6 September 2017. doi: 10.1111/myc.12418.	Case Report	n/a	n/a	n/a	n/a	Use of HEPA filtration during facility demolition was effective in decreasing fungal concentrations within the facility.	VB
195	Zamani Z, Harper EC. Exploring the effects of clinical exam room design on communication, technology interaction, and satisfaction. HERD. 2019;12(4):99-115.	Quasi-experimental	22 patients, 28 caregivers, and 59 clinicians into 4 exam mockup rooms.	Inclusive layout.	Semi-inclusive and exclusive layouts.	Videos for interaction behaviors; perception of layout experience.	Design of exam rooms influences the examination experience, communication, and satisfaction.	IIB
196	Wingler D, Joseph A, Bayramzadeh S, Robb A. Using virtual reality to compare design alternatives using subjective and objective evaluation methods. HERD. 2020;13(1):129-144.	Nonexperimental	21 nursing faculty.	n/a	n/a	Perception of 3 preoperative room layouts.	Virtual reality data was valuable in provided clarity regarding objective and subjective perceptions.	IIIB

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197	Bell SE. Placing care: Embodying architecture in hospital clinics for immigrant and refugee patients. Sociol Health Illn. 2018;40(2):314-326.	Nonexperimental	69 adult immigrant and refugee patients.	n/a	n/a	Encounters with interpreters and clinical staff.	Different place-specific tensions and power dynamics arose; therefore some redesign could make immigrant and refugee patients more comfortable.	IIIB
198	Robinson JT. Applying maslow's hierarchy of needs to human-centered design translating HCAHPS results into designs that support improved care delivery. AAH Academy Journal. 2017;19:4/8/2022. https://www.aia.org/resources/21501-aah-academy-journal.	Expert Opinion	n/a	n/a	n/a	n/a	The researchers used Maslow's hierarchy of needs to determine design principles that can facilitate patient-preferred practices into the healthcare organization's culture.	VB
199	Taaffe K, Lee B, Ferrand Y, et al. The influence of traffic, area location, and other factors on operating room microbial load. Infect Control Hosp Epidemiol. 2018;39(4):391-397.	Nonexperimental	21 procedures in 4 ORs during March or September.	n/a	n/a	Hierarchical regression for cfu rate, temperature and humidity, OR, door openings, people in the room, and amount of traffic.	OR and workflow design could limit the spread of microbes; humidity was significantly higher in September.	IIIB
200	Cockram A. Correct lighting of hospital buildings. 1976. Health Estate. 2007;61(4):21-23.	Expert Opinion	n/a	n/a	n/a	n/a	Summarizies qualities of surgical lights.	VC
201	ECRI Institute. Hazard report. overlap of surgical lighthead beams may present burn risk. Health Devices. 2009;38(10):341-342. https://rpauthor.aorn.org/Environmentofcare2/Documents/Full%20Text%20References/HealthDevicesOverlap.pdf.	Case Report	n/a	n/a	n/a	n/a	Two lights aimed at the same location caused a burn.	IVC
202	Surgical lights. an illuminating look at the LED marketplace. *Health Devices* . 2010;39(11):390-402	Expert Opinion	n/a	n/a	n/a	n/a	LED lights cost more but produce less heat, use less energy, bulbs last a long time and the lights reduce shadows.	VB

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203	Knulst AJ, Mooijweer R, Jansen FW, Stassen LP, Dankelman J. Indicating shortcomings in surgical lighting systems. Minim Invasive Ther Allied Technol. 2011;20(5):267-275. doi: 10.3109/13645706.2010.534169; 10.3109/13645706.2010.534169.	Organizational Experience	Light use during 46 hours of surgery.	n/a	n/a	n/a	Lights should not require large amounts of effort to position.	VC
204	Hanaki T., Noda T., Eguchi H., et al. Successful liver transplantation for liver failure with erythropoietic protoporphyria by covering the operating theater lights with polyimide film: A case report. Transplant Proc. 2020;52(2):625-629.	Case Report	n/a	n/a	n/a	n/a	The procedure was completed in shadowless lights and covered the ceiling lights with polyimide film.	VB
205	Zhou Z, Hu B, Gao X, Bao R, Chen M, Li H. Sources of sporadic pseudomonas aeruginosa colonizations/infections in surgical ICUs: Association with contaminated sink trap. Journal of Infection and Chemotherapy. 2016;22(7):450-455. Accessed 7 September 2017. doi: 10.1016/j.jiac.2016.03.016.	Nonexperimental	244 samples from sinks in two intensive care units over 27 weeks.	n/a	n/a	Presence and strains of *Pseudomonas aeruginosa* in sink drains and patients.	The same strain was found in the sink trap and infected patients.	IIIC
206	Kaneko T, Davidson MJ. Use of the hybrid operating room in cardiovascular medicine. Circulation. 2014;130(11):910–917	Expert Opinion	n/a	n/a	n/a	n/a	Considerations for construction of a hybrid OR.	VB
207	Eder SP, Register JL. 10 management considerations for implementing an endovascular hybrid OR. AORN J. 2014;100(3):260–270	Expert Opinion	n/a	n/a	n/a	n/a	Ten management considerations when building a hybrid OR.	VB
208	Expert Panel on MR Safety, Kanal E, Barkovich AJ, et al. ACR guidance document on MR safe practices: 2013. J Magn Reson Imaging. 2013;37(3):501-530. doi: 10.1002/jmri.24011 [doi].	Guideline	n/a	n/a	n/a	n/a	Guidance for magnetic resonance imaging systems.	IVB
209	Childs S, Bruch P. Successful management of risk in the hybrid OR. AORN J. 2015;101(2):223-237. Accessed 11 September 2017. doi: 10.1016/j.aorn.2014.04.020.	Expert Opinion	n/a	n/a	n/a	n/a	MRI hybrid room safety precautions.	VB

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210	Wright R. Guideline for minimally invasive surgery. In: Kyle E, ed. Guidelines for perioperative practice. Denver, CO: AORN Inc.; 2022.	Guideline	n/a	n/a	n/a	n/a	Recommendations for hybrid OR safety.	IVA
211	*ACR–SIR–SNIS–SPR practice parameter for the clinical practice of interventional radiology.* ; 2019	Position Statement	n/a	n/a	n/a	n/a	Parameters for hybrid OR.	IVB
212	Ashour R, See AP, Dasenbrock HH, et al. Refinement of the hybrid neuroendovascular operating suite: Current and future applications. *World Neurosurg* . 2016;91:6-11.	Organizational Experience	1 neuroendovascular hybrid OR.	n/a	n/a	n/a	Co-locating technologies and refining ergonomics improved workflow efficiency.	VB
213	Lenski M, Hofereiter J, Terpolilli N, et al. Dual-room CT with a sliding gantry for intraoperative imaging: Feasibility and workflow analysis of an interdisciplinary concept. Int j comput assist radiol surg. 2019;14(2):397-407.	Expert Opinion	n/a	n/a	n/a	n/a	Concluded that intraoperative imaging did not increase SSI risk or workflow burden.	VB
214	Traversari AAL, van Heumen,S.P.M., Hoksbergen AWJ. Effect of using ceiling-mounted systems for imaging in hybrid operating rooms on the level of colony-forming units during surgery. J Hosp Infect. 2019;103(1):e61-e67.	Quasi-experimental	4 hybrid ORs in 4 hopsitals.	Ceiling-mounted imaging systems during procedures during the day.	Ors during simulation.	Active slit air samplers.	Using unidrectional flow HVAC systems and keeping the instrument table directly under them can keep cfu levels low.	IIB
215	Nejati A, Shepley M, Rodiek S, Lee C, Varni J. Restorative design features for hospital staff break areas: A multi-method study. HERD. 2016;9(2):16-35.	Nonexperimental	993 members.	n/a	n/a	Design of break areas on staff.	Distance, privacy, socialization, and outdoor spaces increased satisfaction.	IIIA
216	Colussi G, Frutos E, Rapisarda R, et al. Information needs at the O.R. waiting room. Stud Health Technol Inform. 2021;281:921-925.	Nonexperimental	Observation of the waiting room and interviews with 11 patients and companions, 5 administrative staff, and 3 surgeons.	n/a	n/a	Journey map of patient's perspective of the surgical process.	Increasing communication in the waiting room can decrease stress and anxiety for patients and companions.	IIIB

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217	Inal N, Andsoy II. The needs and expectations in the waiting room for the relatives of patients who undergo surgery. INT J CARING SCI. 2019;12(1):384-394.	Qualitative	300 relatives of patients undergoing surgeries.	n/a	n/a	Perception of the surgical waiting area.	Redesign waiting areas for relaxation and comfort.	IIIB
218	Gurses AP, Kim G, Martinez EA, et al. Identifying and categorising patient safety hazards in cardiovascular operating rooms using an interdisciplinary approach: A multisite study. BMJ QUAL SAF. 2012;21(10):810-818. http://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=104438393&site=ehost-live&scope=site.	Nonexperimental	Cardiac ORs at 5 facilities.	n/a	n/a	Safety hazards	Lack of storage and horizontal work spaces created hazards.	IIIA
219	NIOSH alert: Preventing occupational respiratory disease from exposures caused by dampness in office buildings, schools, and other nonindustrial buildings. Department of Health and Human Services: Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH); 2012.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for HVAC system inspection, maintenance, remediation, and reporting moist areas in the building.	VA
220	Curless MS, Bow L, Lentz T, Trexler P, Maragakis LL. Management and mitigation of temperature and humidity events in the perioperative setting. AORN J. 2021;114(6):563-571.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for HVAC variances regarding notification and restoration.	VB
221	Remediation and infection control considerations for reopening healthcare facilities closed due to extensive water and wind damage. https://www.cdc.gov/disasters/reopen_healthfacilities.html. Updated 2014. Accessed 8/29, 2022.	Guideline	n/a	n/a	n/a	n/a	Guidance for handling disruption of the water system.	IVC

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222	Thiel CL, Eckelman M, Guido R et al. Environmental impacts of surgical procedures: life cycle assessment of hysterectomy in the United States. Environ Sci Technol. 2015;49(3):1779–1786	Nonexperimental	Four hysterectomies (vaginal, abdominal, laparoscopic, robotic).	n/a	n/a	Environmental emissions during different procedures.	Use of a ventilation set-back strategy lessens the environmental impact of the facility by using less energey for heating and cooling.	IIIA
223	Operating room HVAC setback strategies. Chicago: American Society for Healthcare Engineering; 2011.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for HVAC ventilation setback strategies.	VB
224	Tejero-González A, DeFreitas-Barros-Galvão VM, Zarzuelo-Sánchez AM, SanJosé-Alonso JF. Energy use optimization in ventilation of operating rooms during inactivity periods. Build Res Inf. 2021;49(3):308-324.	Nonexperimental	2 ORs in 1 facility in Spain.	n/a	n/a	Indoor overpressure; preference to existing coil heat recovery loop.	Indoor overpressure is maintained at 15 Pa under setback, which is prefered; and reduced energy costs and total electric energy comsumption.	IIIB
225	Traversari AAL, Bottenheft C, van Heumen SPM, Goedhart CA, Vos M C. Effect of switching off unidirectional downflow systems of operating theaters during prolonged inactivity on the period before the operating theater can safely be used. Am J Infect Control. 2017;45(2):139–144	Quasi-experimental	3 ORs.	HVAC setback.	Air quality before setback initiated.	Temperature and air particle counts.	After restarting the HVAC system, wait 30 minutes before surgical activity in the OR.	IIB
226	Dettenkofer M, Scherrer M, Hoch V et al. Shutting down operating theater ventilation when the theater is not in use: Infection control and environmental aspects. Infect Control Hosp Epidemiol. 2003;24(8):596–600	Nonexperimental	3 ORs with ten samples at 0, 10, 15, and 20 minutes after HVAC restart.	n/a	n/a	Air particle counts.	Recommends 30 minutes between restarting the system and beginning surgical activity.	IIIB
227	Gniadek A, Macura AB. Air-conditioning vs. presence of pathogenic fungi in hospital operating theatre environment. Wiad Parazytol. 2011;57(2):103-106. https://rpauthor.aorn.org/Environmentofcare2/Documents/Full%20Text%20References/Gniadek2011.pdf.	Nonexperimental	50 air samples; 25 wall samples.	n/a	n/a	Presence of fungi.	Fungi was increased in the later evening; decontamination procedures and the HVAC system should be properly maintained to facilitate air quality.	IIIB

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228	Casha AR, Manché A, Camilleri L, Gauci M, Grima JN, Borg MA. A novel method of personnel cooling in an operating theatre environment. Interact Cardiovasc Thorac Surg. 2014;19(4):687–689	Nonexperimental	One simulated thoracic surgery.	n/a	n/a	Particle and bacterial counts.	The use of a bladeless fan for personnel cooling led to a nonsignificant lowering of both particle and bacterial counts while maintaining the OR clean room conditions.	IIIB
229	Yiallouros PK, Papadouri T, Karaoli C et al. First outbreak of nosocomial Legionella infection in term neonates caused by a cold mist ultrasonic humidifier. Clin Infect Dis. 2013;57(1):48–56	Case Report	n/a	n/a	n/a	n/a	Humidifiers should not be used because they have been identified as a source for legionella.	VB
230	Healthcare water system repair and recovery following a boil water alert or disruption of water supply. Natural Disasters and Severe Weather Web site. https://www.cdc.gov/disasters/watersystemr	Guideline	n/a	n/a	n/a	n/a	Guidance for handling disruption of the water system.	IVC
231	Klinger C, Landeg O, Murray V. Power outages, extreme events and health: A systematic review of the literature from 2011-2012. PLoS Curr. 2014;6:10.1371/currents.dis.04eb1dc5e73dd1377e05a10e9edde673. doi: 10.1371/currents.dis.04eb1dc5e73dd1377e05a10e9edde673 [doi].	Systematic Review	n/a	n/a	n/a	n/a	Loss of electricity can impact other utilities; develop policies and procedures to handle utility outages.	IIIB
232	Working without technology: How hospitals and healthcare organizations can manage communication failure. . 2016. http://www.phe.gov/Preparedness/planning/cip/Documents/workingwithouttechnology.pdf.	Guideline	n/a	n/a	n/a	n/a	Provides considerations when planning for a communications system in the event of power failure.	VC
233	Mitchell L, Anderle D, Nastally K, Sarver T, Hafner-Burton T, Owens S. Lessons learned from hurricane ike. AORN J. 2009;89(6):1073-1078. http://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=105352676&site=ehost-live&scope=site. doi: 10.1016/j.aorn.2009.03.002.	Case Report	n/a	n/a	n/a	n/a	Steps to take to re-establish a facility after a natural diaster.	VB

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234	Carpenter T, Robinson ST. Case reports: Response to a partial power failure in the operating room. Anesth Analg. 2010;110(6):1644-1646. doi: 10.1213/ANE.0b013e3181c84c94.	Case Report	n/a	n/a	n/a	n/a	A plan should be developed for an outage of the electrical supply.	VA
235	Soncrant C, Mills PD, Zubkoff L, et al. Power failures during surgery: A 2000-2019 review of reported events in the veterans health administration. J Patient Saf. 2021;17(8):e815-e820.	Organizational Experience	Reported power failures and impact at one facility.	n/a	n/a	n/a	Though rare, power failures during surgery can cause major or catastrophic patient harm.	VB
236	Vetter AG, Harman RJ, Stamper MJ, Titch JF, Vacchiano CA. Preparing for total power failure in the operating room. AANA J. 2019;87(4):291-297.	Literature Review	n/a	n/a	n/a	n/a	The authors concluded that anesthesia providers take inventory and prepare for a power failure like any other emergency by developing protocols.	VB
237	Boubour J, Jenson K, Richter H, Yarbrough J, Oden ZM, Schuler DA. A shipping container-based sterile processing unit for low resources settings. PLoS ONE. 2016;11(3). Accessed 6 September 2017. doi: 10.1371/journal.pone.0149624.	Nonexperimental	61 sterilization trials.	n/a	n/a	Sterility of instruments as shown by changes in the autoclave tape, indicator strip, biological indicator, and time and temperature .	The mobile sterile processing area could be safely used.	IIIC