# AORN Guideline for Team Communication
## Evidence Table

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 1 | Berry WR, Edmondson L, Gibbons LR et al. Scaling safety: the South Carolina surgical safety checklist experience. Health Aff (Millwood). 2018;37(11):1779–1786. | Nonexperimental | 29 checklist hospitals, 35 comparison hospitals | n/a | n/a | Reporting completion or regular check list use. | To improve checklist use, engage all stakholders, provide various opportunities to participate, allow adequate time and resources. | IIIA |
| 2 | Göras C, Unbeck M, Nilsson U, Ehrenberg A. Interprofessional team assessments of the patient safety climate in Swedish operating rooms: a cross-sectional survey. BMJ Open. 2017;7(9):e015607. | Organizational Experience | 17 | n/a | n/a | n/a | OR staff need preconditions and resources such as having eperience and coordinating and reafirming inromation to make sense of different situations. This requires a mental model which is rated through planning and preparing in different ways. | VA |
| 3 | Odell DD, Quinn CM, Matulewicz RS et al. Association between hospital safety culture and surgical outcomes in a statewide surgical quality improvement collaborative. J Am Coll Surg. 2019;229(2):175–183 | Qualitative | 49 hospitals, 871 team members (administrators, quality improvement teams, nurses, anesthesiologists, surgeons) | n/a | n/a | Positive responses percentage and NSQIP 30-day adverse outcomes. | The researchers concluded that hospital safety culture can influence certain surgical patient outcomes. A positive safety culture is associated with significantly lower risk-adjusted rate of morbidity in Illinois hospitals. Understanding the protective influence of safety culture and the precise nature of how hospital culture can impact patient outcomes should drive future research. | IIIB |
| 4 | Tarling M, Jones A, Murrells T, McCutcheon H. Comparing safety climate for nurses working in operating theatres, critical care and ward areas in the UK: a mixed methods study. BMJ Open. 2017;7(10):e016977 | Qualitative | N=319 UK registered nurses; 23 nurses participated in focus groups | n/a | n/a | Safety Climate Questionnaire (SCQ) and thematic analysis of focus groups | The results of this study suggest that the SCQ has some utility but requires further exploration. The findings indicate that safety in nursing practice is a complex interaction between safety systems and the social and interpersonal aspects of clinical practice. | IIIB |
| 5 | Sundler AJ, Johansson E, Johansson L, Hedén L. Incidents reported by nurse anaesthetists in the operating room. J Interprof Care. 2018;32(6):699–705 | Organizational Experience | N=220 incident report by nurse anesthetists | n/a | n/a | n/a | This study aim was to explore the content and frequency of incidents reported by nurse anesthetists in Sweden in the OR and the risks involved in these incidents. They identified five categories: communication and teamwork; routines and guidelines; patient care; nurses' work environment; devices,materials,and technologies. They found that lack of communication and Interprofessional teamwork as the two most common areas for reported events. | IIIA |
| 6 | Nilsson U, Göras C, Wallentin FY, Ehrenberg A, Unbeck M. The Swedish Safety Attitudes Questionnaire-Operating Room Version: psychometric properties in the surgical team. J Perianesth Nurs. 2018;33(6):935–945 | Qualitative | N=541 surgical team members including periop nurses, physicians, and LPN at three Swedish Hospitals. | n/a | n/a | Validate the Swedish Safety Attitudes Questionnaire-operating room survey tool. | The refined Swedish version of the SAQ-OR is a reasonable reliable and aceptable valid instrument for the measurement of patient safety climate in the surgical team. | IIIB |

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| 7 | Wright MI, Polivka B, Abusalem S. An examination of factors that predict the perioperative culture of safety. AORN J. 2021;113(5):465–475 | Qualitative | N=63 completed survey responses. | n/a | n/a | SAQ;UWES | Using a purposeful sample and three survey tools, the researchers studied the relationships between the length of perioperative nurse experience, perioperative nurse engagement, and an OR culture of safety. The researchers determined that perioperative nurse engagement is a significant predictor of a high level of OR safety culture; therefore, implementing strategies to increase perioperative nurse engagement is of prime importance. | IIIB |
| 8 | Boag-Hodgson C, Duong A, Bagley L. Attitudes toward safety and teamwork: benchmarking Australian surgeons and nurses. J Patient Saf. 2022;18(6):e979–e984 | Qualitative | n=261 surgeons and registered nurses completed the survey | n/a | n/a | Safety Attitudes Questionnaire (Operating room version) | The study provides the baseline of general safety attitudes for Australian surgeons and nurses. The occupational differences found in this study support the notion that safety interventions should target specific professional groups, taking into account the individual differences between each occupation to optimize outcomes. | IIIB |
| 9 | Pimentel MPT, Choi S, Fiumara K, Kachalia A, Urman RD. Safety culture in the operating room: variability among perioperative healthcare workers. J Patient Saf. 2021;17(6):412–416 | Qualitative | n=431 respondents to HSPS | n/a | n/a | safety culture | There was significant variability in safety climate, professional roles and levels of training. | IIIB |
| 10 | de Siqueira Gutierres, Larissa, Guedes dos Santos, JosÃ© L., Faria Barbosa, Sayonara d. F., Camargo Maia, Ana R., Koerich, Cintia and GonÃ§alves, Natalia. Adherence to the objectives of the Safe Surgery Saves Lives Initiative: perspective of nurses 2019 | Organizational Experience | nurses in Brazil | n/a | n/a | n/a | Appropriate adherenc to nine of 10 objectives of the Safe Surgery Saves lives initiative was found. Routine surveillance on surgical capacity, volume and results was presented as unsatisfactory adherence. More discussion is needed about strategies to increase patient safety in relation to surveillance and prevention of never events. | VA |
| 11 | Sexton JB, Helmreich RL, Neilands TB et al. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. BMC Health Serv Res. 2006;6:44 | Qualitative | 10,843 health care providers in 203 clinical areas (ICU, OR, inpatient, and ambulatory clinics) | n/a | n/a | Healthcare provider attitudes about patent safety. | The Safety Attitudes Quesionnaire demonstrated good psychometric properties and healthcare organizations can use the survey to measure caregiver attitudes abour patient safety domains and compare themselves with other organixations and implement interventions to improve safety attitudes as well as measure the effectiveness of those interventions. | IIIB |
| 12 | de Carvalho Mota AS, de Oliveira Mendes Castilho AF, Ferreira Pereira da Silva Martins MM. Assessment of patient safety in the operating room: nurses' perceptions. Rev Enferm Ref. 2021(6):1–9 | Qualitative | 1,001 nurses from 46 OR in Portugal | n/a | n/a | percentage of positive answers to patient safety dimensions. | The survey results point out opportunities for improvement of most patient safety dimensions in the OR, namely the need to implement internal audits, promote organizational learning and continuously improve patient safety culture | IIIB |
| 13 | Habahbeh AA, Alkhalaileh MA. Effect of an educational programme on the attitudes towards patient safety of operation room nurses. Br J Nurs. 2020;29(4):222–228 | Quasi-experimental | n=66 nurses from | 4 hour education program on Patient Safety culture workshop | Pre and post intervention | OR nurses attitudes towards a culture of patient saety | Incorporating courses about safety culture into CE programs may improve nurses' attitudes towards patient safety. | IIIA |

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| 14 | Chard R, Tovin M. The meaning of intraoperative errors: perioperative nurse perspectives. AORN J. 2018;107(2):225–235 | Qualitative | n=10 | n/a | n/a | Intraoperative errors: environment, being human, and moving forward | The fingdings support efforts to improve quality care and foster a culture of safety in the OR through strategies such as perioperative staff training, interprofessional team building and controlling environmental factors that are distracting. | IIIA |
| 15 | Civil I. Operating room culture affects patient outcomes, and we should operate accordingly. ANZ J Surg. 2018;88(4):264–265 | Literature Review | n/a | n/a | n/a | n/a | Proper use of a paperless Checklist is part of the work towards generatig a safe patient culture. This new work reveals that an environment with a healthy culture of respect, where people feel safe to speak up- and where people would be prepared to be operated on - is also one where outcomes are better. | VB |
| 16 | Weiser TG, Haynes AB. Ten years of the Surgical Safety Checklist. Br J Surg. 2018;105(8):927–929 | Expert Opinion | n/a | n/a | n/a | n/a | Discusses the 10 years since the SSC was introduced, what to look for in the future. | VA |
| 17 | Molina G, Jiang W, Edmondson L et al. Implementation of the Surgical Safety Checklist in South Carolina hospitals is associated with improvement in perceived perioperative safety. J Am Coll Surg. 2016;222(5):725–736 | Qualitative | 929 clinicians from 13 hospitals baseline and 815 follow up | n/a | n/a | perception of multiple dimensions of perioperative safety among OR personnel before and after implementation of the SSC | Improved staff perceptions of mutual respect, clinical leadership, assertiveness on behalf of safety, team coordination and communication, safe practice and perceived check list outcomes. | IIIA |
| 18 | Tørring B, Gittell JH, Laursen M, Rasmussen BS, Sørensen EE. Communication and relationship dynamics in surgical teams in the operating room: an ethnographic study. BMC Health Serv Res. 2019;19(1):528 | Qualitative | N=39 surgical teams and 15 semi-structured interviews in 2 orthopedic operating rooms in Denmark. | n/a | n/a | Coding system for analysis associated with inappropriate communication and relationship dynamics and appropriate communication and relationship dynamics. | The findings offer a new typology of teams that goes beyond weak or strong relational coordination to capture four distinct patterns of relational coordination. The identified contexts were 1)proactive and intuitive communication; 2)silent and ordinary communication, 3) inattentive and ambiguous communication, 4)contradictory and highly dynamic communication. In particular, the study highlight the central role of mutual respect and presents proposals for improving relational coordination in surgical teams | IIIC |
| 19 | Lin MW, Papaconstantinou HT, Adair White BA. Moving beyond teamwork in the operating room to facilitating mutual professional respect. Proc (Bayl Univ Med Cent). 2023;36(1):45–53 | Organizational Experience | n=21 participants representing all surgical team roles. | n/a | n/a | n/a | Six major themes influencing psychological safety in the OR were identified. Psychological safety is essential to better, safer patient care. | IIIC |
| 20 | Stucky CH, De Jong MJ. Surgical team familiarity: an integrative review. AORN J. 2021;113(1):64–75 | Systematic Review | n/a | n/a | n/a | n/a | This literature contained 16 full test manuscripts regarding surgical team familiarity. The author concluded that surgical team familiarity has been associated with shorter total operative time, team member safety, decreased surgical errors and disruptions, reduced miscommunication and fewer patient readmission | IIIB |

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| 21 | Etherington C, Burns JK, Kitto S et al. Barriers and enablers to effective interprofessional teamwork in the operating room: a qualitative study using the Theoretical Domains Framework. PLoS One. 2021;16(4):e0249576 | Qualitative | 66 healthcare professionals | n/a | n/a | Assessment and enablers of team communication. | Identification of key determinants of OR teamwork form an interprofessional perspective using a theoretically informed and systematic approach. Results suggest that achieving optimal teamwork in the OR may require a multi-level intervention that addresses individual team and systems-level factors with particular attention to complex social and professional hierarchies. | IIIA |
| 22 | Collette AE, Wann K, Nevin ML et al. An exploration of nurse-physician perceptions of collaborative behaviour. J Interprof Care. 2017;31(4):470–478 | Qualitative | nurses = 355/991; physicians 82/441 | n/a | n/a | Current state of collaboration between frontline nurses and physicians. | Phsysicians perceived greater collaboration than nurses. Physician ratings did not vary by primary practice area. Nurse ratings varied by clinical practic with OR nurses rating lowest collaboration and the ED the highest. Rounding, roles, respect and communication were emergent themes for best collaboration. | IIIA |
| 23 | Stucky CH, De Jong MJ, Kabo FW, Kasper CE. A network analysis of perioperative communication patterns. AORN J. 2020;111(6):627–641 | Organizational Experience | N=47 | n/a | n/a | n/a | This study used Societal network analysis(SNA) to determine how interdependent clinician relationships influence perioperative communication patterns. The results showed that communication effectiveness increased in networks in which clinicians reported interacting frequently, having close working relationships, socializing, and seeking advice and providing advice to others. | VA |
| 24 | Sucato DJ. Strategies and tools to enhance team performance. J Pediatr Orthop. 2020;40 (Suppl 1):S25–S29 | Expert Opinion | n/a | n/a | n/a | n/a | Team performance is a function of talented members who share a common vision, who have he opportunity to voice their thought/opinions, and have the ability to be accountable to each other. | VB |
| 25 | AORN Position Statement on a Healthy Perioperative Practice Environment. AORN, Inc. 2021. Accessed November 1, 2023. https://www.aorn.org/docs/default-source/guidelines-resources/position-statements/patient-workplace-safety/posstat-healthyperioppracenv-0721.pdf?sfvrsn=df148d53_1 | Position Statement | n/a | n/a | n/a | n/a | AORNs position on achieving a health perioperative practice environment. | VA |
| 26 | Aveling EL, Stone J, Sundt T, Wright C, Gino F, Singer S. Factors influencing team behaviors in surgery: a qualitative study to inform teamwork interventions. Ann Thorac Surg. 2018;106(1):115–120 | Organizational Experience | 34 interviews | n/a | n/a | n/a | Organizations should cultivate and reinforce consensus on ideal team behaviors and notechnical skills of surgical team members. | VA |

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| 27 | Brennan PA, Dalal A, Knighton J, Jones R, Oeppen RS. Pilot study to evaluate safety culture perception in the operating theatres of an acute NHS Trust using the National Air Traffic Services (NATS) App. Br J Oral Maxillofac Surg. 2021;59(9):1085–1089 | Qualitative | n=146 surgery staff at one NHS hopstial | n/a | n/a | Ground up safety responsibility;Open, honest conversation about safety;Generate a feeling of healthy unease;Employees ask questions and act | A total of 146 colleagues downloaded and completed the questionnaire. The National Air Traffice Services (NATS) developed a free downloadable self-assessment App to use to assess thir own culture perception in their organisation. 80% of staff felt encouraged to report safety concerns. 86% confirmed a lack of available support from healthcare managers. 43% would find it easy to challenge colleagues if they observed unsafe behavior. | IIIC |
| 28 | O'Brien B, Andrews T, Savage E. Nurses keeping patients safe by managing risk in perioperative settings: a classic grounded theory study. J Nurs Manag. 2019;27(7):1454–1461 | Qualitative | 37 OR nurses, 33 hours of non-participant observations | n/a | n/a | To understand orchestrating in promoting safety and minimizing risk of errors and adverse events in the perioperative setting. | The author developed The theory of anticipatory vigilance from survey and open and selective coding. The core category are orchestrating, routinising and momentary adapting. This theory explains how perioperative ruses minimized risk in the perioperative setting. | IIIB |
| 29 | Işik I, Gümüşkaya O, Şen S, Arslan Özkan H. The elephant in the room: nurses' views of communication failure and recommendations for improvement in perioperative care. AORN J. 2020;111(1):e1–e15 | Organizational Experience | 14 perioperative nurses from two Joint commision international recognition urban hospital in Instanbul, Turkey | n/a | n/a | n/a | Th nurses in this study pointed out the risks and prediposing factors of perioperative communication failure and made precise suggestions. | VA |
| 30 | Johnson AH, Benham-Hutchins M. The influence of bullying on nursing practice errors: a systematic review. AORN J. 2020;111(2):199–210 | Systematic Review | n/a | n/a | n/a | n/a | Further considerations for enhancing a collective safety culture in the perioperative context include team leadership, inter-professional education, and learning from AE's. Perioperative team members can promote patient safety by collectively committing to a patient safety culture. | IIIA |
| 31 | McKenzie L, Shaw L, Jordan JE et al. Factors influencing the implementation of a hospitalwide intervention to promote professionalism and build a safety culture: a qualitative study. Jt Comm J Qual Patient Saf. 2019;45(10):694–705 | Qualitative | 25 participants pre-intervention interview 24 mid intervention. 2,047 health care providers completed three question survey | n/a | n/a | Implementation of "Safe culture program" at amulticamps tertiary hopsital in Melbourne, Australia | This qualitative exploratoy study collected data form two sources. One was a fae to face semistructured interviews conducted pre and mid intervention (18 months). The second source was a survey with open ended questions involving a cross-sectional cohort one year into the Program's implementation. | IIIA |
| 32 | Paradiso L. Just culture: it's more than policy. Nurs Manage. 2019;50(6):38–45 | Qualitative | 185 nurses respondents | n/a | n/a | Just culture assessment tool (JCAT):Feedback and communication, openness of communication, balance, quality of error reporting process, continuous improvement and trust | The study results revealed a statistically significant difference between nurse leaders and clinical nurse perceptions of trust and just culture within the organization. | IIIA |

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| 33 | Salgado D, Barber KR, Danic M. Objective assessment of checklist fidelity using digital audio recording and a standardized scoring system audit. J Patient Saf. 2019;15(3):260–266 | Organizational Experience | one hospital | n/a | n/a | n/a | Used a black box digital recording system to assess SSC use. Used to make improvements in their facility. Suggested this approach as a way to assess for checklist fidelity. | VA |
| 34 | Bracq MS, Michinov E, Le Duff M, Arnaldi B, Gouranton V, Jannin P. Training situational awareness for scrub nurses: error recognition in a virtual operating room. Nurse Educ Pract. 2021;53:103056 | Organizational Experience | n= 18 scrub nurse students, 8 expert scrub nurses. | n/a | n/a | n/a | The participants were immersed in a virtual OR and reported any errors they observed. The results showed that the participants who detectedmost errors had a highter level of situation awareness, detected high-risk erros faster and felt more immersed in the virtual OR than those detecting fewer errors. Students explored the operating room more than experts did and detected more errors, especially those with moderate resk. | VA |
| 35 | Lee A, Finstad A, Tipney B et al. Exploring human factors in the operating room: scoping review of training offerings for healthcare professionals. BJS Open. 2022;6(2):zrac011 | Systematic Review | n/a | n/a | n/a | n/a | Expandng Human Factor education requires a broader inclusion of the entirety of sociotechnical factors | IIIA |
| 36 | Ghobadian S, Zahiri M, Dindamal B, Dargahi H, Faraji-Khiavi F. Barriers to reporting clinical errors in operating theatres and intensive care units of a university hospital: a qualitative study. BMC Nurs. 2021;20(1):211 | Qualitative | 30 nurses and 15 physicians | n/a | n/a | Themes and codes for reporting clinicsl errors | Barriers to reporting clincial errors were extractedin two themes: individual problems and organizational problems. Individual problems included 4 categories and 12 codes. Organizational problems included 6 categories and 17 codes. Nurses expectation for reporting was to change the current prevailing attitudes in the workplace while dotors expected the officials to implement reform policies regarding clinical error in univristy hospitals | IIIB |
| 37 | Pedersen A, Getty Ritter E, Beaton M, Gibbons D. Remote video auditing in the surgical setting. AORN J. 2017;105(2):159–169 | Organizational Experience | Level II trauma hospital, 17 OR rooms camera placement | n/a | n/a | n/a | This facility used Remote video auditing (RVA) to assess and improve Patient Safety Triad (PST), OR efficiency, and room cleaning. | VB |
| 38 | Kolodzey L, Trbovich P, Kashfi A, Grantcharov TP. System factors affecting intraoperative risk and resilience: applying a novel integrated approach to study surgical performance and patient safety. Ann Surg. 2020;272(6):1164–1170 | Qualitative | n= 19 audio/video recordings of laproscopic surgery | n/a | n/a | 79 distinct safety threats and 67 resilience support out of 183 relevant observations from 39.8h of observation time | Safety threats and resilience supports were found to be systematic in the surgical setting. Identified safety threats should be prioritized for remediation, and clinician behaviors that contribute to fostering resilience should be valued and protected | IIIA |
| 39 | Heslin MJ, Singletary BA, Benos KC, Lee LR, Fry C, Lindeman B. Is disruptive behavior inherent to the surgeon or the environment? Analysis of 314 events at a single academic medical center. Ann Surg. 2019;270(3):463–472 | Qualitative | n=314 | n/a | n/a | prospectively recorded the Reporter Account (RA) and the involved party (IP) responses | Unclear policies and urgent competing responsibilities in the surgical environment create stress, leading to conflict. Single events for the majority suggest the environment as the primary contributor. Tactics to improve stressful environments and clarly communicated policies may be more effective and sustainable than individually targeted interventions in enhancing patient safety | IIIB |

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| 40 | Marsh V, Kalisch B, McLaughlin M, Nguyen L. Nurses' perceptions of the extent and type of missed perioperative nursing care. AORN J. 2020;112(3):237–247 | Qualitative | 1,693 AORN members survey results | n/a | n/a | Nurses perception of Missed nursing care; the perceived amount of missed preoperative and Indra operative nursing care by facility characteristics; characteristics of periop nurses, their work schedules or perceived staffing adequacy | Nurses reported most missed care in the communication and pre-preparation categories. The number of ORs at a facility, nurse education and job title and perceptions of staffing adequacy were significantly associated with the perceived amount of missed perioperative nursing care. | IIIB |
| 41 | Moshtaghi O, Haidar YM, Sahyouni R et al. Wrong-site surgery in California, 2007-2014. Otolaryngol Head Neck Surg. 2017;157(1):48–52 | Qualitative | n95 case resulted in incident reports in California 2007-2014 | n/a | n/a | Wrong site surgery (WSS) | WSS continues to occur despite national efforts to decrease the incidence. | IIIB |
| 42 | Neily J, Soncrant C, Mills PD et al. Assessment of incorrect surgical procedures within and outside the operating room: a follow-up study from US Veterans Health Administration medical centers. JAMA Netw Open. 2018;1(7):e185147 | Qualitative | n=483 reports | n/a | n/a | Wrong patient, side, site, procedure or implant. | VA reported surgical advderse events trended downward from 1.74 to 0.47 per 100,000 surgeries between 2000 and 2017.The organization continues to review reported advers events and close call through root cause analysis reports, lessons learned and enhance policy to promote a culture and behavior that is transparent in reporting occurrences. | IIIA |
| 43 | Paige JT, Garbee DD, Bonanno LS, Kerdolff KE. Qualitative analysis of effective teamwork in the operating room (OR). J Surg Educ. 2021;78(3):967–979 | Qualitative | 15 OR staff from one facility in southeastern US. | n/a | n/a | Focus group with semi-structured interview guide exploring views of participant on a variety of topics related to teamwork. Ranking of 7C's in Salas' framework. | OR team members, agreement regarding effective teamwork centers around the concepts of smooth procedure Al flow, unified effort, clear communication, and positive attitude of the team. These findings have helped refine a teamwork instrument to increase its utility for formative use in the clinical environment. | IIIB |
| 44 | Rogers JE, Hilgers TR, Keebler JR, Looke T, Lazzara EH. How to mitigate the effects of cognitive biases during patient safety incident investigations. Jt Comm J Qual Patient Saf. 2022;48(11):612–616 | Literature Review | n/a | n/a | n/a | n/a | This literature review provides a summary of the types of bias and heuristics that can impact investigators' decision making in reviewing adverse events. | VA |
| 45 | AAMI TIR55:2014 (R2017): Human Factors Engineering for Processing Medical Devices. Arlington, VA: Association for the Advancement of Medical Instrumentation (AAMI); 2017 | Consensus | n/a | n/a | n/a | n/a | AAMI technical information report | IVB |
| 46 | Brommelsiek M, Said T, Gray M, Kanter SL, Sutkin G. Absence or presence: silent discourse in the operating room and impact on surgical team action. Am J Surg. 2021;221(5):980–986 | Organizational Experience | 25 interviews from interdisciplinary OR team (3 from each role) | n/a | n/a | n/a | when nurses speak up and resolve issues, they repot better patient outcomes, greater satisfaction in the workplace and heightened organizational commitment. | VB |

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| 47 | dos Santos DJ, Henriques SH, Leal LA, Inácio Soares M, Pedreschi Chaves LD, da Silva BR. Relational competence of nurses in surgical center units. Rev Enferm UERJ. 2020;28:e51314 | Organizational Experience | 43 nurses in Minas Grais hopsital | n/a | n/a | n/a | The researchers identified a need for managers and professional to reflect on the role and necessary competencies for interprofessionl skill in relational competence in order to achieve efficiency in performance. Training centers should add teaching the skill of relational competence to improve the quality of care provided by nurses. | VC |
| 48 | Guttman O, Keebler JR, Lazzara E, Daniel W, Reed G. Rethinking high reliability in healthcare: the role of error management theory towards advancing high reliability organizing. J Patient Saf Risk Manag. 2019;24(3):127–133 | Expert Opinion | n/a | n/a | n/a | n/a | The authors presented the Error Management Theory. It is important to recognize errors but to build effect teams a different approach to resilience offered by EMT facilitates the learner understanding of how to recognize and rescue from error early in order to contain the effect of error. | VA |
| 49 | Savage C, Gaffney FA, Hussain-Alkhateeb L et al. Safer paediatric surgical teams: a 5-year evaluation of crew resource management implementation and outcomes. Int J Qual Health Care. 2017;29(6):853–860 | Organizational Experience | N=153 managers and staff in a large Swedish university pediatric OR | n/a | n/a | n/a | Implementation of the Crew Resource Management (CRM) safety program sustained adhere to new work practice and improved non-technical and technical skills, surgical outcomes and safety culture. | VA |
| 50 | Loh HP, De Korne DF, Yin SQ, Ang E, Lau Y. Assessment of Scrub Practitioners' List of Intraoperative Non-Technical Skills (SPLINTS) in an Asian ambulatory surgical setting. AORN J. 2019;109(4):465–476 | Organizational Experience | n=10 individuals on a multidisciplinary panel. | n/a | n/a | n/a | SPLINTS is a suitanble tool for assessing nontechnical skills of scrub persons in ambulatrory setting in Singapore. | VA |
| 51 | Villafranca A, Hamlin C, Enns S, Jacobsohn E. Disruptive behaviour in the perioperative setting: a contemporary review. Can J Anaesth. 2017;64(2):128–140 | Literature Review | n/a | n/a | n/a | n/a | Disruptive behavior remains a part of OR culture, with many associated deleterious effects. There is a widely accepted view that disruptive behavior can lead to increased patient morbidity and mortality. More studies are need to confirm the effects and estimate the magnitude. An important measure that individual clinicians can take is to monitor and control their own behavior, including their responses to disruptive behavior. | VA |
| 52 | Cruz SA, Idowu O, Ho A, Lee MJ, Shi LL. Differing perceptions of preoperative communication among surgical team members. Am J Surg. 2019;217(1):1–6 | Qualitative | n=170 repondents, 72 surgeions (42.4%), 28 anesthesiologists (16.5%) abd 70 surgical nurses/technologists | n/a | n/a | survey results on preoperative communication timing | Perceptions of the preoperative communication differ between surgeons and anesthesiologists. Significant perceived barriers to an essential form of preparing for a surgical case exist such as a lack of standard method of communication and a lack of time. | IIIB |
| 53 | Kohn LT, Corrigan JM, Donaldson M, eds. To Err Is Human: Building a Safer Health System. Washington, DC: National Academies Press; 2000 | Regulatory | n/a | n/a | n/a | n/a | A report that describes serious concern about medical errors in healthcare. | n/a |

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| 54 | Al Abbas AI, Sankaranarayanan G, Polanco PM et al. The operating room black box: understanding adherence to surgical checklists. Ann Surg. 2022;276(6):995–1001 | Nonexperimental | OR black boxes set up in 5 Ors (primarily robotics) recorded check list use in 3879 procedures. | n/a | n/a | Checklist compliance, engagment and quality | The overall scores for compliance, engagement, and quality were 81%,<br>84%, and 67% respectively. When broken down by phase, the scores for<br>time-out were compliance 100%, engagement 98%, and quality 61%.<br>Scores for the debrief phase were 81% for compliance, 98% for engage ment, and 66% for quality. After a hospital policy change, the debrief<br>scores improved significantly | IIIB |
| 55 | Fleetwood VA, Veenstra B, Wojtowicz A, Kerchberger J, Velasco J. Communication through simulation: developing a curriculum to teach interpersonal skills. Surgery. 2018;164(4):802–809 | Nonexperimental | 9 OR teams, 34 participants, | n/a | n/a | NOTECHS II | Senior residents performed better on NOTECHS II and treatment time in simulation scenario of patient with pulmonary emolis. Nonthechnical skills have emreged as an important contributo to patient safety in surgery. | IIIB |
| 56 | Sens F, Viprey M, Piriou V et al. Safety attitude of operating room personnel associated with accurate completion of a surgical checklist: a cross-sectional observational study. J Patient Saf. 2022;18(5):449–456 | Nonexperimental | Data from 29 French hospitals, including 5677 operated patients and 834 OR professionals, | n/a | n/a | To identify whether the presence of a fully completed checklist inmedical records was associated with team safety attitudes. | Compliance with checklists is associated with safer OR team practice and can be considered as an indicator of the extent of safety<br>in OR practice. | IIIA |
| 57 | Adams-McGavin RC, Jung JJ, van Dalen ASHM, Grantcharov TP, Schijven MP. System factors affecting patient safety in the or: an analysis of safety threats and resiliency. Ann Surg. 2021;274(1):114–119 | Nonexperimental | 24 | n/a | n/a | Safety Threats and Resilience support codes | This cross-sectional study of 24 patients undergoing MIS procedure in one facility used the Black Box technology to capture data from video, audio and patient physiological data. Trained analysts reviewed the recordings and coded safety threats and resilience supports. The study identified the median of 6 safety threats per procedure hour and a median of 6 safety resilience support per hour. Resilience supports in response to threats were heavily dependent on surgical teams. | IIIC |
| 58 | Lee EY, Kim KJ, Ko S, Song EK. Communication competence and resilience are modifiable factors for burnout of operating room nurses in South Korea. BMC Nurs. 2022;21(1):203 | Qualitative | 146 S. Korean nurses | n/a | n/a | Job Stress level, reilience, communication competence, burnout scale, | Communication competence was correlated with resilience and burnout. Increased resilience and communication competence were associated with lower burnout of perioperative nurses. Developing a program targeting communication competence and resilience training could reduce burnout in nurse. | IIIA |
| 59 | Naviaux AF, Rigot A, Janne P, Gourdin M. Understanding stress factors for scrub nurses in the perioperative period: a cross-sectional survey. J Visc Surg. 2022;159(4):273–278 | Qualitative | n=612 respondents | n/a | n/a | Causes of stress for nurses in OR environment | Stress was highest when inexperienced professional were unfamiliear with the procedure and disruptive behavior. Familiarity of team members and procedure shielded nurses from stress. | IIIB |
| 60 | O'Brien B, Andrews T, Savage E. Anticipatory vigilance: a grounded theory study of minimising risk within the perioperative setting. J Clin Nurs. 2018;27(1-2):247–256 | Qualitative | 37 nurses in 11 perioperative settings | n/a | n/a | Explain how nurses minimize risk in the perioperative setting. | Nurses main concern was how to minimize risk. Nurses engaged in anticipatory vigilance through orchestrating, routininizing and momentary adapting. There is a need for training and educationg nurses in maintaining safety and decreasing risk in the perioperative setting. | IIIB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 61 | UP.01.03.01: A time-out is performed before the procedure. The Joint Commission E-dition. Accessed November 1, 2023 | Accreditation | n/a | n/a | n/a | n/a | Time out before the procedure is performed. | n/a |
| 62 | UP.01.02.01: Mark the procedure site. The Joint Commission E-dition. Accessed November 1, 2023 | Accreditation | n/a | n/a | n/a | n/a | Mark the procedural site | n/a |
| 63 | National Patient Safety Goals [Ambulatory]. The Joint Commission E-dition. Accessed November 1, 2023 | Accreditation | n/a | n/a | n/a | n/a | patient safety goals | n/a |
| 64 | Anonymous Chapter: National Patient Safety Goals [Hospital] 2023 | Accreditation | n/a | n/a | n/a | n/a | patient safety goals | n/a |
| 65 | Jones A, Johnstone MJ. Inattentional blindness and failures to rescue the deteriorating patient in critical care, emergency and perioperative settings: four case scenarios. Aust Crit Care. 2017;30(4):219–223 | Case Report | n/a | n/a | n/a | n/a | The findings of this report contriute to a small but growing body of work on the nature and ramifications of inattentianal blindness in health care setting. These findings raise the possibility that inattentional blindness is a salient but overlooked human factor in failure to rescue scenarios. Further study is needed on strategies to prevent inattentional blindness. | VA |
| 66 | Lagoo J, Berry WR, Miller K et al. Multisource evaluation of surgeon behavior is associated with malpractice claims. Ann Surg. 2019;270(1):84–90 | Nonexperimental | n=264 surgeons having at least one malpractice claim | n/a | n/a | 360-degree review compared to number of claims | Surgeon behavior, as assessed by 360-degree review, is asociated with malpractice claims. These findings highlight the improtance of teamwork and communication in exposure to malpractice. | IIIB |
| 67 | Sexton JB, Adair KC, Profit J et al. Perceptions of institutional support for “second victims” are associated with safety culture and workforce well-being. Jt Comm J Qual Patient Saf. 2021;47(5):306–312 | Qualitative | N=10,627 survey respondents | n/a | n/a | Institutional support for second victim | Perceived institutional support for second victims was associated with a better safety culture and lower emotional exhaustion. Investment in programs to support second victims may improve overall safety culture and HCQ well-being. | IIIB |
| 68 | Haydar B, Baetzel A, Stewart M, Voepel-Lewis T, Malviya S, Christensen R. Complications associated with the anesthesia transport of pediatric patients: an analysis of the Wake Up Safe database. Anesth Analg. 2020;131(1):245–254 | Nonexperimental | 167 safety events | n/a | n/a | anesthesia transport associated events | 5% of events were associated with transport and handovers | IIIB |
| 69 | Laflamme LL. Enhancing perioperative patient safety: a collective responsibility. ORNAC J. 2017;35(4):13–56 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | Team training interventions that included educational components related to budling team skills supported an interprofessional collaborative approach to perioperativ patient safety. | IIA |
| 70 | Serou N, Husband AK, Forrest SP, Slight RD, Slight SP. Support for healthcare professionals after surgical patient safety incidents: a qualitative descriptive study in 5 teaching hospitals. J Patient Saf. 2021;17(5):335–340 | Qualitative | N=45 | n/a | n/a | medical records was associated with teams’ safety attitudes. | OR staff mainly utilized peers for support after an adverse event. The study participants emphasized the importance of receiving personalized support soon after the incident. Senior clinicians should be proactive in offering support to junior colleagues and empathize with their own experiences. | IIIB |
| 71 | Keebler JR, Lazzara EH, Blickensderfer E, Looke TD. Human factors applied to perioperative process improvement. Anesthesiol Clin. 2018;36(1):17–29 | Literature Review | n/a | n/a | n/a | n/a | This literature review provides discussion of the human factors and ergonomics in the perioperative enviroment. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 72 | Kirschbaum K, McAuliffe MS Swanson M. Team communication in the operating room: a measure of latent factors from a national sample of nurse anesthetists. AANA J. 2018;86(1):11–18 | Qualitative | n=474 CRNA | n/a | n/a | PRIOR survey | The researchers validated that the Practice in Operating Room (PRIOR) survey is an appropriate tool to be used to measure latent cultural values that lead to communication errors among CRNA , anesthesia and other medical providers. This theoretical framework is also valid to explore how to improve systemic and institutional level communicatiom practices to increase patient safety during operative procedures. | IIIA |
| 73 | Sinskey JL, Chang JM, Shibata GS, Infosino AJ, Rouine-Rapp K. Applying conflict management strategies to the pediatric operating room. Anesth Analg. 2019;129(4):1109–1117 | Literature Review | n/a | n/a | n/a | n/a | The authors provide a framework for anesthesiologists to manage conflict. | VA |
| 74 | Baldwin CA, Hanrahan K, Edmonds SW et al. Implementation of peer messengers to deliver feedback: an observational study to promote professionalism in nursing. Jt Comm J Qual Patient Saf. 2023;49(1):14–25 | Quasi-experimental | n=590 reports about problematic behavior | Training in use of Peer Messenger Co-Worker Observation System (CORS) tool | Observed how peer messenging system was implemented. | Feasibility and fidelity of the CORS process. | The implementation study demonstrated feasibility and fidelity to the CORS process for nursing. This peer feedback tool was successful in creating a just culture and transparent reporting. | IIA |
| 75 | van Dalen ASHM, Strandbygaard J, van Herzeele I, Boet S, Grantcharov TP, Schijven MP. Six Sigma in surgery: how to create a safer culture in the operating theatre using innovative technology. Br J Anaesth. 2021;127(6):817–820 | Expert Opinion | n/a | n/a | n/a | n/a | The author provided incite into the use of Black Box technologies for error management and improved team resilience. More transparency concerning error management and shared belief that engagement leads to safety improvement are of utmost importance. To reduce the incidence of errors in the OR, quality and safety improvement initiatives ought to involve the entire team, promoted and supported by the organization. The use of OR Black box should support process optimization and help healthcare organizations reach the level of a progressive, sustainable, and Six Sigma safety culture in the OR. | VB |
| 76 | The Operating Room Emergency Checklist Implementation Toolkit. Accessed November 1, 2023. https://www.implementingemergencychecklists.org/implementing-the-checklist/getting-started/ | Expert Opinion | n/a | n/a | n/a | n/a | Ariadne's implementation tool | VA |
| 77 | Developing tools to improve surgical safety. Ariadne Labs. Accessed November 1, 2023. https://www.ariadnelabs.org/safe-surgery-safe-systems/surgical-safety/ | Expert Opinion | n/a | n/a | n/a | n/a | Tools to improve surgical safety are featured. | VA |
| 78 | Sinyard RD, Rentas CM, Gunn EGM et al. Managing a team in the operating room: the science of teamwork and non-technical skills for surgeons. Curr Probl Surg. 2022;59(7):101172 | Literature Review | n/a | n/a | n/a | n/a | This literature review focused on the historical development of team training and NTS to the OR and provides a review of the evidence regarding their efffectiveness. This article also provides resources for the development of individual and team NTS. | VB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 79 | Hemingway M, Pian-Smith M. Multidisciplinary planning teams crucial for creating effective simulation scenarios. AORN J. 2018;108(4):P18–P19 | Expert Opinion | n/a | n/a | n/a | n/a | Nurses should be included in multidisciplinary team training programs in structure simulation scenarios. | VB |
| 80 | Mafra CR, Rodrigues MCS. Surgical safety checklist: an integrative review of the benefits and importance. Rev Fund Care Online. 2018;10(1):268–275 | Systematic Review | n/a | n/a | n/a | n/a | Studies show the benefits of using the SSC, notably on improving professional communication and importance to patient care and the decrease in potential complications. | IIIA |
| 81 | Frasier LL, Pavuluri Quamme SR, Becker A et al. Investigating teamwork in the operating room: engaging stakeholders and setting the agenda. JAMA Surg. 2017;152(1):109–111 | Qualitative | 23 participants | n/a | n/a | topics of team identity, the effect and management of team member unfamiliartiy and intraoperative hand-offs | More research needed in intraoperative teamwork and safety, including inentificaiton of the optimal design and timing of introperative hand-offs | IIIC |
| 82 | Gregory ME, Hughes AM, Benishek LE et al. Toward the development of the perfect medical team: critical components for adaptation. J Patient Saf. 2021;17(2):e47–e70 | Literature Review | n/a | n/a | n/a | n/a | Framework for communication and strategies to enhance teamwork | VB |
| 83 | Frasier, Lane L., Pavuluri Quamme, Sudha,R., Ma, Yue, et al. Familiarity and Communication in the Operating Room 2019 | Qualitative | 2499 communication events were identified. | n/a | n/a | Audio recordings of communication events in the OR | The researcher investigated the impact of starting an operation with familiar versus unfamiliear providers. The researchers found that familiarity with team members did not lead to increased verbal communication between the team. Cross-disciplinary communication is less frequent and more vulnerable to failure than intradisciplinary communication. | IIIA |
| 84 | Kanji F, Catchpole K, Choi E et al. Work-system interventions in robotic-assisted surgery: a systematic review exploring the gap between challenges and solutions. Surg Endosc. 2021;35(5):1976–1989 | Systematic Review | n/a | n/a | n/a | n/a | This literature review identified the inconsistency in implementation of RAS in healthcare. Consequently, there is a need to change the way stakeholders think about issues in RAS. This includes developing interventions that include multiple solutions from developing checklists to rearranging operating room layout, and evaluating effects on individuals, processes and outcomes. | IIIA |
| 85 | Roberts ER, Hider PN, Wells JM, Beasley SW. The frequency and effects of distractions in operating theatres. ANZ J Surg. 2021;91(5):841–846 N., Wells, Jonathan M. and Beasley, Spencer W. The frequency and effects of distractions in operating theatres 2021 | Qualitative | 57 surgical procedures in pediatric hospital in NZ | n/a | n/a | Door openings and a tool used to record predefined distraction categories and an ordinal rating scale to rate the impact of the distraction | Distractions occurred approximately every minute. Most were trivial but some had potential to disrupt the procedure and result in patient harm. | IIIB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 86 | Bretonnier M, Michinov E, Morandi X, Riffaud L. Interruptions in surgery: a comprehensive review. J Surg Res. 2020;247:190–196 | Systematic Review | n/a | n/a | n/a | n/a | The concept of interruption of surgical procedures needs to be defined more precisely. The literature review identified several classifications of interruptions. It has been identified that interruptions are probably risk factors for errors in the OR but the evidence of the link between their umber and these errors is not clear.Separating out positive and negative interruptions could make it possible to identify safe guards to reduce errors and not change interruptions with no potential consequence. | IIIA |
| 87 | 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 | 25 | n/a | n/a | Circulating Nurse (CN) activities were: patient, equipment, materials and information related activities. Flow disruptions and OR layout. | OR layout should be considered for efficient and safer patient care to decrease flow dirupstion patterns. | IIIC |
| 88 | Mcmullan RD, Urwin R, Gates P, Sunderland N, Westbrook JI. Are operating room distractions, interruptions and disruptions associated with performance and patient safety? A systematic review and meta-analysis. Int J Qual Health Care. 2021;33(2):mzab068 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | Distractions, interruptions and disruptions (DID) studies were reviewed. Most were prospecitve observational studies. DIDs in surgery are associated with negative outcomes. More research is needed to make recommendations about useful interventions. | IIIA |
| 89 | Widmer LW, Keller S, Tschan F et al. More than talking about the weekend: content of case-irrelevant communication within the OR team. World J Surg. 2018;42(7):2011–2017 | Organizational Experience | N=125 surgeries in one facility in Switzerland | n/a | n/a | n/a | The high proportion of Case-irrelevant communication (CIC) indicates that surgical teams deal iwth other tasks during surgeries. Surgical teams adapt CIC according to the demands of the procedure. Hospital policies should support these adaptations rather than attempt to suppress CIC entirely. | VA |
| 90 | Padmakumar AD, Cohen O, Churton A, Groves JB, Mitchell DA, Brennan PA. Effect of noise on tasks in operating theatres: a survey of the perceptions of healthcare staff. Br J Oral Maxillofac Surg. 2017;55(2):164–167 | Qualitative | n=510 survey responses | n/a | n/a | Six closed-ended questions about noise in the OT | Noise in the OR was identified to contribute to human errors by 83% of respondents. The responses indicated that both communication among staff and concentration were adversely affected by noise. Seventy-eight percent of respondents did not think music adversely affected their performance. | IIIC |
| 91 | Friend TH, Jennings SJ, Copenhaver MS, Levine WC. Implementation of the Vocera Communication System in a quaternary perioperative environment. J Med Syst. 2017;41(1):6 | Organizational Experience | OR staff at one hospital | n/a | n/a | n/a | Implementation of a wireless hands free communication device increased communication efficiency, percieved to rasie the overall noise level in the OR. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 92 | Levin M, Brace M, Sommer DD, Roskies M. Operating room noise and team communication during facial plastic and reconstructive surgery: a multicenter study. Facial Plast Surg. 2022;38(3):311–314 | Nonexperimental | 61 surgical team members surveyed, 423 noise measurements | n/a | n/a | Quantify noise and evaluate team members' perspectives on communication | Suction (34.5%) and music (22.4%) were the largest noise contributors according to questionnaire replies. Intraoperative noise, awake patients, and suction/music may negatively impact FPRS OR communication. Innovation to improve FPRS intraoperative communication should be considered for effective patient care. | IIIA |
| 93 | Keller S, Tschan F, Semmer NK et al. Noise in the operating room distracts members of the surgical team. An observational study. World J Surg. 2018;42(12):3880–3887 | Organizational Experience | n=110 abdominal surgeries in one facility | n/a | n/a | n/a | Reported on noise levels during three phases of the surgery (opening, main phase and closing). Higher concentration of noise was distracting during main phase and closing phase. | VA |
| 94 | Yu CV, Foglia J, Yen P, Montemurro T, Schwarz SKW, MacDonell SY. Noise in the operating room during induction of anesthesia: impact of a quality improvement initiative. Can J Anaesth. 2022;69(4):494–503 | Organizational Experience | Part A = 100 cases, Part B = 109 cases | n/a | n/a | n/a | Noise levels during induction were lowered after education program on noise reduction. | VA |
| 95 | Tsafrir Z, Janosek-Albright K, Aoun J et al. The impact of a wireless audio system on communication in robotic-assisted laparoscopic surgery: a prospective controlled trial. PLoS One. 2020;15(1):e0220214 | Organizational Experience | One facility, departments of Gynecology and Urology. | n/a | n/a | n/a | The use of wireless headset devices improved quality of communication between team members and reduced the peak noise level in the robotic OR. | VA |
| 96 | Mcleod RWJ, Myint-Wilks L, Davies SE, Elhassan HA. The impact of noise in the operating theatre: a review of the evidence. Ann R Coll Surg Engl. 2021;103(2):83–87 | Literature Review | n/a | n/a | n/a | n/a | This review examined studies describing the effects of sound on surgical performance. | VA |
| 97 | Fu VX, Oomens P, Merkus N, Jeekel J. The perception and attitude toward noise and music in the operating room: a systematic review. J Surg Res. 2021;263:193–206 | Systematic Review | n/a | n/a | n/a | n/a | Not all increases in noise levels have the same effects. The OR team in most studies felt music is a positive effect. Althought the 'sterile cockpit concept' is often mentioned, a total sound-sterile work environment in the OR seems to be neither practically possible nor desirable. | IIIA |
| 98 | Grant LC, Nicholson PF, Davidson B, Manias E. "Can you hear me?" Barriers to and facilitators of communication in the presence of noise in the operating room. J Perioper Nurs. 2021;34(3):Article 2 | Organizational Experience | 26 health professionals | n/a | n/a | n/a | Noise is encounter by all health professionals in the OR. Experienced health professionals are able to filter out unwanted sounds. Communication can be facilitated by the judicious use of non-verbal communication. | VA |
| 99 | Yousefiazar A, Vafaeiardeh S, Nabavi A, Ahmadzadeh J. Influence of perioperative practice on cognitive function of scrub nurses: a cross-sequential study. J Contin Educ Nurs. 2021;52(12):565–574 | Organizational Experience | 75 scrub nurses in general surgery, opthalmology, urology, orthopedics, and OB-GYN ORs | n/a | n/a | n/a | A significant difference was found between overall mean values for total number of items processed, number of errors, and concentration performance scores for the posttest compared to the prestest. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 100 | Grade MM, Tamboli MK, Bereknyei Merrell S, Mueller C, Girod S. Attending surgeons differ from other team members in their perceptions of operating room communication. J Surg Res. 2019;235:105–112 | Qualitative | 54 one on one interviews | n/a | n/a | interviews with OR team members to explore contribuors and barriers to optimal OR communication. | Team familiarity is important to all particiants in the OR, the survey responses noted the a disconnect between attending surgeons and the rest of the OR team. Other themes were the importance of procedural-focused discussion, team hierarchy and attending surgeon's mood were contribuotors to successful OR communication. | IIIC |
| 101 | Avidan A, Yacobi G, Weissman C, Levin PD. Cell phone calls in the operating theater and staff distractions: an observational study. J Patient Saf. 2019;15(4):e52–e55 | Organizational Experience | 52 surgeries observed; 205 cell phone calls | n/a | n/a | n/a | The number of cell phone calls in the operating rooms during elective surgery was lower than expected and caused short-lived distractions mainly to the operating surgeons. | VA |
| 102 | El Boghdady M, Ewalds-Kvist BM. The influence of music on the surgical task performance: a systematic review. Int J Surg. 2020;73:101–112 | Systematic Review | n/a | n/a | n/a | n/a | 18 studies were reviewed. Five studies provided both strong and moderate scientific evidence for a positive effect of music on surgeon's task perfomamce. In contrast 2 high quality studie revealed a negative effect of music on surgeon's task performace. Certain music elements affect the surgical task performance in positive or negative way. | IIIA |
| 103 | Narayanan A, Gray AR. First, do no harmony: an examination of attitudes to music played in operating theatres. N Z Med J. 2018;131(1480):68–74 | Organizational Experience | n=106 survery response with response rate of 45% | n/a | n/a | n/a | Respondents generally like music in the operating theatre and believe it has a positive impact. | VB |
| 104 | Rastipisheh P, Choobineh A, Razeghi M et al. The effects of playing music during surgery on the performance of the surgical team: a systematic review. Work. 2019;64(2):407–412 | Systematic Review | n/a | n/a | n/a | n/a | 13 studies reported on positive effects of music in the OR. | IIIC |
| 105 | Birnbach DJ, Rosen LF, Fitzpatrick M, Shekhter I, Arheart KL. Preparing anesthesiology residents for operating room communication challenges: a new approach for conflict resolution training. Anesth Analg. 2021;133(6):1617–1623 | Quasi-experimental | 37 anesthesiology residents | Conflict resolution course | 19 residents completed the course and 18 did not complete the course. All residents participatded in a simulation-based testing with a confrontation of a surgery with loud musci playing under the control of the surgeon. | Did the resident ignore the music, asked for the surgeon to turn it off, or attempt to turn it off themselves | 14/15 of The residents who completed the course deescalated the situation. Only 2/19 who completed the course ingored the music versus 10/18 who did not complete the course. The study suggests that a conflicit resoluiom course may improve the ability of residents to defuse clinical conflicts. It also demonstrateds simulation based assessment of communication skills can be used to defuse OR confrontation. | IIC |
| 106 | Crockett CJ, Donahue BS, Vandivier DC. Distraction-free induction zone: a quality improvement initiative at a large academic children's hospital to improve the quality and safety of anesthetic care for our patients. Anesth Analg. 2019;129(3):794–803 | Qualitative | 53 anesthesia providers, observations in ENT ORs | n/a | n/a | percentage of cases with distraction during induction and extubation in Pediatric ENT cases | This quality improvement project use educational interventions of having the circulating nurse silence music when they go to preop to pick up patient, anesthesiologist remid staff of induction time and ask for quiet. The percentage of cases with a distraction during induciton of general anesthesia decreased from 61% to 15% by April 15, 2017 and to 10% by June 5, 2017 | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 107 | Tomlinson R. East Lancashire Hospital Trust creates an open culture paving the way for service improvement “Below ten thousand”. J Perioper Pract. 2018;28(5):115–119 | Organizational Experience | Na | n/a | n/a | n/a | A Trust in the UK describes their process for reviewing never events. The demonstrated that treating staff with respect after a never event, created an open culture that encourages problem solving and service improvement. They developed a patient centric behavioral noise reduction strategy 'Below ten thousand' | VB |
| 108 | Boet S, Etherington C, Crnic A et al. Defining critical and noncritical moments in the operating room: a modified Delphi consensus study. Can J Anaesth. 2020;67(8):949–958 | Qualitative | n+ 304 respondents in first round of survey. 155 in second round and 74 in all three rounds. | n/a | n/a | Critical moments obtained by consensus were: induction of anesthesia; preoperative briefing;final counts at the end of the procedure; anesthesiologist or surgeon elevant intraoperative event; handovers; procdure specifi high risk surgical moments; crisis resource management situations; medication and equipment preparation; and key medication administration | In order to establish the "sterile cockpit" rule in surgery we need to define critical moments to develop a shared mental model among team members and inform teamwork and communication realted interventions by specifying the time at twhich certain behaviors are needed. | IIIA |
| 109 | Bodin JE. Excessive noise in the operating room: can it be improved? J Perioper Nurs. 2022;35(2): Article 6 | Organizational Experience | One facility's ORs | n/a | n/a | n/a | Implemented the use of a safe word to use during the debriefing to assess the level of noise during the procedure | VB |
| 110 | Webster KLW, Lazzara EH, Keebler JR, Roberts LL, Abernathy JH. Noise and turn-taking impact postanesthesia care unit handoff efficiency. J Patient Saf Risk Manag. 2020;25(3):99–105 | Nonexperimental | 85 handoff observations, OR to PACU | n/a | n/a | Characterize communication variables influencing the efficiency of handoffs. | Handoff efficiency was impacted my activity noise and turn taking. Handovers should take place in quiet locations, a two-person team participate so one nurse can participate in the handoff and the other can facilitate patient care. Allow the provider to check the patient before recieving the handoff, limit interruptions during handoffs. Tailor the handoff around the receiver to minimize the need to ask questions and clarify information. | IIIA |
| 111 | Shelton CL, Smith AF. Workplace distractions in the digital era - are smartphones a threat to safety or an essential tool? Anaesthesia. 2021;76(3):305–308 | Literature Review | n/a | n/a | n/a | n/a | Smartphones are used in the OR and can be a distract or but also can be an important communication tool. Anesthesia professionals should adopt a responsible professional approach to the use of cell phone technology. | VB |
| 112 | Ford DA, Fencl JL. Distractions in the OR can compromise patient care. AORN J. 2020;112(6):690–697 | Expert Opinion | n/a | n/a | n/a | n/a | Perioperative nurses should increase their knowledge of the dangers of distractiona, other patient safety concerns and ways to mitigate distraction and concerns. | VC |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 113 | Pal A, Lal R, Frizelle F. Aviation-based teamwork skills work for surgeons: time for an "aviation bundle"? ANZ J Surg. 2018;88(12):1231–1235 | Qualitative | Five focus groups in one hospital in the UK | n/a | n/a | 8 Themes emerged from focus group to explore the role of aviation-based practice in theatre, potential barriers to their success and how they may be tailored for application in theatre. | The researchers concluded that aviation best practices can be tailored to the operating room. They identified themes that could be used and suggest the development of a toolkit for teaching these skills. | IIIC |
| 114 | Brodzinsky L, Crowe S, Lee HC et al. What's in a name? Enhancing communication in the operating room with the use of names and roles on surgical caps. Jt Comm J Qual Patient Saf. 2021;47(4):258–264 | RCT | 117 providers | labeled caps | non-labled caps | impact on communication | Wearing a labeled cap led to more frequent name uses and less frequent missed communication. | IB |
| 115 | Dougherty J, Slowey C, Hermon A, Wolpaw J. Simple budget-neutral tool to improve intraoperative communication. Postgrad Med J. 2020;96(1141):703–705 | Organizational Experience | 20 data sheets and 48 pre and post intervention surverys | n/a | n/a | n/a | The study demonstrated in a small sample group that surgical providers addressed anesthesia residents by their first names after where a surgical cap with the Anesthesia residents name displayed. This simple intervention can result in dramatic improvement in intraoperative communication and engagement between teams. | VB |
| 116 | Grogan M, Crowell NA, Dalley CB, O'Guin C. Identifier bouffants: an exploration of the impact on verbal communication among interdisciplinary operating room personnel. AANA J. 2022;91(1):27–33 | Quasi-experimental | 72 completed surveys | Wearing a bouffant hat with name and title on forehead | Other healthcare providers did not wear bouffant | survey results on impact of bouffant on communication | The data collected from the study show a positive correlation between the use of identifier bouffants and self-reported increase in communication amongst the interdisciplinry OR team. | IIB |
| 116 | Grogan M, Crowell NA, Dalley CB, O'Guin C. Identifier bouffants: an exploration of the impact on verbal communication among interdisciplinary operating room personnel. AANA J. 2022;91(1):27–33 | Organizational Experience | 52 survey respondents ( n=23 pre and n=24 post) | n/a | n/a | n/a | Effect of role based head covering system to improve identification of Graduate medical students vs OR faculty improved the identification of roles. OR personnel were better able to identify a student vs. faculty which can improve patient safety and learning opportunities for medical students. | VA |
| 117 | Rosen DA, Criser AL, Petrone AB, Jackson E, Bowers J. Utilization of a role-based head covering system to decrease misidentification in the operating room. J Patient Saf. 2019;15(4):e90–e93 | Organizational Experience | OR faculty and graduate medical students | n/a | n/a | Determine the general opinion toward the inability to identify persons in the OR and how this contributes to patient safety and adverse outcomes. | Implementation of a role-based head covering system in the OR significantly increased the ability to determine a person's role in the OR. Suppoerts a simpe inexpensive solution to improve patient safety. | VA |
| 118 | Bodor R, Nguyen B, Broder K. We are going to name names and call you out! Improving the team in the academic operating room environment. Ann Plast Surg. 2017;78(5 Suppl 4):S222–S224 | Organizational Experience | n = 50 participants (18 surgeons, 14 anesthesioloists and 18 nursing members | n/a | n/a | n/a | Refining our own idnentified gaps in OR communiation may demonstrate improved teamwork and safer task delegations and perhaps even stimulate other performace benefits for academic OR | VB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 119 | Etherington C, Wu M, Cheng-Boivin O, Larrigan S, Boet S. Interprofessional communication in the operating room: a narrative review to advance research and practice. Can J Anaesth. 2019;66(10):1251–1260 | Literature Review | n/a | n/a | n/a | n/a | Based on this reveis, a research agenda to inform best practices in interprofessional operating rom communication is suggested.Factors that support effective communication are less documeted than barriers, but include team integration, flattened hierarchies, and sturucture/standardization | VA |
| 120 | Brommelsiek M, Krishnan T, Rudy P, Viswanathan N, Sutkin G. Human-caused sound distractors and their impact on operating room team function. World J Surg. 2022;46(6):1376–1382 | Nonexperimental | 60 surgical staff, recorded 19 machine and 48 human-caused sounds, observed 59 surgeries | n/a | n/a | Compare machine vs human-caused sounds for their loudness and distraction, and potential impact on team communication | Avoidable human-caused sounds are a major source of disruption in the OR and interfere with communication and job performance. Surgical team training should be conducted to minimize these sounds. | IIIA |
| 121 | Weber J, Catchpole K, Becker AJ, Schlenker B, Weigl M. Effects of flow disruptions on mental workload and surgical performance in robotic-assisted surgery. World J Surg. 2018;42(11):3599–3607 | Nonexperimental | 40 robotic-assisted radical prostatectomies, 216 reports on mental workload including distractions | n/a | n/a | Disruptions | Flow disruptions occure frequently and are associated with increased workload, strategies are needed to manage disruptions to maintain OR teamwork and safety during robotic assisted surgeries. | IIIA |
| 122 | Aouicha W, Tlili MA, Limam M et al. Evaluation of the impact of intraoperative distractions on teamwork, stress, and workload. J Surg Res. 2021;259:465–472 | Nonexperimental | n = 50 cases, 160 participants | n/a | n/a | Distraction observation sheet, Observational Teamwork Assessmemt for Surgery tool, STAI-6, Surg-TLX | Distractions occur on a regular basis. When distraction rates increased, team performance got poorer and workload and stress got higher. Teams tend to ignore or underestimate the effects of these distractions on surgical workflow and outcome. | IIIA |
| 123 | Boquet A, Cohen T, Diljohn F, Cabrera J, Reeves S, Shappell S. A theoretical model of flow disruptions for the anesthesia team during cardiovascular surgery. J Patient Saf. 2021;17(6):e534–e539 | Qualitative | n= 10 cardiovascular surgeries 301 disruptions observed | n/a | n/a | alerts, distractions, searching activity, spilling/dropping, teaching moment, and task deviations | By defining a calculable error space associated with disruptions, the research provides a conceptual metric for intifyin g and designing targeted interventions. This method serves a proactive approach for recognizing systemic threats and potentially mitigating the incidence of preventable errors. | IIIC |
| 124 | El-Hamamsy D, Walton TJ, Griffiths TRL, Anderson ES, Tincello DG. Surgeon-team separation in robotic theaters: a qualitative observational and interview study. Female Pelvic Med Reconstr Surg. 2020;26(2):86–91 | Nonexperimental | 25 procedures (2o robotic) | n/a | n/a | Communication challenge, surgeon immersion versus distraction, and emotional impact. | Surgeon team separation in robotic theaters poses communication challenges which impacts on situational awareness and staff emotions. | IIIB |
| 125 | Mackenzie S, Foran P. The impact of distractions and interruptions in the operating room on patient safety and the operating room team: an integrative review. J Perioper Nurs. 2020;33(3):Article 6 | Systematic Review | n/a | n/a | n/a | n/a | The literature review confirms distraction and interruptions occure on average every six minutes. The impact of these distractions can be mitigated by nurses through education and development of polices. | IIIB |
| 126 | Levesque M, Etherington C, Lalonde M, Stacey D. Interprofessional collaboration in the OR: a qualitative study of nurses' perspectives. AORN J. 2022;116(4):300–311 | Qualitative | n=19 candadian perioperative nurses | n/a | n/a | IPC | This study explored nurse's perspectives on their contributions to interprofessional collaboration (IPC). Created Interprofessional education for collaborative Patient-centered practice: An evolving Framework | IIIA |

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|---|---|---|---|---|---|---|---|---|
| 127 | Göras C, Nilsson U, Ekstedt M, Unbeck M, Ehrenberg A. Managing complexity in the operating room: a group interview study. BMC Health Serv Res. 2020;20(1):440 | Organizational Experience | One facility's OR staff | n/a | n/a | n/a | In one facility in Sweden interviews with nurses, nurse anesthetists and assisting surgeons revealed three generic categories for crating safe care in the OR: preconditions and resources, planning and preparing for the expected and unexpected, and adapting to the unexpected. | VA |
| 128 | McCulloch P, Morgan L, New S et al. Combining systems and teamwork approaches to enhance the effectiveness of safety improvement interventions in surgery: the Safer Delivery of Surgical Services (S3) Program. Ann Surg. 2017;265(1):90–96 | Quasi-experimental | 453 operations in 5 UK hospitals (255 intervention, 198 control) | Teamwork training (TT), system redesign and standardization (SOP), Lean quality improvement SOP+TT combination or Lean +TT | No training | Team technical and nontechnical performance and WHO checklist compliance measured for 3 months before and after intervention. | The evidence of for benefit from a combined approach at a modest increase in cost over single intervention approach. | IIB |
| 129 | Creating a Culture of Collaboration between Nursing and Support Services in the Clinical Setting. American Organization for Nurse Leadership (AONL). Accessed November 1, 2023. https://www.aonl.org/creating-culture-collaboration-between-nursing-and-support-services-clinical-setting | Expert Opinion | n/a | n/a | n/a | n/a | White paper examines the relationship between nursing and support service functions within a hospital setting. | VA |
| 130 | Almeras C, Almeras C. Operating room communication in robotic surgery: place, modalities and evolution of a safe system of interaction. J Visc Surg. 2019;156(5):397–403 | Qualitative | n = 130 questionnaires | n/a | n/a | feelings and the expectations of the diffeent members of the operating room team in terms of communication during a robotic surgery with remote operator immersion | The operator loses non-verbal exchange and becomes cut off from the surgical environmnet | IIIC |
| 131 | Hardie JA, Oeppen RS, Shaw G, Holden C, Tayler N, Brennan PA. You have control: aviation communication application for safety-critical times in surgery. Br J Oral Maxillofac Surg. 2020;58(9):1073–1077 | Literature Review | n/a | n/a | n/a | n/a | This review covered concepts of 'sterile cockpit' and the use in safety-crititcal moments in health care. | VB |
| 132 | Ivarsson J, Åberg M. Role of requests and communication breakdowns in the coordination of teamwork: a video-based observational study of hybrid operating rooms. BMJ Open. 2020;10(5):e035194 | Organizational Experience | n=12 | n/a | n/a | n/a | The results suggest the possiblity of devising an interactional framework to minimise problems with communication. By making the distinction between different types of requests explicit, certain ambiguities can be mitigated. Conversational repairs are central in establishing a joint understanding. | VA |
| 133 | D'Agostino TA, Bialer PA, Walters CB, Killen AR, Sigurdsson HO, Parker PA. A communication training program to encourage speaking-up behavior in surgical oncology. AORN J. 2017;106(4):295–305 | Qualitative | 35 surgical oncology staff members focus group and 42 completed a communication training program | n/a | n/a | Increased communication about patient safety concerns | Participants reported significant improvement in communication patient safety concerns and training demonstrates the potential to improve team communication. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 134 | Pattni N, Arzola C, Malavade A, Varmani S, Krimus L, Friedman Z. Challenging authority and speaking up in the operating room environment: a narrative synthesis. Br J Anaesth. 2019;122(2):233–244 | Systematic Review | n/a | n/a | n/a | n/a | Promoting speaking up within health teams requires organizations to cultivate a culture of open, safe communication by education regarding the importance of speaking up. | IIIA |
| 135 | Long J, Jowsey T, Garden A, Henderson K, Weller J. The flip side of speaking up: a new model to facilitate positive responses to speaking up in the operating theatre. Br J Anaesth. 2020;125(6):1099–1106 | Qualitative | n=79 participants | n/a | n/a | content of speakers message, message interpretation of receiver, and receivers response. | Speaking up can be stressful for all team members - the speaker, the reciever and the rest of the team. The recievers response can improve team cohesion. The researchers presented a theory that covers influence on this interaction and optimizing the responses. | IIIB |
| 136 | Quintana D. Surgical conscience: a concept analysis for perioperative nurses. AORN J. 2022;116(6):533–546 | Literature Review | n/a | n/a | n/a | n/a | Using system based analysis, the state if the science showed that surgical conscience is an active and influential aspect of perioperative nursing. Surgical conscience begins with the knowledge of the principles of aseptic technique, infection control, and safety and is supported with constant awareness of surroundings, self-awareness, and self evaluation to maintain sterile integrity. Upholding surgical conscience involves ethical and moral decision making and an obligation to speak and act with courage to benefit the patient. | VA |
| 137 | Bracq MS, Michinov E, Le Duff M, Arnaldi B, Gouranton V, Jannin P. "Doctor, please": educating nurses to speak up with interactive digital simulation tablets. Clin Simulation Nurs. 2021;54:97–104 | Organizational Experience | 33 students in a French school for scrub nurses | n/a | n/a | n/a | A simulation vignette was used on tablet. The Scrub nurse was asked whether they would point out the error, whether they would be embarrassed and how they would do it. Nurses expressed greater embarrassment with a colleague of a different satus. This scenario was well accepted and could be used to train other health professionals | VA |
| 138 | Kim S, Frans E, Bohannon I et al. "Hot seat" simulation model for conflict resolution: a pilot study. J Healthc Qual. 2018;40(4):177–186 | RCT | N=60 | 3h conflict resolution trainig session | 30 participants were in control group and 30 paricipants received the conflict managerment training | Evaluation of partipants conflict resolutionskills in veidotaped simulations with actors protraying interprofessional colleagues. | The pilot results suggest that a health care-specific approach to conflict resolution can be effectively taught through facilitated practice, coaching and feedback | IB |
| 139 | Clark CM, Kenski D. Promoting civility in the OR: an ethical imperative. AORN J. 2017;105(1):60–66 | Case Report | n/a | n/a | n/a | n/a | When nurses speak up and resolve issues, they repot better patient outcomes, greater satisfaction in the workplace and heightened organizational commitment. | VA |
| 140 | Sentinel Event Alert 58: Inadequate hand-off communication. The Joint Commission. September 12 , 2017. Accessed November 1, 2023. https://www.jointcommission.org/-/media/tjc/newsletters/sea-58-hand-off-comm-9-6-17-final2.pdf | Expert Opinion | n/a | n/a | n/a | n/a | Problems with inadequate handovers highlighted from JC. | |

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|---|---|---|---|---|---|---|---|---|
| 141 | Hoonakker PLT, Wooldridge AR, Hose BZ et al. Information flow during pediatric trauma care transitions: things falling through the cracks. Intern Emerg Medicine. 2019;14(5):797–805 | Nonexperimental | 18 clinicians in the ED, OR and Peds ICU in one facility | n/a | n/a | Communication and coordination and cooperation among team members | Important patient care information is lost when handing off patients, better ways to manage information is needed. | IIIC |
| 142 | Lazzara EH, Keebler JR, Simonson RJ, Agarwala A, Lane-Fall MB. Navigating the challenges of performing anesthesia handoffs and conducting anesthesia handoff research. Int Anesthesiol Clin. 2020;58(1):32–37 | Expert Opinion | n/a | n/a | n/a | n/a | Provides some ideas for strengthening anesthesia handoff research | VA |
| 143 | Krishnan S, Wheeler KK, Pimentel MP, Vacanti JC, Urman RD. The nature of reported safety events related to care coordination in the operating room setting in a tertiary academic center. J Healthc Risk Manag. 2022;41(3):25–29 | Organizational Experience | n=7,827 adverse event reports | n/a | n/a | n/a | 61.2% of the reports were filed by nurses and 5.6% by physicicans. This institution studied one specific category of advers events- coordination of care. They found that insufficient handoff (15%-26.9%). Communication failures were judged to be one of leading causes of inadvertent harm. | VA |
| 144 | Faiz T, Saeed B, Ali S, Abbas Q, Malik M. OR to ICU handoff: theory of change model for sustainable change in behavior. Asian Cardiovasc Thorac Ann. 2019;27(6):452–458 | Quasi-experimental | Preintervention-49 handovers, postintervention-29 handovers, 6 monts post intervention-51 handovers | Handover tool | Before the handover tool | Quality of knowledge transfer and staff satisfaction | Theroy of change model was a highly effective tool to implement the handover tool which improved the quality of knowledge transfer and overall staff satisfaction. | IIA |
| 145 | Tun KS, Wai KS, Yin Y, Thein MK. Postoperative handover among nurses in an orthopedic surgical setting in Myanmar: a best practice implementation project. JBI Database System Rev Implement Rep. 2019;17(11):2401–2414 | Organizational Experience | One 500 bed hospital, ortho service | n/a | n/a | n/a | Implemented a atructured hand over tool with significant improvement over baseline. | VB |
| 146 | Lillibridge N, Botti M, Wood B, Redley B. An observational study of patient care outcomes sensitive to handover quality in the postanaesthetic care unit. J Clin Nurs. 2017;26(23-24):4786–4794 | Nonexperimental | 31 handover observations in 3 hospitals | n/a | n/a | To identify patient care outcomes sensitive to the quality of the handover | Standardizing handover processes and content to include key recommendations for pain management and recognition and responses to clinical deterioration can improve patient outcomes of PACU care and reduce time wasted by nurses seeking missing information. | IIIB |
| 147 | López-Parra M, Porcar-Andreu L, Arizu-Puigvert M, Pujol-Caballé G. Cohort study on the implementation of a surgical checklist from the operating room to the postanesthesia care unit. J Perianesth Nurs. 2020;35(2):155–159 | Quasi-experimental | 59 handovers pre intervention and 63 transfers after the intervention | Structured handover checklist | Before intervention was implemented | Transfer of relevant and correct information, time, interruptions and satisfaction | A structured handover process minimizes the loss of relevant information and improves safety. | IIB |
| 148 | Servas L, Hayes C, Mayhorn T, Milner KA. Navigating the path to a sustainable "PACU pause" and standardized perioperative handoff: a quality improvement project. J Perianesth Nurs. 2022;37(1):44–47 | Organizational Experience | Level II Trauma Center | n/a | n/a | n/a | Developed a pause and standardized handover process from OR to PACU which improved the quality of the handover at this facility. | VA |

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|---|---|---|---|---|---|---|---|---|
| 149 | Amon CC, Paley AR, Forbes JA et al. Implementing structured handoffs to verify operating room blood delivery using a quality academy training program: an interrupted time-series analysis. Int J Qual Health Care. 2021;33(2):mzab061 | Quasi-experimental | 2606 blood deliveries | Structured hand offs | Standard blood delivery before the intervention | Verified blood deliveries | Implementing a structured hand off resulted in a significant increase in verified blood deliveries. | IIA |
| 150 | Hong Mershon B, Vannucci A, Bryson T et al. A collaborative partnership between the multicenter handoff collaborative and an electronic health record vendor. Appl Clin Inform. 2021;12(3):647–654 | Consensus | n/a | n/a | n/a | n/a | A collaborative partnership the Multicenter Handoff Colloborative and an EHR vendor worked on a handover tool that is standardized but customizable and in the HER | VA |
| 151 | Jaulin F, Lopes T, Martin F. Standardised handover process with checklist improves quality and safety of care in the postanaesthesia care unit: the Postanaesthesia Team Handover Trial. Br J Anaesth. 2021;127(6):962–970 | Quasi-experimental | 266 adult patients in the checklist group and 267 in the control group | Postanesthesia Team Handover (PATH) checklist | No checklist use | Rate of hyoxemic events post op and hypotension, PONV, excessive postop pain, LOS in the PACU, duration of handover, calls from PACU to the OR team, interuptions and nurse satisfaction as secondary outcomes | Implementation of the checklist was associated with a reduction in the rate of hypoxemic events, less interruptions. | IIA |
| 152 | Rhudy LM. Handoff from operating room to intensive care unit: specific pathways to decrease patient adverse events. Nurs Clin North Am. 2019;54(3):335–345 | Literature Review | n/a | n/a | n/a | n/a | Summary of key points around handoffs and patient safety, success, content, standardization, future research | VA |
| 153 | Kitney P, Tam R, Bramley D, Simons K. Handover using ISBAR principles in two perioperative sites – a quality improvement project. J Perioper Nurs. 2020;33(4):Article 7 | Organizational Experience | 2 facilities | n/a | n/a | n/a | This is a follow up to the above study, the overall complance with the handover implemented improved over time. | VA |
| 154 | Friend K, Hook L, Joshi ART. Improving information transfer during transitions of care via standardized handoffs. Am Surg. 2018;84(7):1169–1174 | RCT | 28 surgical residents | 5 standardized handover tools | No handover tool | Improvement of information transfer and reduction in medical errors. | The . SIGNOUT? led to a statistically significant improvement of transmission of information when compared with the control model. More research needed to identify the best handover method but a method should be used to improve transitions of care. | IB |
| 155 | Agarwala AV, Lane-Fall MB, Greilich PE et al. Consensus recommendations for the conduct, training, implementation, and research of perioperative handoffs. Anesth Analg. 2019;128(5):e71–e78 | Nonexperimental | prospective 4 round modified Delphi process 99 participants | n/a | n/a | Consensus statements | Findings suggest activities that health care organizations and individual practitioners can implement to improve handoff processes and reduce harm. | IIIA |
| 156 | Thaeter L, Schröder H, Henze L et al. Handover training for medical students: a controlled educational trial of a pilot curriculum in Germany. BMJ Open. 2018;8(9):e021202 | Quasi-experimental | 147 4th year medical students, 78 no training in handovers and 69 handover training | Standardized handover training in curriculum | Handover training not in curriculum | attitude, confidence and knowledge towards handover and patient safety | There was a significant increase in knowledge and self confidence as well as accurate handover performance in the handover training group. | IIB |

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|---|---|---|---|---|---|---|---|---|
| 157 | Kitney P, Bramley D, Tam R, Simons K. Perioperative handover using ISBAR at two sites: a quality improvement project. Phase 2: Observation of the quality of handovers since inception of project including initial assessment of all other handovers points. J Perioper Nurs. 2018;31(4):Article 3 | Quasi-experimental | 413 handovers in various locations in 2 hospitals | Training and education including simulation. Developed cue cards | Before training and education | Differences in compliance pre and post training | The education program produced statistically significant results for compliance with handovers. | IIB |
| 158 | Piazza AJ, Brozanski B, Grover T et al. STEPP IN: a multicenter quality improvement collaborative standardizing postoperative handoffs. Pediatrics. 2021;148(6):e2020016402 | Nonexperimental | 181 postop handoffper month for 12 months, 320 respondents per month assessed the handoff process. | n/a | n/a | Reduce care failures | Team engagement had a positive impact on the perioperative handoff process and improved care was demonstrated by a decrease in postoperative care failures and high provider satisfaction. | IIIA |
| 159 | Massa S, Wu J, Wang C, Peifer H, Lane-Fall MB. Interprofessional training and communication practices among clinicians in the postoperative ICU handoff. Jt Comm J Qual Patient Saf. 2021;47(4):242–249 | Nonexperimental | 130 OR personnel in one facility, interviews and survey | n/a | n/a | Characterize communication training, practices and preferences of interprofessional clinicians who participate in OR to ICU handoffs. | Education should be focused on interprofessional to improve communication | IIIB |
| 160 | Wooldridge AR, Carayon P, Hoonakker P et al. Care transition of trauma patients: processes with articulation work before and after handoff. Appl Ergon. 2022;98:103606 | Organizational Experience | 29 physicians and nurses surveyed | n/a | n/a | n/a | The benefit of using SEIPS tools by clinicians and support of handoffs. | VB |
| 161 | Webster KLW, Keebler JR, Lazzara EH, Chaparro A, Greilich P, Fagerlund A. Handoffs and teamwork: a framework for care transition communication. Jt Comm J Qual Patient Saf. 2022;48(6-7):343–353 | Expert Opinion | n/a | n/a | n/a | n/a | Identification and understanding of the relationships between factors that contribute to handoff success and failure is paramount to improving healthcare communication. This theoretical model provides a foundation for further research, potential interventions, measurement, and organizational policy. | VA |
| 162 | Loh HP, de Korne DF, Chee SP, Mathur R. Reducing wrong intraocular lens implants in cataract surgery. Int J Health Care Qual Assur. 2017;30(6):492–505 | Nonexperimental | Tertiary academic eye center. | Systems Engineering Intiative for Patient Safety Framework | n/a | Incidence of wrong lens implant. | The SEIPS framework seems to be helpful to assess components involved and develop sustainable quality and safety interventions that intervene at different levels of the system. The SEIPS model is supportive to address differences between person and system root causes comprehensively and thereby foster quality and patient safety culture | IIIB |
| 163 | Alidina S, Goldhaber-Fiebert SN, Hannenberg AA et al. Factors associated with the use of cognitive aids in operating room crises: a cross-sectional study of US hospitals and ambulatory surgical centers. Implement Sci. 2018;13(1):50 | Nonexperimental | 368 respondants who downloaded cognitive aids from the Ariadne Labs website in US hospitals and ASCs | n/a | n/a | Context and use of cognitive aids for an OR crises. | Successful implementation of the crisis checklist (cognitive aid) resulted in an increase of their use which may improve patient outcomes. | IIIA |

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|---|---|---|---|---|---|---|---|---|
| 164 | Linqvist Leonardsen AC, Klavestad Moen E, Karlsøen G, Hovland T. A quantitative study on personnel's experiences with patient handovers between the operating room and the postoperative anesthesia care unit before and after the implementation of a structured communication tool. Nurs Rep. 2019;9(1):1–5 | Quasi-experimental | 116 nurses before implementation and 90 after implementation | Structured hand over tool | Before intervention was implemented | Quality of handovers | Handovers improved significantly. Relevant patient information was coummunicated, ambiguities resolved and documentation was more complete | IIB |
| 165 | Hall M, Robertson J, Merkel M, Aziz M, Hutchens M. A structured transfer of care process reduces perioperative complications in cardiac surgery patients. Anesth Analg. 2017;125(2):477–482 | Quasi-experimental | 550 hand overs pre intervention and 577 after intervention | comprehensive multidisciplinary transfer of care process | Pre intervention | Preventable postoperative complications | Patients experienced fewer preventable complications | IIA |
| 166 | Dusse F, Pütz J, Böhmer A, Schieren M, Joppich R, Wappler F. Completeness of the operating room to intensive care unit handover: a matter of time? BMC Anesthesiol. 2021;21(1):38 | Nonexperimental | 102 handovers in a single institution | n/a | n/a | Completeness of information transfer, loss of information during post-op handovers | Handover completeness is affected by time pressure, interruptions, and inappropriate surroundings, which increase the risk of information loss. To improve completeness and ensure patient safety, an adequate time span for handover, and the implementation of communication tools are required. | IIIB |
| 167 | Keebler, Joseph R., Lazzara, Elizabeth H., Patzer, Brady S., et al. Meta-Analyses of the Effects of Standardized Handoff Protocols on Patient, Provider, and Organizational Outcomes 2016 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | Hand off protocols tend to improve results on multiple levels, including information passesand patient, provider and prganizational outcomes. Publication bias exists in the literature and negative outcomes are also discussed. | IIA |
| 168 | Brennan PA, Brands MT, Caldwell L et al. Surgical specimen handover from the operating theatre to laboratory – can we improve patient safety by learning from aviation and other high-risk organisations? J Oral Pathol Med. 2018;47(2):117–120 | Expert Opinion | n/a | n/a | n/a | n/a | Human error in handovers with specimens reviewed and a novel checklost to reduce processing and mislabelling errors | VB |
| 169 | Lambert LH, Adams JA. Improved anesthesia handoff after implementation of the Written Handoff Anesthesia Tool (WHAT). AANA J. 2018;86(5):361–370 | Quasi-experimental | 13 CRNAs and 13 PACU RNs | The Written Handoff Anesthesia Tool | Before intervention was implemented | Identify barriers and omission in anesthesial handoffs between CRNAs and PACu RNs. Secondary was to improve perception and satisfaction with anesthesia handoff communication. | Adequacy of the handoff process was significantly improved for CRNA to PACU RN as well as CRNA to CRNA handoffs. Satisfaction was also significantly improved. | IIA |
| 170 | Lazzara EH, Simonson RJ, Gisick LM et al. Does standardisation improve post-operative anaesthesia handoffs? Meta-analyses on provider, patient, organisational, and handoff outcomes. Ergonomics. 2022;65(8):1138–1153 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | standardised post-operative anaesthesia handoffs changed all listed outcomes in a positive direction. | IIA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 171 | Jullia M, Tronet A, Fraumar F et al. Training in intraoperative handover and display of a checklist improve communication during transfer of care: an interventional cohort study of anaesthesia residents and nurse anaesthetists. Eur J Anaesthesiol. 2017;34(7):471–476 | Quasi-experimental | 204 intraoperative handovers between anesthesia providers in 2 hospitals | Training and display of the checklist | No training or display of the checklist | Improved communication | Intraoperative handover training and display of a checklist improved the intraoperative transfer of care in anesthesia | IIA |
| 172 | Rambourg J, Gaspard-Boulinc H, Conversy S, Garbey M. A continuum of interfaces to engage surgical staff in efficient collaboration. J Med Syst. 2019;43(7):184 | Expert Opinion | n/a | n/a | n/a | n/a | A study and solution for improved communication between front desk and OR suites. Utilizes a electonic whiteboard to communicate progress of surgical procedure along with cameras to track key time stamps ie patient in room, intubation, incision closed, extubation. | VA |
| 173 | Abraham J, King CR, Meng A. Ascertaining design requirements for postoperative care transition interventions. Appl Clin Inform. 2021;12(1):107–115 | Nonexperimental | 24 participants, anesthesia and nursing representatives | n/a | n/a | identify factors affecting sustainability of hand-offs, develop and prototype hand-off interventions, explore the potential role of AI | insights from this study point to an EHR integrated flexible hand-off or adaptive care transistion intervention using an AI generated tailored hand-off summary and risk based interventions that is easily accessible to interdisciplinary sending and recieving teams. | IIIB |
| 174 | Frasier LL, Pavuluri Quamme SR, Wiegmann D, Greenberg CC. Evaluation of intraoperative hand-off frequency, duration, and context: a mixed methods analysis. J Surg Res. 2020;256:124–130 | Nonexperimental | 10 surgeries lasting over 3 hours | n/a | n/a | Intraoperative Hand off coordination and impact | Intraoperative Hand offs were frequent but not well coordinated, happening during counts and other hand offs. | IIIB |
| 175 | Rose MW, Newman S, Brown C. Postoperative information transfers: an integrative review. J Perianesth Nurs. 2019;34(2):403–424 | Systematic Review | n/a | n/a | n/a | n/a | Developing an instrument to improve postoperative handovers should integrate recommendations from key stakeholders, integrate evidence-based practices and reference information from existing instruments. | IIIA |
| 176 | Gleadall R, Masiglat C, Hutter S, Sanariz S. SWITCH-ing in the perioperative setting. ASORN Insight. 2018;43(2):27–30 | Organizational Experience | One opthamology facility-7 ORs | n/a | n/a | n/a | Implemented a modified SWITCH hand off intraoperative tool which was concluded to be a standardized, easy to use and effective means for capturing essential elements for intraoperative hand off reporting | VB |
| 177 | Sexton P, Whiteman K, George EL, Fanning M, Stephens K. Improving PACU throughput using an electronic dashboard: a quality improvement initiative. J Perianesth Nurs. 2022;37(5):613–619 | Organizational Experience | Level I Trauma Center | n/a | n/a | n/a | Implemented a nursing patient dashboard in the EMR to be used during patient handovers. Along with a verbal report, improved handover and patient throughput. | VA |
| 178 | Shah AC, Oh DC, Xue AH, Lang JD, Nair BG. An electronic hand-off tool to facilitate transfer of care from anesthesia to nursing in intensive care units. Health Informatics J. 2019;25(1):3–16 | Organizational Experience | Academic Medical Center | n/a | n/a | n/a | Implemented an electronic handover tool from anesthesia to nursing in the ICU. Overall quality of handoff was improved. Omissions were improved because memory wasn't relied upon. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 179 | Sun YK, Shih WC, Cheng KH. An electronic handover system to improve information transfer for surgical patients. Comput Inform Nurs. 2018;36(12):610–614 | Nonexperimental | 20 nursing handovers | n/a | n/a | Efficacy and satisfaction of an electronic handover tool | Improved communication and decreased handover time. | IIIB |
| 180 | Abraham J, Meng A, Tripathy S, Avidan MS, Kannampallil T. Systematic review and meta-analysis of interventions for operating room to intensive care unit handoffs. BMJ Qual Saf. 2021;30(6):513–524 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | The handoff intervention group had statistically significant improvments in time to analgesia dosing, fewer information omissiona, fewer technical errors, and greater information sharing. Heterogeneity must be accounted for and implications from OR to ICU handoff practice are discussed. | IIIA |
| 181 | Appelbaum RD, McCullough MA, Barnett RS et al. Improving the culture of safety: a prospective handoff initiative from the operating room to the trauma intensive care unit. Am Surg. 2022;88(7):1584–1587 | Organizational Experience | One trauma hospital | n/a | n/a | n/a | Standardizing an OR to intensive care unit handoff clarifies expectations and improves care team satisfaction. | VA |
| 182 | Bonds RL. SBAR tool implementation to advance communication, teamwork, and the perception of patient safety culture. Creat Nurs. 2018;24(2):116–123 | Organizational Experience | Large training military hospital | n/a | n/a | n/a | Created a customized SBAR tool for handovers between SICU and the OR, standardized communication increased by 100% and documentation of antibiotic administration increased by 43%, reinforced current evidence supporting the use of standardized handoff communication. | VA |
| 183 | Caruso TJ, Marquez JLS, Gipp MS, Kelleher SP, Sharek PJ. Standardized ICU to OR handoff increases communication without delaying surgery. Int J Health Care Qual Assur. 2017;30(4):304–311 | Quasi-experimental | 28 handovers pre-intervention and 29 handovers post intervention. | Structured Handoff process | Before the handoff process | Frequency of formal handoff occurrence and transport readiness. secondary outcome measures were: frequency of on-time first case surgery starts, average duration of first case delays, turnover times for non-first case surgeries, and anesthesiologist satisfaction with the ICU to | A standardized, team based ICU to OR handoff increased the frequency of face-to-face handoffs, patient readiness and anesthesia provider satisfaction within increasing turnover between cases | IIA |
| 184 | Geoffrion TR, Lynch IP, Hsu W et al. An implementation science approach to handoff redesign in a cardiac surgery intensive care unit. Ann Thorac Surg. 2020;109(6):1782–1788 | Organizational Experience | 1 facility OR | n/a | n/a | n/a | Redesigned and implemented a hand over process from the OR to ICU, rapid cycle process improvement reduced the hand over duration and demonstrated 23 hand off best practices. | VA |
| 185 | Hamid S, Joyce F, Burza A et al. OR and ICU teams “running in parallel” at the end of cardiothoracic surgery improves perceptions of handoff safety. BMJ Open Qual. 2021;10(1):e001001 | Organizational Experience | One hospital OR to CVICU handoff | n/a | n/a | n/a | Team developed a novel handoff protocol after cardiac surgery to increase postive response rates to handoff safety questions. Using a PDCA method over the course of 123 handoffs and after 10 months achieved their aim of changing perceptions of safety. They have an ICU team run in parallel with the surgical team and it postively impacted safety culure. | VA |

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|---|---|---|---|---|---|---|---|---|
| 186 | Hebballi NB, Gupta VS, Sheppard K et al. Standardization of pediatric noncardiac operating room to intensive care unit handoffs improves communication and patient care. J Patient Saf. 2022;18(6):e1021–e1026 | Organizational Experience | One pediatric hospital OR to ICU | n/a | n/a | n/a | Standardized handoffs for pediatric noncardiac surgical patients from the OR to the ICU can improve provider attendance and communication. | VA |
| 187 | Kumar S, McKean AR, Ramwell A, Johnston C, Leaver S. Optimizing postoperative handover to the intensive care unit at a tertiary centre. Br J Hosp Med (Lond). 2017;78(1):12–15 | Organizational Experience | A tertiary care center | n/a | n/a | n/a | Implemented a series of simple handover interventions which resulted in a more effective handover from postop to ICU. | VA |
| 188 | Lane-Fall MB, Christakos A, Russell GC et al. Handoffs and transitions in critical care – understanding scalability: study protocol for a multicenter stepped wedge type 2 hybrid effectiveness – implementation trial. Implement Sci. 2021;16(1):63 | Quasi-experimental | 4 person (surgeon, anesthesia provider, ICU nurse, ICU provider) teams in 12 ICUs, 5 health systems | Standardized hand offs from OR to ICU-customized protocol | Before intervention was implemented | fidelity to the customized hadoff protocol and a composite measure of new-onset organ failure cases | This is the description of the study, has not been conducted yet. | IIA |
| 189 | Lane-Fall MB, Pascual JL, Massa S et al. Developing a standard handoff process for operating room-to-ICU transitions: multidisciplinary clinician perspectives from the Handoffs and Transitions in Critical Care (HATRICC) Study. Jt Comm J Qual Patient Saf. 2018;44(9):514–525 | Qualitative | Interviews with 62 individuals directly involved in OR to ICU handoffs. 2 focus groups with 16 CRNAs and one focus group with 2 residents and one critical care fellow | n/a | n/a | Barriers | Several barriers were identified, time pressure, unclear expectations and confusion about the other clinicians' informational needs. | IIIA |
| 190 | Lane-Fall MB, Pascual JL, Peifer HG et al. A partially structured postoperative handoff protocol improves communication in 2 mixed surgical intensive care units: findings from the Handoffs and Transitions in Critical Care (HATRICC) Prospective Cohort Study. Ann Surg. 2020;271(3):484–493 | Quasi-experimental | 2 surgical ICUs in 2 hospitals, 68 preintervention handoffs and 97 post intervention handoffs | Standardized handoff protocol | Before intervention was implemented | Omissions | Handoffs significantly improved information exchange, there was a increase in handoff duration | IIA |
| 191 | Lupei M, Munshi N, Kaizer AM, Patten L, Wahr J. Implementation and 1-year follow-up of the cardiovascular ICU standardised handover. BMJ Open Qual. 2021;10(3):e001063 | Organizational Experience | One hospital OR to CVICU | n/a | n/a | n/a | Provider satisfaction was increased, more team members participated and the transfer of information increased | VA |
| 192 | Malenka EC, Nett ST, Fussell M, Braga MS. Improving handoffs between operating room and pediatric intensive care teams: before and after study. Pediatr Qual Saf. 2018;3(5):e101 | Organizational Experience | OR to PICU handovers in one facility | n/a | n/a | n/a | Standardization of OR to PICU handover process using a predetermined checklist can improve the completeness of information transfer without increasing the length of the handoff. | VA |
| 193 | Mukhopadhyay D, Wiggins-Dohlvik KC, MrDutt MM et al. Implementation of a standardized handoff protocol for post-operative admissions to the surgical intensive care unit. Am J Surg. 2018;215(1):28–36 | Quasi-experimental | 31 OR handoffs before implementation and 31 after of the same OR team OR to ICU handoffs | Handoff protocol | Before intervention was implemented | Improvements in practitioner involvemen and communication | Significantly improved caregiver involvement and reduced information omission withour affecting provider time commitment. | IIB |

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|---|---|---|---|---|---|---|---|---|
| 194 | Riley CM, Merritt AD, Mize JM, Schuette JJ, Berger JT. Assuring sustainable gains in interdisciplinary performance improvement: creating a shared mental model during operating room to cardiac ICU handoff. Pediatr Crit Care Med. 2017;18(9):863–868 | Organizational Experience | One peds hospital | n/a | n/a | n/a | New handover process with a new algorithm was effective in creating and sustaining high levels of staff communication and adherence to the handover process. | VA |
| 195 | Marshall AP, Tobiano G, Murphy N et al. Handover from operating theatre to the intensive care unit: a quality improvement study. Aust Crit Care. 2019;32(3):229–236 | Organizational Experience | 16 pre-intervention handovers and 15 after intervention handovers from OR to ICU in one hospital | n/a | n/a | n/a | Anesthetists lead the handovers and did not use the checklist because they did not view it as beneficial, handover practice was improved, need target strategies to improve use and sustainability. | VB |
| 196 | Karamchandani K, Fitzgerald K, Carroll D et al. A multidisciplinary handoff process to standardize the transfer of care between the intensive care unit and the operating room. Qual Manag Health Care. 2018;27(4):215–222 | Organizational Experience | OR and ICU in one large academic medical center | n/a | n/a | n/a | Developed a standardized hand over tool and checklist with good compliance and overall satisfaction. | VA |
| 197 | Chatterjee S, Shake JG, Arora RC et al. Handoffs from the operating room to the intensive care unit after cardiothoracic surgery: from the Society of Thoracic Surgeons Workforce on Critical Care. Ann Thorac Surg. 2019;107(2):619–630 | Systematic Review | n/a | n/a | n/a | n/a | A dedicated hand over process is associated with improved hand-off completeness, fewer adverse events, improved compliance with process measures and provider satisfaction. | IIIA |
| 198 | Krimminger D, Sona C, Thomas-Horton E, Schallom M. A multidisciplinary QI initiative to improve OR-ICU handovers. Am J Nurs. 2018;118(2):48–59 | Organizational Experience | 38 patients pre and post process improvement were observed | n/a | n/a | n/a | Post QI initiative which was the development of a new handover procedure for OR to ICU handovers, There was a decrease in process and information sharing errors and increased provider satisfaction with no increase in handover time | VA |
| 199 | Zjadewicz K, Deemer KS, Coulthard J, Doig CJ, Boiteau PJ. Identifying what is known about improving operating room to intensive care handovers: a scoping review. Am J Med Qual. 2018;33(5):540–548 | Literature Review | n/a | n/a | n/a | n/a | Published literature suggests that there is a significant gap in evidence of measured patient outcomes from standardization of OR to ICU handover processes. Identifying formal QI strategies used to sustain standardized handover processes will allow accurate measurement of patient outcomes. | VA |
| 200 | Abraham J, Meng A, Sona C, Wildes T, Avidan M, Kannampallil T. An observational study of postoperative handoff standardization failures. Int J Med Inform. 2021;151:104458 | Nonexperimental | 84 clinicians, 29 hand-offs, 17 interviews | n/a | n/a | highlight compliance failures, factors contributing to commpliance failures, develop guidelines for hand-offs | Compliance failures are prevelant at all stages of the hand-off process. The researchers developed some guidance for flexible hand-offs from OR to ICU. | IIIA |
| 201 | Fruhen L, Carpini JA, Parker SK, Leung Y, Flemming AFS. Perceived barriers to multiprofessional team briefings in operating theatres: a qualitative study. BMJ Open. 2020;10(2):e032351 | Qualitative | 103 operating room staff in 4 hospitals | n/a | n/a | Barriers to implementation of briefings | Key barrier was getting everyone into the room at the same time. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 202 | Forsyth KL, Hildebrand EA, Hallbeck MS, Branaghan RJ, Blocker RC. Characteristics of team briefings in gynecological surgery. Appl Ergon. 2019;78:263–269 | Nonexperimental | 24 team briefings | n/a | n/a | Understand the current state of pre-operative team briefings | Introductions occurred in only 25% of briefings, exhibited a herarchical structur with the surgeon speaking the most frequenty, resident-led briefings displayed a non-hierarchical structure with all team members communication with the resident. A standardized protocol is needed to improve variable communication betwenn the role leading and the team members present. | IIIB |
| 203 | Davidson M, Brennan PA. Leading article: What has an Airbus A380 captain got to do with OMFS? Lessons from aviation to improve patient safety. Br J Oral Maxillofac Surg. 2019;57(5):407–411 | Expert Opinion | n/a | n/a | n/a | n/a | Comparing OR care to the aviation industry discussing the importance of huddles and checklists. | VB |
| 204 | Lavin J, Walker A, Thompson DM et al. The impact of standardized huddle tools on case duration in pediatric microlaryngoscopy/bronchoscopy. Int J Pediatr Otorhinolaryngol. 2022;152:110974 | Organizational Experience | Peds microlaryngoscopy/bronchoscopy OR in one academic peds hospital | n/a | n/a | n/a | A standardized huddle tool was associated with a median decrease of 6 min of OR tine without a change in OR turnover time. | VA |
| 205 | Scofield H, Teigen K, Blair S, Rechter G, Webb B. Implementation of a preoperative huddle at a level 1 trauma center. J Patient Saf. 2022;18(4):e747–e752 | Organizational Experience | One trauma hospital | n/a | n/a | n/a | A preoperative huddle was created and implemented, helped to standardize communication without impacting work flow. | VA |
| 206 | Tyerman Z, Mehaffey JH, Hawkins RB et al. Nightly preoperative huddle email improves perioperative efficiency. Ann Thorac Surg. 2020;109(2):445–451 | Quasi-experimental | 643 pre-huddle cases and 437 huddle cases | Nightly huddle email | Pre-huddle | delays, in room to incision time and total minutes untilized | Implementation of the huddle improved delay time, on-time entry and long delay, strategies focused on optimizing perioperative care are beneficial to multidisciplinary teams. | IIB |
| 207 | Leong KBMSL, Hanskamp-Sebregts M, van der Wal RA, Wolff AP. Effects of perioperative briefing and debriefing on patient safety: a prospective intervention study. BMJ Open. 2017;7(12):e018367 | Quasi-experimental | 5 surgical teams of a tertiary care hosptial | Perioperative briefing and debriefin | 1 month before the intervention, 4 months after the intervention and 2.5 years after the intervention | Changes in team climate, team experience and duration of briefings | Significant increase in team climate, positve influence on the tas, higher efficiency with on-time starts and the briefings were less than 4 minutes. | IIB |
| 208 | Cumin D, Skilton C, Weller J. Information transfer in multidisciplinary operating room teams: a simulation-based observational study. BMJ Qual Saf. 2017;26(3):209–216 | Nonexperimental | 20 OR teams (surgeon, anesthesia, anesthesia tech, circulating nurse, scrub nurse, surgical assistant) 39 simulations | n/a | n/a | Communication of clinically relevant information during briefing and time outs. | Study supports the value of formal team communications during precase briefing, sign in and time out in the SSC, they also suggest suboptimal transmission of information between team members and unequal contributions of information by different professional groups. | IIIA |
| 209 | Aggarwal R, Plough A, Henrich N et al. The design of “Team-Birth”: a care process to improve communication and teamwork during labor. Birth. 2021;48(4):534–540 | Organizational Experience | Team development included obstetricians, researcers, designers and implementation scientists | n/a | n/a | n/a | Designe TeamBirth, an intrapartum care process composed of brief team meetings (“huddles”) between clinicians and patients. Process that promotes reliable and structured communication. | VA |

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|---|---|---|---|---|---|---|---|---|
| 210 | Ber R, London D, Senan S et al. Perioperative team communication through a mobile app for improving coordination and education in neurosurgery cases. J Neurosurg. 2021;136(4):1157–1163 | Organizational Experience | 637 surgical cases before intervention and 893 after | a standardized pre- and postoperative workflow that was executed through a mobile app prototype | n/a | n/a | This standardized workflow platform in the mobile app resulted in improved communication and a reduction in last minute requests that could impact costs. | VA |
| 211 | Revised Guidance Related to New & Revised Regulations for Hospitals, Ambulatory Surgical Centers (ASCs), Rural Health Clinics (RHCs) and Federally Qualified Health Centers (FQHCs). Centers for Disease Control and Prevention. January 30 , 2015. Accessed November 1, 2023. https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Policy-and-Memos-to-States-and-Regions-Items/Survey-and-Cert- | Regulatory | n/a | n/a | n/a | n/a | CMS revised guidance on the time-out process. | n/a |
| 212 | Implementation Manual WHO Surgical Safety Checklist 2009. World Health Organization. 2009. Accessed November 1, 2023. https://www.who.int/publications/i/item/9789241598590 | Guideline | n/a | n/a | n/a | n/a | Guideline for using WHO safe surgical checklist | IVA |
| 213 | Ishak B, Abdul-Jabbar A, Tawfik T et al. Prevention of wrong-level surgery in the thoracic spine: preoperative computer tomography fluoroscopy-guided percutaneous gold fiducial marker placement in 57 patients. Spine (Phila Pa 1976). 2020;45(24):1720–1724 | Nonexperimental | 57 patients who had CT flouro guided gold fiducial marker placement of the thoracic spine | n/a | n/a | patient outcomes, complications, and prevention of wrong level surgery | Gold fiducial marker placement is safe, feasible and accurate. | IIIB |
| 214 | Starling J 3rd, Coldiron BM. Outcome of 6 years of protocol use for preventing wrong site office surgery. J Am Acad Dermatol. 2011;65(4):807–810 | Organizational Experience | One Dermatology Clinic | n/a | n/a | n/a | Retrospective chart review of dermatology clinic to identify the number of wrong site surgeries. The chart review did not find any incidence of wrong site surgery but did find 18 cases where there was failure to identify the primary lesion. | VB |
| 215 | Wahr JA, Prager RL, Abernathy JH 3rd et al. Patient safety in the cardiac operating room: human factors and teamwork: a scientific statement from the American Heart Association. Circulation. 2013;128(10):1139–1169 | Guideline | n/a | n/a | n/a | n/a | Guideline for cardiac teams with recommendations to improve teamwork from literature review. | IVA |
| 216 | Zahiri HR, Stromberg J, Skupsky H et al. Prevention of 3 “never events” in the operating room: fires, gossypiboma, and wrong-site surgery. Surg Innov. 2011;18(1):55–60 | Literature Review | n/a | n/a | n/a | n/a | Recommendations to prevent never events - fire, gossypiboma, and wrong-site surgery. | VA |
| 217 | Clarke JR, Waddell L, Wolff DD Jr. Quarterly update on wrong-site surgery: how to do an effective time-out in the dark. Pa Patient Saf Advis. 2014;11(2):88–92 | Expert Opinion | n/a | n/a | n/a | n/a | This is a report on wrong site surgery of the eye during laser surgery and addresses how to do a time out in the dark. | VA |

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|---|---|---|---|---|---|---|---|---|
| 218 | Weiser TG, Berry WR. Review article: perioperative checklist methodologies. Can J Anesth. 2013;60(2):136–142 | Literature Review | n/a | n/a | n/a | n/a | Checklists can aid clinicians involved in complex processes and multidisciplinary team interactions to improve the quality and safety of care by prompting dialogue and exchange of information. | VB |
| 219 | Caruso TJ, Munshey F, Aldorfer B, Sharek PJ. Safety stop: a valuable addition to the pediatric Universal Protocol. Jt Comm J Qual Patient Saf. 2018;44(9):552–556 | Organizational Experience | One Pediatric OR | n/a | n/a | n/a | QI project, the facility implemented a safety stop which was performed prior to prep and draping. | VA |
| 220 | Montgomery K, Khan I, Thomson K, Wynne D. Improving the practice of the World Health Organisation's surgical pause checklist at a tertiary paediatric surgical unit. Scott Med J. 2016;61(2):88–91 | Organizational Experience | Peds surgical unit | n/a | n/a | n/a | Implemented a surgical pause checklist to use in time out, staff were engaged to create the checklist and a poster was developed, a better standard of patient safety was created. | VB |
| 221 | Freundlich RE, Bulka CM, Wanderer JP, Rothman BS, Sandberg WS, Ehrenfeld JM. Prospective investigation of the operating room time-out process. Anesth Analg. 2020;130(3):725–729 | Nonexperimental | 166 time outs | n/a | n/a | Compliance with each step, nonroutine events, distractions. | The time out can be completed quickly and efficiently but distractions may occur | IIIB |
| 222 | Maloley L, Morgan LA, High R, Suh DW. Wrong-site surgery in pediatric ophthalmology. J Pediatr Ophthalmol Strabismus. 2018;55(3):152–158 | Qualitative | 156 pediatric opthalmology surgeons | n/a | n/a | wrong site surgery, risk factors, years in practice, surgical experience, adherence to the Universal Protocol time out and OR factors | WWS has occurred, important practices should be adopted: makring the surgical site, designated individual leads the time-out, surgeon is involved directly in the time out process, surgeons who have been in practice more than 15 years may require additional safeguards. | IIIA |
| 223 | Korkiakangas T. Mobilising a team for the WHO Surgical Safety Checklist: a qualitative video study. BMJ Qual Saf. 2017;26(3):177–188 | Qualitative | 20 surgical cases | n/a | n/a | Examine the ways perioperative teams come together and their level of participation in the SSC. | Appropriate team practices to bring teams fully together is important-relevance to team training/implementation of the SSC. | IIIB |
| 224 | Kwofie, Kwesi, UKwofie K, Uppal V. Wrong-site nerve blocks: evidence-review and prevention strategies. Curr Opin Anaesthesiol. 2020;33(5):698–703Wrong-site nerve blocks: evidence-review and prevention strategies 2020 | Expert Opinion | n/a | n/a | n/a | n/a | Multiple strategies should be used such as preprocedural markings, well contructed checklists, time-out, cognitive and physical aids as well as education and empowerment to speak up. | VA |
| 225 | Barrington MJ, Uda Y, Pattullo SJ, Sites BD. Wrong-site regional anesthesia: review and recommendations for prevention? Curr Opin Anaesthesiol. 2015;28(6):670–684 | Literature Review | n/a | n/a | n/a | n/a | Wrong site anesthetic procedures occur and a time out should occur immediately before an invasive procedure. If more than one block is performed on one patient, it is recommended that the time out be repeated each time the patient position is changed or separated in time or performed by a different team. Anesthesia teams should implement guidelines and checklists to reduce the occurrence of wrong site regional anesthetic procedures. | VA |

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|---|---|---|---|---|---|---|---|---|
| 226 | Slocombe P, Pattullo S. A site check prior to regional anaesthesia to prevent wrong-sided blocks. Anaesth Intensive Care. 2016;44(4):513–516 | Organizational Experience | Two hospitals, 274 patients undergoing regional blocks | n/a | n/a | n/a | Implemented a pause before regional blocks, uptake was not very good, only about 57% of blocks confirmed the site. Concluded that education was insufficient, suggest adding to the SSC | VA |
| 227 | Mancone AG, Dickey AR, Fitzgerald BM, Kraus GP, Dhanjal ST. LAST double check - a comprehensive pre-regional checklist for the busy institution. Mil Med. 2018;183(9-10):e281–e285 | Organizational Experience | Pre-regional block checklist implementation in one hospital | n/a | n/a | n/a | Created the LAST Double Check for use in all locations where regional anesthesia is performed. The ais was to prevent errors associated with wrong site blocks. 1,000 regional blocks were performed using the checklsit with no events reported. | VA |
| 228 | Deutsch ES, Yonash RA, Martin DE, Atkins JH, Arnold TV, Hunt CM. Wrong-site nerve blocks: a systematic literature review to guide principles for prevention. J Clin Anesth. 2018;46:101–111 | Systematic Review | n/a | n/a | n/a | n/a | There is a lack of reporting criteria and divergence in the data and theories may reflect a variety of cirucmstances effecting when and how nerve blocks are performed as well as the infrequency of a wrong site block. Procedural steps are identified. | IIIA |
| 229 | Song JB, Vemana G, Mobley JM, Bhayani SB. The second "timeout": a surgical safety checklist for lengthy robotic surgeries. Patient Saf Surg. 2013;7(1):19 | Organizational Experience | One service line in one facility | n/a | n/a | n/a | The second time out was easy to implement and did not add to the surgical time. | VA |
| 230 | Guideline for minimally invasive surgery. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:529–566 | Guideline | n/a | n/a | n/a | n/a | AORNs recommendations for creating a safe environment of care for patients and perioperative personnel during minimally invasive surgical procedures. | IVA |
| 231 | Guideline for unintentionally retained surgical items. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:825–892 | Guideline | n/a | n/a | n/a | n/a | AORNs recommendations for preventing RSI in patients un | IVA |
| 232 | Bajracharya J, Shrestha R, Karki D, Shrestha A. Compliance of WHO Surgical Safety Checklist at a pediatric surgical unit in a tertiary level hospital: a descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2021;59(244):1256–1261 | Nonexperimental | 267 peds surgical cases | n/a | n/a | Compliance with the use of the SSC | 103 cases were fully compliant, 69 partially compliant. Compliance with the SSC plays a major role in patient morbidity and mortality. | IIIB |
| 233 | Sotto KT, Burian BK, Brindle ME. Impact of the WHO Surgical Safety Checklist relative to its design and intended use: a systematic review and meta-meta-analysis. J Am Coll Surg. 2021;233(6):794–809 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | The WHO SSC positively impacts the things it was explicitly designed to address and does not positively impact things it was not explicitly designed for | IIA |
| 234 | Armstrong BA, Dutescu IA, Nemoy L et al. Effect of the surgical safety checklist on provider and patient outcomes: a systematic review. BMJ Qual Saf. 2022;31(6):463–478 | Systematic Review | n/a | n/a | n/a | n/a | Of the studies that described completion of the SSC, a clearer positive relationship was observed concerning the SSC's influence on provider outcomes compared with patient outcomes (complications and mortality) as well as related moderators. There is not much research on how the SSC is completed. | IIIA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 235 | Wong SSN, Cleverly S, Tan KT, Roche-Nagle G. Impact and culture change after the implementation of a preprocedural checklist in an interventional radiology department. J Patient Saf. 2019;15(4):e24–e27 | Organizational Experience | One hospital, interventional radiology suite | n/a | n/a | n/a | The checklist is a consistent safety measure to ensure relevant patient data are captured and is an important communication tool and improves collaboration among team members. | VA |
| 236 | Safe Surgery Checklist Implementation Guide. Ariadne Labs. 2015. Accessed November 1, 2023. https://www.ariadnelabs.org/wp-content/uploads/2018/08/safe_surgery_implementation_guide__092515.012216_.pdf | Expert Opinion | n/a | n/a | n/a | n/a | Guidance for successful implementation of the SSC. | VA |
| 237 | Delisle M, Pradarelli JC, Panda N et al. Variation in global uptake of the Surgical Safety Checklist. Br J Surg. 2020;107(2):e151–e160 | Nonexperimental | 85,957 patients from 1464 facilites from 94 countries | n/a | n/a | SSC use | Use of the SSC is high | IIIA |
| 238 | Haugen AS, Søfteland E, Sevdalis N et al. Impact of the Norwegian National Patient Safety Program on implementation of the WHO Surgical Safety Checklist and on perioperative safety culture. BMJ Open Qual. 2020;9(3):e000966 | Nonexperimental | 920 operating room personnel in a large Norwegian hospital | n/a | n/a | Patient safety culture as a primary outcome and correlation between SSC fidelity and safety culture as a secondary outcome | The National Patient Safety Program fostering engagement from trust boards, hospital managers and frontline operating theatre personnel enabled effective implementation of the SSC. As part of a wider strategic safety initiative, implementation of SSC coincided with an improved safety culture. | IIIB |
| 239 | Saxena S, Krombach JW, Nahrwold DA, Pirracchio R. Anaesthesia-specific checklists: a systematic review of impact. Anaesth Crit Care Pain Med. 2020;39(1):65–73 | Systematic Review | n/a | n/a | n/a | n/a | Anesthesia specific checklists were the focus but the WHO SSC was included, checklists have the ability to decrease human error, improve team communication, and increase quality of care. | IIA |
| 240 | Zingiryan, Areg, Paruch, Jennifer L., Osler, Turner M. and Hyman, Neil H. Implementation of the surgical safety checklist at a tertiary academic center: Impact on safety culture and patient outcomesZingiryan A, Paruch JL, Osler TM, Hyman NH. Implementation of the surgical safety checklist at a tertiary academic center: impact on safety culture and patient outcomes. Am J Surg. 2017;214(2):193–197 2017 | Qualitative | 259 OR team members | n/a | n/a | Patient complications and attitudes of surgical team members | Implementation of the SSC did not result in a significant decrease in perioperative morbidity or mortality. However, it did improve the perception of safety culture by operating room staff. | IIIA |
| 241 | Treadwell JR, Lucas S, Tsou AY. Surgical checklists: a systematic review of impacts and implementation. BMJ Qual Saf. 2014;23(4):299–318 | Systematic Review | n/a | n/a | n/a | n/a | Surgical checklists were associated with increased detection of potential safety hazards, decreased surgical complications and improved communication among operating staff. Strategies for successful checklist implementation included enlisting institutional leaders as local champions, incorporating staff feedback for checklist adaptation and avoiding redundancies with existing systems for collecting information | IIIA |
| 242 | Thomassen Ø, Storesund A, Søfteland E, Brattebø G. The effects of safety checklists in medicine: a systematic review. Acta Anaesthesiol Scand. 2014;58(1):5–18 | Systematic Review | n/a | n/a | n/a | n/a | A systematic review of the medical literature to show the effects of safety checklists with a number of outcomes. Narrowed search to outcome measures on mortality and morbidity ( 7 studies). Also included studies reporting 'softer' process related measure: adherence to guidelines, human factors and reduction of adverse events. Findings included improved communication reduced adverse events, better adherence to standard operating procedures, and reduced morbidity and mortality. None of the studies reported decreased patient safety or quality after introducing safety checklists. | IIIA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 243 | Russ S, Rout S, Sevdalis N, Moorthy K, Darzi A, Vincent C. Do safety checklists improve teamwork and communication in the operating room? A systematic review. Ann Surg. 2013;258(6):856–871 | Systematic Review | n/a | n/a | n/a | n/a | Safety checklists are beneficial for OR teamwork and communication and this may be one mechanism through which patient outcomes are improved. Future research should aim to further elucidate the relationship between how safety checklists are used and team skills in the OR using more consistent methodological approaches and utilizing validated measures of teamwork such that best practice guidelines can be established. | IIIA |
| 244 | Lyons VE, Popejoy LL. Meta-analysis of surgical safety checklist effects on teamwork, communication, morbidity, mortality, and safety. West J Nurs Res. 2014;36(2):245–261 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | Surgical safety checklists improve teamwork and communication, reduce morbidity and mortality and improve compliance with safety measures. | IA |
| 245 | Bergs J, Lambrechts F, Simons P et al. Barriers and facilitators related to the implementation of surgical safety checklists: a systematic review of the qualitative evidence. BMJ Qual Saf. 2015;24(12):776–786 | Systematic Review | n/a | n/a | n/a | n/a | In order to implement a surgical checklist, leaders must facilitate team learning to foster the mutual understanding of perspectives and motivations and the realignment of routines. | IB |
| 246 | Bliss LA, Ross-Richardson CB, Sanzari LJ et al. Thirty-day outcomes support implementation of a surgical safety checklist. J Am Coll Surg. 2012;215(6):766–776 | Quasi-experimental | All OR personnel in a 600 bed tertiary care facility and major teaching hospital | 3 session team based training program | Data from ACS NSQIP compared to 2,079 historical control cases, 246 without checklist use and 73 with checklist use | 30 day morbidity | Statistically significant reduction in overall adverse event rates from 23.60% for historical controls cases and 15.9% in cases with only team training to 8.2% in cases with checklist use. Checklist use was correlated with a decrease in all measured areas of 30-day morbidity. | IIA |
| 247 | Bock M, Fanolla A, Segur-Cabanac I et al. A comparative effectiveness analysis of the implementation of surgical safety checklists in a tertiary care hospital. JAMA Surg. 2016;151(7):639–646 | Quasi-experimental | 10,741 surgical patients (5444 preintervention and 5297 post intervention) | Implementation of surgical safety checklists | Before and after intervention | Risk adjusted rates of 90 and 30 day mortality, readmission rates and length of stay | The implementation of SSCs was associated with a 27% reduction in the adjusted risk for all cause death within 90 days but not within 30 days. The adjusted length of stay was reduced. | IIA |
| 248 | Haynes AB, Weiser TG, Berry WR et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. BMJ Qual Saf. 2011;20(1):102–107. | Quasi-experimental | 8 hospitals, 281 clinicians in the preintervention group and 257 in the post intervention group | A survey modified from the Safety Attitudes Questionnaire was administered pre and post checklist intervention | Pre and post checklist implementation | Safety attitude score, post operative outcomes | Improvements in postoperative outcomes were associated with improve perception of teamwork and safety climate suggesting that changes in these may be partially responsible for the effect of the checklist. | IIA |
| 249 | Healey A, Søfteland E, Harthug S et al. A health economic evaluation of the World Health Organization Surgical Safety Checklist: a single center assessment. Ann Surg. 2022;275(4):679–684 | Nonexperimental | 3702 surgical procedures at one facility | n/a | n/a | Cost effectiveness of the WHO SSC | Implementation of the WHO checklist was a cost-effective strategy for improving surgical safety | IIIB |
| 250 | Acar YA, Mehta N, Rich MA et al. Using standardized checklists increase the completion rate of critical actions in an evacuation from the operating room: a randomized controlled simulation study. Prehosp Disaster Med. 2019;34(4):393–400 | RCT | checklist group=13, non-checklist group=15, 9 scenarios used the checklist, 10 did not use the checklist | Use of a checklist | Did not use a checklist | Completion rate of critical actions and evacuation time | Using a standardized checklist increased the completion rate of critical actions which likely improves patient safety but did not have a significant effect on total evacuation time. | IC |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 251 | Carlos G, Saulan M. Robotic emergencies: are you prepared for a disaster? AORN J. 2018;108(5):493–501 | Expert Opinion | n/a | n/a | n/a | n/a | Highlights using an emergency robotic checklist, time outs and other communication tools. | VA |
| 252 | Combs CA, Einerson BD, Toner LE; Patient Safety and Quality Committee, Society for Maternal-Fetal Medicine. Society for Maternal-Fetal Medicine Special Statement: Surgical safety checklists for cesarean delivery. Am J Obstet Gynecol. 2021;225(5):B43–B49 | Consensus | n/a | n/a | n/a | n/a | Special C-section checklist created to address both patient and baby needs. | VB |
| 253 | Etheridge JC, Moyal-Smith R, Lim SR et al. Implementation of a device briefing tool reduces interruptions in surgery: a nonrandomized controlled pilot trial. Surgery. 2023;173(4):968–972 | Quasi-experimental | 107 operations before DBT and 103 after | Device Briefing tool | Surgeries before the DBT was in use | Device related interruptions | Implementation of the DBT resulted in a 28% reduction in device related interruptions. | IIB |
| 254 | Etheridge JC, Moyal-Smith R, Lim SR et al. Utility of a device briefing tool to improve surgical safety. J Surg Res. 2022;280:218–225 | Nonexperimental | 91 surveys of the DBT | n/a | n/a | Utility, relative advantage, and implementation effectiveness of the DBT as an adjunct to the SSC | Rated as moderately to extremely useful, utility was greatest for complex and new devices. | IIIB |
| 255 | Lau CY, Seymann G, Imershein S et al. UC Care Check – a postoperative neurosurgery operating room checklist: an interrupted time series study. J Healthc Qual. 2020;42(4):224–235 | Quasi-experimental | 11,447 preintervention neurosurgical cases, 10,973 post intervention in 4 large academic medical centers | Checklist | Before intervention was implemented | Communication, safety attitudes and clinical outcomes | OR team communication improved, clinical outcomes and health system costs did not change | IIA |
| 256 | Lorkowski J, Maciejowska-Wilcock I, Pokorski M. Compliance with the Surgery Safety Checklist: an update on the status. Adv Exp Med Biol. 2022;1374:1–9 | Literature Review | n/a | n/a | n/a | n/a | The SSC reduces perioperative complications including fatalities. There are issues reported with the itemized content of the checklist. Facilites should update the SSC to be up to date with medical knowledge and emerging technologies. | VA |
| 257 | Nicholson P, Kuhn L, Manias E, Sloman M. The design and evaluation of a pre-procedure checklist specific to the cardiac catheterisation laboratory. Aust Crit Care. 2021;34(4):350–357 | Quasi-experimental | 35 cath lab healthcare professionals before implementation and 31 after | Pre-procedure checklist | Before intervention was implemented | Improvement in clinical information transer | Improved patient transter information prior to cath lab procedures | IIB |
| 258 | Panda N, Etheridge JC, Singh T et al. We asked the experts: the WHO Surgical Safety Checklist and the COVID-19 pandemic: recommendations for content and implementation adaptations. World J Surg. 2021;45(5):1293–1296 | Nonexperimental | 18 panelists from 5 continents and multiple clinical specialties-Delphi study | n/a | n/a | How the SSC might be best adapted during the COVID-19 pandemic | 16 recommendations of how the SSC can adapt to meet urgent and emerging needs of surgical systems by targeting important processes and encouraging critical discussions | IIIA |
| 259 | Soma M, Jacobson I, Brewer J, Blondin A, Davidson G, Singham S. Operative team checklist for aerosol generating procedures to minimise exposure of healthcare workers to SARS-CoV-2. Int J Pediatr Otorhinolaryngol. 2020;134:110075 | Organizational Experience | One hospitals OR team | n/a | n/a | n/a | Created a multidisciplinary operative checklist for patients undergoing aersolized generating procedures. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 260 | Sommer DD, Arbab-Tafti S, Farrokhyar F et al. A challenge-response endoscopic sinus surgery specific checklist as an add-on to standard surgical checklist: an evaluation of potential safety and quality improvement issues. Int Forum Allergy Rhinol. 2018;8(7):831–836 | Organizational Experience | One hospital, 39 surgical cases. | n/a | n/a | n/a | Designed a endoscopic surgery specific checklist that they added to the standard SSC which resulted in improved efficiency and patient safety. | VA |
| 261 | Stienen MN, Fierstra J, Pangalu A, Regli L, Bozinov O. The Zurich Checklist for Safety in the Intraoperative Magnetic Resonance Imaging Suite: technical note. Oper Neurosurg (Hagerstown). 2019;16(6):756–765 | Organizational Experience | One facility's iMRI suite | n/a | n/a | n/a | Implementing the Zurich Checklist in the IMRI suite promotes a zero-tolerance attitude for errors, can lower complications, and can help create an environment that is both efficient and safe for the patient and the OR personnel. | VA |
| 262 | Tuleasca C, Zeverino M, Patin D et al. Lausanne checklist for safe stereotactic radiosurgery. Acta Neurochir (Wien). 2019;161(4):721–727 | Organizational Experience | One ORs stereotactice radiosurgery service | n/a | n/a | n/a | Implemented a SSC specific to stereotactic radiosurgery. Standardized safety checklists ensure the complete and effective communication between several disciplines. They avoid preventable errors in patient's management, increasing the safety and efficacy of the procedures. This further reduces complications, as well as ambiguities in the workflow. | VA |
| 263 | Westman, Marjut, Takala, Riikka, Rahi, Melissa and Ikonen, Tuija S. The Need for Surgical Safety Checklists in Neurosurgery Now and in the Future-A Systematic Review 2020 | Systematic Review | n/a | n/a | n/a | n/a | Checklists seem to improve patient safety in neurosurgery, although the amount of evidence is still limited. | IIIA |
| 264 | Williams AK, Cotter RA, Bompadre V, Goldberg MJ, Steinman SS. Patient safety checklists: do they improve patient safety for supracondylar humerus fractures? J Pediatr Orthop. 2019;39(5):232–236 | Quasi-experimental | 394 pre-checklist and 537 postchecklist in patients with operative supracondylar humerus fractures | Implementation of the SSC | Before implementation | Patient nerve injury, placement of a medial pin, infection, loss of alignment, loss of fixation, and return to the operating room. | No significant differences were found between pre checklist and postchecklist patients in regards to loss of fixation, loss of alignment, infection, or nerve injury. The SSC did not affect patient care in a clinically significant matter. Important to validate and refine specialty specific checklists. | IIA |
| 265 | Kane P, Marley R, Daney B, Gabra JN, Thompson TR. Safety and communication in the operating room: a safety questionnaire after the implementation of a blood-borne pathogen exposure checkpoint in the surgical safety checklist preprocedure time-out. Jt Comm J Qual Patient Saf. 2019;45(10):662–668 | Qualitative | 99 perioperative team members who handle sharps | n/a | n/a | Improved safety and communication | Communication was imroved, a blood borne pathogen checkpoint added to the SSC resulted in team members feeling safer when handling sharps and reported sharp incidents decreased. | IIIB |
| 266 | Columbus AB, Castillo-Angeles M, Berry WR, Haider AH, Salim A, Havens JM. An evidence-based intraoperative communication tool for emergency general surgery: a pilot study. J Surg Res. 2018;228:281–289 | Organizational Experience | Emergency general surgery service line at one hospital | n/a | n/a | n/a | Developed a discussion based communication tool for EGS patients, improved a shared understanding in the team but needed enhanced reinforcment of the tool. | VA |
| 267 | Hammond Mobilio M, Paradis E, Moulton C. "Some version, most of the time": the surgical safety checklist, patient safety, and the everyday experience of practice variation. Am J Surg. 2022;223(6):1105–1111 | Nonexperimental | SSC observations in one hospital, 51 observation days, 8 interviews and 2 suveys over 2 years | n/a | n/a | Checklist compliance and assumptions about the SSC | Checklist compliance data is iinsufficient to understand how complex interventions impact care delivery. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 268 | Hepner DL, Arriaga AF, Cooper JB et al. Operating room crisis checklists and emergency manuals. Anesthesiology. 2017;127(2):384–392 | Expert Opinion | n/a | n/a | n/a | n/a | Cognitive aids such as checklists have proven to be beneficial but need effective trainign and implementation strategies that encourages their use to reduce preventable perioperative adverse events. | VA |
| 269 | Mahmood T, Mylopoulos M, Bagli D, Damignani R, Aminmohamed Haji F. A mixed methods study of challenges in the implementation and use of the surgical safety checklist. Surgery. 2019;165(4):832–837 | Nonexperimental | 51 checklist observations and interviews with 6 surgeons, 6 nurses and 6 anesthesia providers at a tertiary care peds hospital | n/a | n/a | To understand the quality of the SSC | SSC being viewed as a tick box exercise with limited value, challenges with implementation. Tailoring the SSC to individual teams, simplifying the checklist were some strategies for improvement. | IIIB |
| 270 | Munn Z, Giles K, Aromataris E et al. Mixed methods study on the use of and attitudes towards safety checklists in interventional radiology. J Med Imaging Radiat Oncol. 2018;62(1):32–38 | Nonexperimental | 4 radiology departments 39 radiology procedures observed, 4 radiologists interviewed, 137 medical record audits | n/a | n/a | Evaluation of how SSC is used and completed in radiology and attitudes or radiologists | Overall completion of the SSC was low, significant barriers to use in radiology | IIIB |
| 271 | Ziman R, Espin S, Grant RE, Kitto S. Looking beyond the checklist: an ethnography of interprofessional operating room safety cultures. J Interprof Care. 2018;32(5):575–583 | Qualitative | Observations of 14 procedures and interviews with 10 clinicians in orthopedic surgery | n/a | n/a | Team perception, attitudes and practices | SSC compliance was influenced by the perceived unimportance or importance of individual checklist items within the orthopedic setting. | IIIB |
| 272 | Arriaga AF, Bader AM, Wong JM et al. Simulation-based trial of surgical-crisis checklists. N Engl J Med. 2013;368(3):246–253 | RCT | 17 ORs, 106 simulated OR crisis scenarios | Used a crisis checklist | Used memory alone | Adherence to critical processes of patient care | Checklist use was associated with significant improvement in the management of operating-room crises. These findings suggest that checklists for use during operating-room crises have the potential to improve surgical care | IB |
| 273 | Jelacic S, Bowdle A, Nair BG et al. Aviation-style computerized surgical safety checklist displayed on a large screen and operated by the anesthesia provider improves checklist performance. Anesth Analg. 2020;130(2):382–390 | Quasi-experimental | 547 in the SSC group and 671 in the control group | computerized SSC system | Before the computerized checklist | Improved performance of the SSC | The implementation of the computerized SSC resulted in an improvement in checklist performance | IIA |
| 274 | Boillat T, Grantcharov P, Rivas H. Increasing completion rate and benefits of checklists: prospective evaluation of surgical safety checklists with smart glasses. JMIR Mhealth Uhealth. 2019;7(4):e13447 | Quasi-experimental | 4 surgeons | 39 checklists conducted using smart glasses | 41 checklists using conventional methods (memory or poster) | Improved completion rates | Compared with alternatives such as posters, paper, and memory, smart glasses checklists are easier to use and follow. The glasses allowed surgeons to use contextualized time-out checklists, which increased the completion rate to 100% and reduced the checklist execution time and time required to prepare the equipment during surgical cases. | IIB |
| 275 | Gitelis ME, Kaczynski A, Shear T et al. Increasing compliance with the World Health Organization Surgical Safety Checklist – a regional health system's experience. Am J Surg. 2017;214(1):7–13 | Nonexperimental | 4 hospital ORs | n/a | n/a | Impact of an electronic SSC on compliance and patient safety | Compliance increased from 48% to 92% and a 32% decrease in risk events. LOS and 30 day readmissions were lower. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 276 | Gloystein DM, Heiges BA, Schwartz DG, DeVine JG, Spratt D. Innovative technology system to prevent wrong site surgery and capture near misses: a multi-center review of 487 cases. Front Surg. 2020;7:563337 | Organizational Experience | 487 surgeries performed by 11 surgeons at 6 sites using the system | n/a | n/a | n/a | In near miss events the StartBox System was effective in preventing wrong site surgery. | VC |
| 277 | Kiefel K, Donsa K, Tiefenbacher P et al. Feasibility and design of an electronic surgical safety checklist in a teaching hospital: a user-based approach. Stud Health Technol Inform. 2018;248:270–277 | Organizational Experience | 12 interviews from surgeons, assistants, nurses, CRNAs and managers | n/a | n/a | n/a | Designed a prototype which was a tablet based checklist | VB |
| 278 | Shear T, Deshur M, Avram MJ et al. Procedural timeout compliance is improved with real-time clinical decision support. J Patient Saf. 2018;14(3):148–152 | Organizational Experience | 45 ORs in a 4 hospital system, 300 surgical procedures | n/a | n/a | n/a | Implemented an electronic SSC with clinical decision support, this improved compliance with the SSC. | VA |
| 279 | Guideline for medical device and product evaluation. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2023:777–788 | Guideline | n/a | n/a | n/a | n/a | AORNs recommendations on medical device and product evaluation. | IVA |
| 280 | Moyal-Smith R, Etheridge JC, Lim SR et al. Creating a high-performance surgical safety checklist: a multimodal evaluation plan to reinvigorate the checklist. J Eval Clin Pract. 2023;29(2):341–350 | Nonexperimental | 294 checklist observations. 270 staff surveys. Atlas context assessment survey 78 | n/a | n/a | Evaluation of the SSC. | Challenges in communication and teamwork, silos perceived, needed improvement in safety processes, lack of engagment with the SSC. Limited engagement by the surgical team and minimal communication between teams. | IIIA |
| 281 | Burian BK, Clebone A, Dismukes K, Ruskin KJ. More than a tick box: medical checklist development, design, and use. Anesth Analg. 2018;126(1):223–232 | Expert Opinion | n/a | n/a | n/a | n/a | A narrarative on the state of the checklist and what is needed for improvement. | VA |
| 282 | Alidina S, Goldhaber-Fiebert SN, Hannenberg AA et al. Factors associated with the use of cognitive aids in operating room crises: a cross-sectional study of US hospitals and ambulatory surgical centers. Implement Sci. 2018;13(1):50 | Nonexperimental | 368 respondants who downloaded cognitive aids from the Ariadne Labs website in US hospitals and ASCs | n/a | n/a | Context and use of cognitive aids for an OR crises. | Successful implementation of the crisis checklist (cognitive aid) resulted in an increase of their use which may improve patient outcomes. | |
| 283 | Alidina S, Hur H, Berry WR et al. Narrative feedback from OR personnel about the safety of their surgical practice before and after a surgical safety checklist intervention. Int J Qual Health Care. 2017;29(4):461–469 | Qualitative | n=38 hospital Pre (2038responded/4932)41. 3% response rate . N=13 hopstials Post (815responded/1909) 42.7% response rate | n/a | n/a | Positive negative responses to use of SSC pre and post implementation | Narrative feedback suggested that SSC implementation can facilititate paitient safety by averting complication; however, buy-in is a persitent challenge. Surgical team members most frequently reported that checklist use averted complications involving antibiotic administration, equipment and side/site of surgery. | IIIB |
| 284 | Haugen AS, Wæhle HV, Almeland SK et al. Causal analysis of World Health Organization's Surgical Safety Checklist implementation quality and impact on care processes and patient outcomes: secondary analysis from a large stepped wedge cluster randomized controlled trial in Norway. Ann Surg. 2019;269(2):283–290 | RCT | 2304 surgery cases using the SSC | SSC | 1398 surgery cases not using the SSC | Improved care processes and reduction of peri and post op compications | This study successfully applied Donabedian's improvement framework of clinical structures, processes, and outcomes as a clinical causal model for the SSC intervention. Use of SSC improved operating room care processes; subsequently, high-quality SSC implementation and improved care processes led to better patient outcomes. | IA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 285 | Haugen AS, Sevdalis N, Søfteland E. Impact of the World Health Organization Surgical Safety Checklist on patient safety. Anesthesiology. 2019;131(2):420–425. | Literature Review | n/a | n/a | n/a | n/a | Describes a literature synthesis on advantages and disadvantages in use of surgical safety checklists emphasizing checklist development, implementation, and possi ble clinical effects and using a theoretical framework for quality of provided healthcare (structure—process—outcome) to understand the checklists' possible impact on patient safety. | VB |
| 286 | Ramírez-Torres CA, Pedraz-Marcos A, Maciá-Soler ML, Rivera-Sanz F. A scoping review of strategies used to implement the Surgical Safety Checklist. AORN J. 2021;113(6):610–619 | Scoping review | n/a | n/a | n/a | n/a | Identified intervention strategies before durin and after SSC implementation, effective implementation occurred when there was adequate planning, leaders should work with nursing during implementation and monitor after implementation to verify compliance and help prevent negative patient outcomes. | VA |
| 287 | Rakoff D, Akella K, Guruvegowda C, Chhajwani S, Seshadri S, Sola S. Improved compliance and comprehension of a surgical safety checklist with customized versus standard training: a randomized trial. J Patient Saf. 2018;14(3):138–142 | RCT | 28 perioperative staff in standard training and 26 in customized training | Customized SSC training | Standard training program (WHO training materials) | Compliance and comprehension of the SSC | A customized training program improves verbal compliance and comprehesnion among health care workers when implementing a SSC compared with standard, readily available training. | IB |
| 288 | Panda N, Koritsanszky L, Delisle M et al. Global survey of perceptions of the Surgical Safety Checklist among medical students, trainees, and early career providers. World J Surg. 2020;44(9):2857–2868 | Qualitative | 318 medical students, trainees and early career providers pursuing surgery. | n/a | n/a | Perceptions of the SSC and suggestions for improvement | Clinical exposure to the SSC was associated with promoting future use, earlier formal clinical training may improve perceptions. | IIIA |
| 289 | Moyal-Smith R, Etheridge JC, Turley N et al. CheckPOINT: a simple tool to measure surgical safety checklist implementation fidelity. BMJ Qual Saf. 2023. doi: 10.1136/bmjqs-2023-016030 | Qualitative | 2 rounds of face validity testing | n/a | n/a | inter-rater reliability | The CheckPOINT tool had excellent inter-rater reliability across SSC phases.CheckPOINT is a simple and reliable tool to assess SSC implementation fidelity and identify areas of focus for improvement efforts. | IIIA |
| 290 | Hilton K, Anderson A. How one health system overcame resistance to a surgical checklist. Harvard Business Review. May 20 , 2019. Accessed November 1, 2023. https://hbr.org/2019/05/how-one-health-system-overcame-resistance-to-a-surgical-checklist | Expert Opinion | n/a | n/a | n/a | n/a | Change strategies for implementation of the SSC | VA |
| 291 | Panda N, Haynes AB. Effective implementation and utilization of checklists in surgical patient safety. Surg Clin North Am. 2021;101(1):37–48 | Expert Opinion | n/a | n/a | n/a | n/a | Authors discuss large scale implementation of the SSC in diffferent health systems around the world. Implementation science. | VA |
| 292 | Seppey R, Oesch A, Viehl CT. Compliance to the Surgical Safety Checklist over time in late and early adopters. J Perioper Pract. 2020;30(3):57–62 | Nonexperimental | 348 early SSC adopters cases and 476 late adopters | n/a | n/a | Compliance with the use of the SSC | Early adopters maintained a high level of compliance and late adopters improved their compliance over time. SSC was implemented in emergency procedures as well as planned procedures. Highlighted the importance of surgeon involvement in implementation. | IIIA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 293 | do Prado Tostes MF, Galvão CM. Implementation process of the Surgical Safety Checklist: integrative review. Rev Lat Am Enfermagem. 2019;27:e3401 | Systematic Review | n/a | n/a | n/a | n/a | Insight into the implementation of the SSC process, different strategies in the literature. | IIIA |
| 294 | Lyons VE, Popejoy LL. Time-out and checklists: a survey of rural and urban operating room personnel. J Nurs Care Qual. 2017;32(1):E3–E10 | Nonexperimental | 77 rural and 47 urban perioperative staff members | n/a | n/a | Frequency of time outs, checklist use, barriers | Low compliance with some components of the checklist, did not value some of the content, checklist fatigue, staff and physican resistance | IIIC |
| 295 | Tian TM, Bray APJJ, Bogucki P, Myers L, de Berker D. WHO Surgical Checklist in dermatology: compliance, barriers, and attitudes. Dermatol Surg. 2019;45(8):1042–1046 | Nonexperimental | 217 dermatological surgery patients and 10 nurses and 15 derm doctors | n/a | n/a | SSc completion rate ad barriers to use. | The SSC is important in dermatology, repeated training sessions are necessary to improve checklist completion. | IIIA |
| 296 | Urban D, Burian BK, Patel K et al. Surgical teams' attitudes about surgical safety and the Surgical Safety Checklist at 10 years: a multinational survey. Ann Surg Open. 2021;2(3):e075 | Qualitative | 2032 health care professionals | n/a | n/a | Attitudes on the SSC | Most percieve the checklist as enhancing patient safety but not all surgical teams members are actively engaging with its use. Health systems should provide more training on the checklist with respect to its purpose and strengthening teamwork. | IIIA |
| 297 | Wæhle HV, Haugen AS, Wiig S, Søfteland E, Sevdalis N, Harthug S. How does the WHO Surgical Safety Checklist fit with existing perioperative risk management strategies? An ethnographic study across surgical specialties. BMC Health Serv Res. 2020;20(1):111 | Nonexperimental | 12 surgical cases-2 hospitals observed and 17 staff member interviews. | n/a | n/a | Integration of the SSC within risk management strategies. | When the SSC is percieved as an add on its fidelity is compromised, limiting its potential clinical effectiveness. Strategies in implementation should integrate the SSC as a risk management tool and included in education and training. | IIIB |
| 298 | Neuhaus C, Spies A, Wilk H, Weigand MA, Lichtenstern C. "Attention everyone, time out!": safety attitudes and checklist practices in anesthesiology in Germany. A cross-sectional study. J Patient Saf. 2021;17(6):467–471 | Qualitative | 304 physicians and nurses | n/a | n/a | implementation, attitudes and compliance with the SSC | Importance of interdisciplinary training focusing on human factors, communication and collaboration, customized training and implementation strategies for sustained change is needed. | IIIB |
| 299 | Bartz-Kurycki M, Anderson KT, Abraham JE et al. Debriefing: the forgotten phase of the surgical safety checklist. J Surg Res. 2017;213:222–227 | Organizational Experience | 603 pediatric cases | n/a | n/a | Assess adherence to a bebrief checklist and identify areas of improvement | Only half of the checklists were completed in full. Interventions should be implemented to improve. | VB |
| 300 | Magill ST, Wang DD, Rutledge WC et al. Changing operating room culture: implementation of a postoperative debrief and improved safety culture. World Neurosurg. 2017;107:597–603 | Organizational Experience | Neurosurgical staff at a major academic medical center | n/a | n/a | n/a | Postop debriefing can be effectively introduced into the OR and improves safet culture. It is an effective tool to identify OR inefficiencies and potential adverse events. | VA |
| 301 | Norton R, Mordas D. A postprocedure wrap-up tool for improving or communication and performance. AORN J. 2018;107(1):108–115 | Organizational Experience | One hospital | n/a | n/a | n/a | Deriefing tool created which allowed improvement in efficiency and staff member satisfaction | VA |
| 302 | Leonard LD, Shaw M, Moyer A et al. The surgical debrief: just another checklist or an instrument to drive cultural change? Am J Surg. 2022;223(1):120–125 | Organizational Experience | 182 OR clinicians at one academic medical center | n/a | n/a | n/a | Clinicians perceive value in the debrief and agreed that it would improve patient safety and positively impact OR safety culture. This OR added prmpts encouraging team to discussion to their checklist. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 303 | Rose MR, Rose KM. Use of a surgical debriefing checklist to achieve higher value health care. Am J Med Qual. 2018;33(5):514–522 | Quasi-experimental | 54,003 debriefs reviewed with analyses of 4523 defects in care. | Debrief driven improvements tool | 2009 data was prior to implementation of briefing tool. | Quality and safety metric, productivity and labor costs, and safety culture. | In 2009 reported case defects/events was 9% of surgical cases. After the debrief driven process improvements the sustained leve of 2% with surgical cases with a defect. Over the 12-quarter study period surgical labor hour per case dropped by 7.5h with a annual gain of more than $4 million in surgical team productivity. The study found that teams do not have the means in the moment to mitigate the many dimensions of harm identified during surgery. This creates work around by the team to push ahead in less than ideal situations. The debrief driven checklist allowed the team to collaborate and then change practice to improve future outcomes. | IIB |
| 304 | Hicks CW, Rosen M, Hobson DB, Ko C, Wick EC. Improving safety and quality of care with enhanced teamwork through operating room briefings. JAMA Surg. 2014;149(8):863–868. | Organizational Experience | One facility | n/a | n/a | n/a | Briefings and debriefings are a good method for improving teamwork and communication in the OR. Effective implementation may be associated with improve patient outcomes. Commitment by the participating providers is essential for effective briefings which includes discussion of relevant information pertaining to the procedure. | VA |
| 309 | Doorey AJ, Turi ZG, Lazzara EH, Mendoza EG, Garratt KN, Weintraub WS. Safety gaps in medical team communication: results of quality improvement efforts in a cardiac catheterization laboratory. Catheter Cardiovasc Interv. 2020;95(1):136–144 | Organizational Experience | 1st observation = 101 cases; 2nd obs 102; 3rd obs = 168 cases in Cardiac Catheterization Lab (CCL) | n/a | n/a | n/a | Complete eadbacks are the goal of closed-loop communications and required by Joint Commission. In this study the organization observed CCL readback and verification to verbal orders for medications and equipment. Three observations periods were recorded over three distict time intervals from 2015-2017. Perfomance feedback and focused education on the value of readbacks was provided to the teams in two waves. Overall, medication order readback improved over time but equipment order readback did not. Closed-loop communication of physician verbal orders was used infrequently in the medical team setting and proved difficult to fully improve. | VA |
| 310 | Hamilton EC, Pham DH, Minzenmayer AN et al. Are we missing the near misses in the OR? – underreporting of safety incidents in pediatric surgery. J Surg Res. 2018;221:336–342 | Organizational Experience | n=211 surgical case observations at Memorial Herman childrens hospital | n/a | n/a | n/a | The hospital has two mechanisms for reporting adverse events or near misses-an electronic form and a paper form. Even with the two reporting systems the near misses were under reported. The observers noted 137 near misses. 57 were reported via the handwritten process and 9 were reported through the electronic process. | VA |
| 311 | Burton E, Flores B, Jerome B et al. Assessment of bias in patient safety reporting systems categorized by physician gender, race and ethnicity, and faculty rank: a qualitative study. JAMA Netw Open. 2022;5(5):e2213234 | Nonexperimental | 401 adverse event reports in a 9y period representing 187 physicians. | n/a | n/a | no planned outcome measure | The researchers compared the variation in the content of SAFE reports based on demographic characteristics of physicians who are subject of the event report. They found that physicians who were female or memebers of racial and ehtnic minority groups were more likely to be reported for low-severity communication issues compared with their male and white counterparts. | IIIB |
| 312 | Sendlhofer G, Lumenta DB, Pregartner G et al. Reality check of using the surgical safety checklist: a qualitative study to observe application errors during snapshot audits. PLoS One. 2018;13(9):e0203544 | Organizational Experience | N=136 surgical interventions (2015 n=67, 2016 n=69) | n/a | n/a | n/a | Snapshot audits revealed that SSC compliance has improved over the observed period, while its application had inconsistencies during the three phases of the SSC. Snapshot audits are valuable in analyzing SSC compliance. | VA |

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|---|---|---|---|---|---|---|---|---|
| 313 | Lozito M, Whiteman K, Swanson-Biearman B, Barkhymer M, Stephens K. Good Catch Campaign: improving the perioperative culture of safety. AORN J. 2018;107(6):705–714 | Organizational Experience | n=391 good catches in one organization | n/a | n/a | n/a | The campaign was successful in improving the perioperative patient safety. | VA |
| 314 | Etherington N, Larrigan S, Liu H et al. Measuring the teamwork performance of operating room teams: a systematic review of assessment tools and their measurement properties. J Interprof Care. 2021;35(1):37–45 | Systematic Review | n/a | n/a | n/a | n/a | OTAS and NOTECHS have acceptable measurement properties for assessing teamwork of intraoperative teams. Both tools rely on the assumption that the teamwork of a team is equivalent to the sum o individual performances. | IIIA |
| 315 | Gjeraa K, Mundt AS, Spanager L et al. Important non-technical skills in video-assisted thoracoscopic surgery lobectomy: team perspectives. Ann Thorac Surg. 2017;104(1):329–335 | Qualitative | 172 participants involved in 64 VATS | n/a | n/a | SMM, TS, NTS | VATS team members' Shared Mental Model (SMM) varied when quantitatively explored in the clinical setting. Analysis showed poor agreement between team members with respect to risk assessment but higher levels of agreement were found for assessment of familiarity, technical skils (TS) and NTIS within the team. | IIIA |
| 316 | Jung JJ, Jüni P, Lebovic G, Grantcharov T. First-year analysis of the Operating Room Black Box Study. Ann Surg. 2020;271(1):122–127 | Systematic Review | n/a | n/a | n/a | n/a | Many tools have been developed to measure NTS at the individual and subteam level. A specific NTS tool needs to be developed specifically for Circulating nurses. | IIIA |
| 317 | McMullan RD, Urwin R, Sunderland N, Westbrook J. Observational tools that quantify nontechnical skills in the operating room: a systematic review. J Surg Res. 2020;247:306–322 | Systematic Review | n/a | n/a | n/a | n/a | NTS for surgeons has the strongest validity and reliability for assessing individuals. Oxford Non-TECHnical skills is good tool for evaluating teams. | IIIA |
| 318 | Pfandler M, Stefan P, Mehren C, Lazarovici M, Weigl M. Technical and nontechnical skills in surgery: a simulated operating room environment study. Spine (Phila Pa 1976). 2019;44(23):E1396–E1400 | Qualitative | 6 surgeons participated in simulated vertebral plasty procedure(VP) | n/a | n/a | Technical skills were assessed using Objective Structured Assessment of Technical Skill scores: NTS were assessed with the OATS | Surgeons non- technical skills correlated their technical skills and surgical outcome scores. | IIIC |
| 319 | Rao R, Caskey RC, Owei L et al. Curriculum using the in-situ operating room setting. J Surg Educ. 2017;74(6):e39–e44 | Organizational Experience | 53 particpants: 8 general surgery residents, 16 anesthesia residents, 16 circulating nurses, and 13 anesthesia technicians | n/a | n/a | n/a | The in-situation OR environment is an effective setting to perform team-based training. Administrating and departmental "buy-in" were necessary for in-situation training to be successful. | VA |
| 320 | Redaelli I. Nontechnical skills of the operating theatre circulating nurse: an ethnographic study. J Adv Nurs. 2018;74(12):2851–2859 | Qualitative | 26 nurse in one Italian operating room | n/a | n/a | NTS taxonomy for circulating RN | Five categories were defined:leadership, situation awareness, task management, teamwork and communication. | IIIB |
| 321 | Rehim SA, DeMoor S, Olmsted R, Dent DL, Parker-Raley J. Tools for assessment of communication skills of hospital action teams: a systematic review. J Surg Educ. 2017;74(2):341–351 | Systematic Review | n/a | n/a | n/a | n/a | The comparison did not demonstrate that one tool is superior to the other. Field-testing and evidence of psychometric validity of these tools are still either lacking or underreported. Further validation is needed | IIIA |

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|---|---|---|---|---|---|---|---|---|
| 322 | Sirevåg I, Tjoflåt I, Hansen BS. A Delphi study identifying operating room nurses' non-technical skills. J Adv Nurs. 2021;77(12):4935–4949 | Nonexperimental | N=106 minimum of 2yr of OR experience nurses in Norway | n/a | n/a | Identify nontechnical skills for the scrub and circulating OR nurses | Consensus from three rounds of surveys for nontechnical skills are: situation awareness, leadership, decision-making, communication and teamwork. | IIIA |
| 323 | Stewart-Parker E, Galloway R, Vig S. S-TEAMS: a truly multiprofessional course focusing on nontechnical skills to improve patient safety in the operating theater. J Surg Educ. 2017;74(1):137–144 | Nonexperimental | n=68 health care professionals. | n/a | n/a | self assessments immediately after training and at 6-months after. | This one day mulidisciplinary course "S-TEAMS" was successful in teaching speaking up skills, patient safety and teamwork. | IIIB |
| 324 | Leuschner S, Leuschner M, Kropf S, Niederbichler AD. Nontechnical skills training in the operating theatre: a meta-analysis of patient outcomes. Surgeon. 2019;17(4):233–243 | Organizational Experience | Eight interviews with perioperative nurses in a Melbourne OR | n/a | n/a | n/a | Four themes were identified-Simulation was valued; Nontechnical skills; emotional response; and trust. Key findings were that nurse leaders were valued in interdisciplinary teams and trust amongst team members was significant for nontechnical skill use during crisi. | VB |
| 325 | Leuschner S, Leuschner M, Kropf S, Niederbichler AD. Nontechnical skills training in the operating theatre: a meta-analysis of patient outcomes. Surgeon. 2019;17(4):233–243 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | This review was conducted to evaluate whether NTS training of theatre staff imporves patient outcomes. In this small number of studies the meta analysis failed to find a statistically significant improvement of patient outcomes. | IIIA |
| 326 | Oppikofer C, Schwappach D. The role of checklists and human factors for improved patient safety in plastic surgery. Plast Reconstr Surg. 2017;140(6):812e–817e | Expert Opinion | n/a | n/a | n/a | n/a | Overview of patient safety and proven safety methods including the SSC and nontechnical skills | VA |
| 327 | Anton NE, Athanasiadis DI, Karipidis T et al. Surgeon stress negatively affects their non-technical skills in the operating room. Am J Surg. 2021;222(6):1154–1157 | Nonexperimental | n=15 surgeons | n/a | n/a | STAI-6, SURG-TLX, NTS | Surgeon stress and workload negatively affected their NTS in the OR. Further, unfamiliartity with the surgical team contributed to surgeon's stress. | IIIB |
| 328 | Brennan PA, Holden C, Shaw G, Morris S, Oeppen RS. Leading article: What can we do to improve individual and team situational awareness to benefit patient safety? Br J Oral Maxillofac Surg. 2020;58(4):404–408 | Expert Opinion | n/a | n/a | n/a | n/a | The loss of situational awareness (SA) either by indiviuals or teams, can have an adverse effect on patient safety. The importance of a thorough team briefing improves situational awareness. Discussing What if questions in the briefing allows the team to plan and identify roles in unexpected complications. Giving every member a chance to speak during the briefing improves the ability of individuals to speak up when they observe something doesn't seem quite right. | VB |
| 329 | Brogaard L, Kierkegaard O, Hvidman L et al. The importance of non-technical performance for teams managing postpartum haemorrhage: video review of 99 obstetric teams. BJOG. 2019;126(8):1015–1023 | Nonexperimental | 99 video recordings of postpartum hemorrhage cases. | n/a | n/a | primary outcome was score on Obstetric postpartum haemorrhage tool-adherence to the protocol. Secondary outcome was delayed transfer to the operating theatre (defined as blood loss >1500ml in the delivey room) The ATOPS tool was used to measure NTS | Collecting and reviewing the videos of obstetric emergencies is possible and through systematic analysis the researcher were abe to identify the important non-technical skills as being vigilance, role assignment, problem solving, management of disruptive behavior and leaderhsip. These skills can be included in future obstetric training programs | IIIA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 330 | Clendinneng D. Case study research on nurses' perceptions of various educational strategies for learning perioperative nontechnical skills. ORNAC J. 2020;38(1):12–40 | Case Report | n/a | n/a | n/a | n/a | Profession-specific non-technical skills training is an essential component for perioperative nursing educational programs as it promotes nursing effectivenss in high-performing team environments. | VB |
| 331 | Cole DC, Giordano CR, Vasilopoulos T, Fahy BG. Resident physicians improve nontechnical skills when on operating room management and leadership rotation. Anesth Analg. 2017;124(1):300–307 | Nonexperimental | n=10 anesthesia residents enrolled in a leadership/management course | n/a | n/a | Measure NTS improvement during a 2-week senior elective rotation | The course allowed for assessment of the resident education and skills required to meet specific milestones. Fostering the NTS improved communication. | IIIB |
| 332 | Doumouras AG, Hamidi M, Lung K et al. Non-technical skills of surgeons and anaesthetists in simulated operating theatre crises. Br J Surg. 2017;104(8):1028–1036 | Nonexperimental | 26 simulated crises performed by surgical teams. 13 different surgical teams were assessed | n/a | n/a | Non-Technical skills for Surgeons (NOTSS) and Anesthetists' Non-Technical Skills (ANTS) rating scales | A higher level of NTS of surgeions and anesthetists led to quicker crisis resolution in a simulated operating room. | IIIA |
| 333 | Kalantari R, Zamanian Z, Jamali J, Faghihi SA, Hasanshahi M, Gheysari S. Reviewing the existing observational tools for assessment of circulating nurses' nontechnical skills. J Pediatr Surg Nurs. 2022;11(1):204–211 | Systematic Review | n/a | n/a | n/a | n/a | This systematic review looked at existing tool for assessment of ciruclating nurses' NTS. | IIIA |
| 336 | Duff J, Bowen L, Bradley OG. What does surgical conscience mean to perioperative nurses: an interpretive description. Collegian. 2022;29(2):147–153 | Qualitative | 15 Australian perioperative nurses | n/a | n/a | interview themes and patterns within experiences and perceptions of participants on Surgical conscience | The aim of this study was to generate insight into the phenomenon of Surgical conscience.The researcher found that Surgical Conscience was defined as 'the moral obligation to uphold and defend surgical asepsis and perioperative safety no matter the cost or consequence'. TA conceptual model illustrates that a surgical Consience is dependent on the presence of three constructs: consciousness (knowing), conscience (feeling), and agency (acting) and is moderated by contextual factors such as education, training, mentorship, environment, culture and | IIIB |
| 337 | Gross B, Rusin L, Kiesewetter J et al. Crew resource management training in healthcare: a systematic review of intervention design, training conditions and evaluation. BMJ Open. 2019;9(2): e025247 | Systematic Review w/ Meta-Analysis | n/a | n/a | n/a | n/a | This systematic review analyzed studies using Crew Resource Management (CRM) training. The majority of studies Used CRM interventions in a 1-day or half day format. Critical topics were identified for the CRM training and include the following: the ned to agree on common terms and definitions fror CRM in healthcare, standards of good practice for reporting CRM interventions and their effects, as well as the need for more research to establish non-educational criteria for success in implementation of CRM in healthcare organizations. | IIIA |
| 338 | Ahn S, Lee NJ. Development and evaluation of a teamwork improvement program for perioperative patient safety. J Nurs Res. 2021;29(6):e181 | Quasi-experimental | n=60 | Teamwork Improvement Plan | Experimental - Perioperative nurses in the Cancer OR (n=28). Control - Perioperative nurses in Main OR (n=35) | Team work knowledge, attitudes, communiation self-efficacy, and teamwork skills and behaviors | The TIP used in this study focused on knowledge of nursing teamwork in the perioperative seting, pateint safety concepts and the relatioship between teamwork and patient safety In the healthcare system. | IIA |

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|---|---|---|---|---|---|---|---|---|
| 339 | Alvarez AG, Dal Sasso GTM, Iyengar MS. Mobile persuasive technology for the teaching and learning in surgical safety: content validation. Nurse Educ Today. 2018;71:129–134 | Organizational Experience | A Federal University in Brazil | n/a | n/a | n/a | Validity study of an education tool for implementation of the safety practices in a hospital in Brazil. | VA |
| 340 | Gillespie BM, Steel C, Kang E et al. Evaluation of a brief team training intervention in surgery: a mixed-methods study. AORN J. 2017;106(6):513–522 | Quasi-experimental | 179 surgeries (pre and post intervention) 99 before, 80 after | Team training TEAMANATOMY | n/a | Teamwork and Safety Climate Survey (TSCS) ; NOTECHS score | There were significant NTS improvements across all teams in the observed use of the WHO SSC. The time out and sign out improvements were significant (P<.001). There were no improvements in percieed teamwork across the sample. | IIA |
| 341 | Gros E, Shi R, Hasty B et al. In situ interprofessional operating room simulations: empowering learners in crisis resource management principles. Surgery. 2021;170(2):432–439 | Quasi-experimental | n=134 | simulation scenario | na | pre and post confidence level survey | Teaching crisis management in an in situ operative simulation is an effective way to incease the confidence of commuication skills among team members in a crisis situation. | IIB |
| 342 | Picard J, Evain J, Douron C et al. Impact of a large interprofessional simulation-based training course on communication, teamwork, and safety culture in the operating theatre: a mixed-methods interventional study. Anaesth Crit Care Pain Med. 2022;41(1):100991 | Quasi-experimental | 39 ORs with 300 healthcare professionals (surgeons, anesthetists, residents, specialized nurses and other professionals | Interprofessional Simulated training program | First period 131 surgeries observed for communication failures. Second period after simulation training 122 surgical procedures observed for communication failure associated with an adverse event. Also observed other communication failures, checklist adherence. Teamwork and safety culture were assessed by questionnaires | Assess the impact of an interprofessional simulation based training course on communication, teamwork, checklist adherence and safety culture. | This study shows that although the rate of procedures with at least on communication failure associated with adverse event (primary endpoint) was not significantly different,a large Interprofessional simulation based training course has a positive effect on communication failures, teamwork, and checklist adherence. | IIB |
| 343 | Ridley CH, Al-Hammadi N, Maniar HS et al. Building a collaborative culture: focus on psychological safety and error reporting. Ann Thorac Surg. 2021;111(2):683–689 | Nonexperimental | N=73 at baseline, n=68 at 6 mos and 12 mos | n/a | n/a | Positive psychological safety, | Overall result is that structured team training improved teamwork, psychological safety and communication and potentially also patient outcomes. | IIIB |
| 344 | Truong H, Sullivan AM, Abu-Nuwar MR et al. Operating room team training using simulation: hope or hype? Am J Surg. 2021; 222(6):1146–1153 | Quasi-experimental | 208 OR team members | Simulation training | Before simulation training | To determine how simulated team training is percieved by surgeons, anesthesiologists and nurses after an extended period of time. | Simulated OR team training is initially highly valued by participants and is perceived as contributing to patient safety. Diminution of particpant enthusiasm over time suggest that repeat training requirements be reconsidered and less costly, alternative methods should be explored. | IIB |
| 345 | Arad D, Finkelstein A, Rozenblum R, Magnezi R. Patient safety and staff psychological safety: a mixed methods study on aspects of teamwork in the operating room. Front Public Health. 2022;10:1060473 | Organizational Experience | n = 2,184 direct observation of surgical cases; 25 semi-structured interviews with OR clinicians and risk managers | n/a | n/a | n/a | This study revealed that the level of preoperative teamwork can predict the level of intraopertive teamwork, specifically with regard to patient safety. They also found a correlation of the number of clinicians turnover affects teamwork. | VA |

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|---|---|---|---|---|---|---|---|---|
| 346 | van Grevenstein WMU, van der Linde EM, Heetman JG et al. Crew resource management training for surgical teams, a fragmented landscape. J Surg Educ. 2021;78(6):2102–2109 | Qualitative | 10 CRM training providers of surgical teams | n/a | n/a | Compare CRM training courses on didactic components and simulation exercises to explore if these courses are interchangeable. | CRM training courses are diverse and noninterchangeable. CRM should be part of surgical training and be embedded in OR culture to become high value for patients and professionals. | IIIB |
| 347 | Kuy S, Romero RAL. Improving staff perception of a safety climate with crew resource management training. J Surg Res. 2017;213:177–183 | Qualitative | Surgical staff at one VA hospital | n/a | n/a | Effect of CRM training | There was 100% adherence to performance of briefings and debriefings after initiation of CRM training. There were 3 critical incident tracking network (CITN) reports prior to impementation of CRM training;following CRM training there have been zero CITN events. | IIIC |
| 348 | Hanssen I, Smith Jacobsen IL, Skråmm SH. Non-technical skills in operating room nursing: ethical aspects. Nurs Ethics. 2020;27(5):1364–1372 | Organizational Experience | n= 11 Norwegian nurses | n/a | n/a | n/a | The nurses find respect and patient safety , and espect and reciprocal politenss among the members of the perioperative team as centrl ethical non-technical skills. | VC |
| 349 | Bezemer J, Cope A, Korkiakangas T et al. Microanalysis of video from the operating room: an underused approach to patient safety research. BMJ Qual Saf. 2017;26(7):583–587 | Organizational Experience | 42 operations | n/a | n/a | n/a | Video recording within surgery offers rich possibilities for mixed methods research. The authors used systematically coded logs for the video analysis. They found that the video recording could be used for counting the prevalence of certain behaviors, explore the likely effects of certain behaviors, and explore the association of the behaviors with contextual factors. | VB |
| 350 | Long JA, Webster CS, Holliday T, Torrie J, Weller JM. Latent safety threats and countermeasures in the operating theater: a national in situ simulation-based observational study. Simul Healthc. 2022;17(1):e38–e44 | Qualitative | n= 103 postcourse reports . | n/a | n/a | Latent Safety Threats. | Latent Safety Threats (LST) were recored post in situ simulations training across 21 hospital in New Zealand. Common safety threats were staff knowledge and skill in emergencies, creating shared mental model. The researchers concluded that in situ simulation in the quality improvement in healthcare. | IIIB |
| 351 | van Dalen ASHM, Jung JJ, Nieveen van Dijkum EJM et al. Analyzing and discussing human factors affecting surgical patient safety using innovative technology: creating a safer operating culture. J Patient Saf. 2022;18(6):617–623 | Organizational Experience | N= 35 laparoscopic procedure recorded using a medical data recorder device (MDR) | n/a | n/a | n/a | Patient safety threats identified by the MDR and discussed by the operating room team were most frequently related to communication, teamwork, and situational awareness. To create an even safer operating culture, educational and quality improvement initiatives should aim at training the entire OR team, as it contributes to a shared mental model of relevant safety issues. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 352 | Burke JF, Anciano V, Novicoff WM, Yarboro SR. Use of standardized language for C-arm fluoroscopy improves intraoperative communication and efficiency. J Am Acad Orthop Surg. 2021;29(9):e458–e464 | Quasi-experimental | 83 responses for the pre education survey ( 40 - surgeons and 43- RT) 81 post education survey (40 surgeons, 41 RT) | education about C-arm fluoroscopy terminiology protocol | Pre and post intervention of common C-arm fluoroscopy terminology education protocol. | survey results | A standardized fluoroscopy language protocol improves intraoperative communication between orthopaedic surgeons and readiology technologists (RT).Mean fluoroscopy time was reduced from 90 seconds pre edcuation to 52.7 seconds post education (P=0.004). The survey results also demonstrated a improvement in quality of intraoperative communication, decrease in confusion, movement correction of the C-arm and need for repeat radiographs. | IIIB |
| 353 | Marrone SR. Perioperative accountable care teams: improving surgical team efficiency and work satisfaction through interprofessional collaboration. J Perioper Pract. 2018;28(9):223–230 | Organizational Experience | n/a | n/a | n/a | n/a | Interprofessional learning , teamwork and collaborative practice support healthcare prctitionser' abilities to provide safe care and to perform as a cohesive team. This process improvement plan with focused education on three specialty teams utilitized turnover data, OR revenue and staff satisfaction data to measure effect of inter professional collaboration. | VA |
| 354 | Watkins SC, de Oliveira Filho GR, Furse CM et al. The effect of novel decision support tools on technical and non-technical performance of teams in managing emergencies. J Med Syst. 2022;46(11):75 | RCT | 35 pediatric perioperative interdisciplinary clinical teams, completed 4 scenarios under each of the 4 sutdy conditions. | DST with only technical information,DST with non-technical information and a DST with both technical and non-technical | Memory alone | Technical and non-technical performance of teams. | There was no effect on the non-technical performance of the teams. | IA |
| 355 | Daly Guris RJ, Duarte SS, Miller CR, Schiavi A, Toy S. Training novice anaesthesiology trainees to speak up for patient safety. Br J Anaesth. 2019;122(6):767–775 | RCT | n=22 anesthesia residents. Control n=11 SE+ group n=11 | focused speaking up instruction sheet | Baseline education | participants performancein identifuing and expressing patient care concerns (speaking up behviour) | In novice anesthesia trainees, intrapersonal factors and communication performance benefit from repeated simulation training. Focused teaching may help trainees develop assertive behaviors. | IC |
| 356 | Rudolph JW, Simon R, Dufresne RL, Raemer DB. There's no such thing as "nonjudgmental" debriefing: a theory and method for debriefing with good judgment. Simul Healthc. 2006;1(1):49–55 | Case Report | n/a | n/a | n/a | n/a | Created a proces call "Debriefing with good judgement". It provides guidance to instructors providing feedback after a simulation learning event. | VA |
| 357 | Brunges M, Hughes TE. Using virtual human technology in perioperative team training simulations. AORN J. 2020;111(6):617–626 | Organizational Experience | 200 perioperative RN and ST | n/a | n/a | n/a | The universit of florida developed a Virtual Human technology to train staff in three scenarios over three years to improve patient safety and adherence to policy. The VH provided participants with thte opportunity to practice their communciation skils and improve patient safety.Using validated tools to promote standardized communication, partipants had to address patient safety conerns assertively during the siulations. | VA |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 358 | Cohen TN, Griggs AC, Kanji FF et al. Advancing team cohesion: using an escape room as a novel approach. J Patient Saf Risk Manag. 2021;26(3):126–134 | Quasi-experimental | 62 teams (280 particpants) | Escape room scenario where participants needed to successfully escape in the allotted 45 minutes. | 3 time series | escape room questionnaires related to two facets of group cohesion. PGC-B = belonging and PGC-M = morale. | Researchers sought to understand how an escape room might influence perceptions of cohesion in the healthcare setting. Their results indicate that an escape room may be a worthwhile mechanism; however, more research is needed as the evidence surrounding escape rooms is still in its infancy | IIIB |
| 359 | Dubé 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 | Organizational Experience | 24 stakeholder teams | n/a | n/a | n/a | This project demonstrates that the use of simulation and human factors methods is an effective and value-added approach to optimize clinical commissioning for healthcare environments, care pathways and systems for patient safety and organizational efficiency. Purposeful real-to-life simulated events were rehearsed to allow helathcare teams opportunity to identify what is working well and what needs improvement within the work environment. 24 stakeholder groups evaluated two transport routes, switching OR tabletops, the use of the C-arm and timely access to lead in the OR. | VA |
| 360 | Goodwin CDG, Velasquez E, Ross J et al. Development of a novel and scalable simulation-based teamwork training model using within-group debriefing of observed video simulation. Jt Comm J Qual Patient Saf. 2021;47(6):385–391 | Qualitative | 129 survey participants | n/a | n/a | simulation training evaluation | This study tested the protogype training program developed to be delivered in one-hour segments and rlies on observotaion of video simulation scenarios with a group debriefing.Participant evlauations of the redesigned prototyp were heighly positive with 92% reporting they would like to particpate in additional training sessions. | IIIB |
| 361 | Hartman JA, Anderson DM, Ding J, Keech JC. Interprofessional veno-veno bypass simulation improved team confidence. Surgery. 2022;171(4):904–907 | Organizational Experience | One facility's liver transplant team | n/a | n/a | survey post simulation veno-veno bypass assessing confidence in understanding communication | Participants concluded going through veno-veno bypass steps in a simulation was a positive experinece. The simulation experience allowed the team to create a checklist and standardize the steps for the proceure | VB |
| 362 | Jowsey T, Beaver P, Long J et al. Towards a safer culture: implementing multidisciplinary simulation-based team training in New Zealand operating theatres – a framework analysis. BMJ Open. 2019;9(10):e027122 | Qualitative | n=314 | n/a | n/a | participant experience with implementation of NetworkZ simulation in Operating Theatre across New Zealand | Implementation challenges existnd implementing a quality model across a whole nation reuires significant and sustained. The gains in patient safety and workplace culture are substantial. | IIIB |
| 363 | Lee MY, Kim SS. A safety simulation program for operating room nurses. Clin Simul Nurs. 2018;18:6–13 | Quasi-experimental | n=51 OR nurses; 25 from B hospital in experimental group and 23 OR nurses from K hospital control group | safety simulation program of a standardized patient (SSPSP) | pre and post survey | Safety Attitudes Quetionnaire | Safety attitudes and complinace with safty management differed significantly between experimental and control group, but awareness of the importance of safety management did not. The safety simulation program was effective and useful. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 364 | Mascagni P, Padoy N. OR black box and surgical control tower: recording and streaming data and analytics to improve surgical care. J Visc Surg. 2021;158(3S):S18–S25 | Expert Opinion | n/a | n/a | n/a | n/a | Surgical Data Science is a novel discipline using surgical digital data and advanced analytical methods to improve surgical care. Operating Room block boxes record data from mulitple sources to study factors affecting surgical safety, while surgical control towers analyze live surgical data to provide real-time assistance during surgical procedures. | VA |
| 365 | Nguyen, Ngan, Watson, William D. and Dominguez, Edward. Simulation-Based Communication Training for General Surgery and Obstetrics and Gynecology Residents 2019 | Qualitative | N=34 GS and ObGYN residents | n/a | n/a | Communication skills were compared during simulation of a laparoscopic procedure and observations recorded for briefs/time-out, debriefs, call-out, check-back/closed-loop, and empowerment/engagement. | The program improved the residents to use effective communication techniques during the Bradycardia and OR fire events. | IIIB |
| 366 | Nguyen N, Watson WD, Dominguez E. Simulation-based communication training for general surgery and obstetrics and gynecology residents. J Surg Educ. 2019;76(3):856–863 | Organizational Experience | 16 vascular and general surgical trainees | n/a | n/a | n/a | Endovascular simulation with structured debrief is a robust tool to improve NTS and TS. | VA |
| 367 | Shi R, Marin-Nevarez P, Hasty B et al. Operating room in situ interprofessional simulation for improving communication and teamwork. J Surg Res. 2021;260:237–244 | Organizational Experience | N=34(14 pre and 10 post) Surgeons, anesthesia and nurses | n/a | n/a | n/a | Effective team communication training leads to safe patient outcomes and a productive supportive work environment. | VB |
| 368 | Sigmon D, Dumon K, Hoeltzel G et al. Comparison of nontechnical skills grading rubrics for OR in situ simulation for general surgery and obstetrician/gynecologist residents. Surgery. 2020;168(5):898–903 | Organizational Experience | N=19 perioperative teams | n/a | n/a | n/a | Team Strategies and Tool to Enhance Performance and Patient Safety was used to educate multidisciplinary teams prior to a crisis simulation scenario. Nontechnical skills for surgeon improved. | VB |
| 369 | Turrentine FE, Schroen AT, Hallowell PT et al. Enhancing medical students' interprofessional teamwork through simulated room of errors experience. J Surg Res. 2020;251:137–145 | Organizational Experience | Third year medical students | n/a | n/a | n/a | TeamSTEPPS was instrumental in Medical students understanding of other discipline's perspective in a multidisciplinary team. | VA |
| 370 | Vortman R. Using simulation-based education to improve team communication during a massive transfusion protocol in the OR. AORN J. 2020;111(4):393–400 | Organizational Experience | N=150 perioperative personnel. | n/a | n/a | n/a | Perioperative personnel reported that the simulation-based education helped them understand their roles and responsibilities during a hemorrhagic crisis in the OR and improved their confidence in their ability to manage a hemorrhagic crisis via the MTP. | VA |

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|---|---|---|---|---|---|---|---|---|
| 371 | Wu G, Podlinski L, Wang C et al. Intraoperative code blue: improving teamwork and code response through interprofessional, in situ simulation. Jt Comm J Qual Patient Saf. 2022;48(12):665–673 | Organizational Experience | n=21 | n/a | n/a | n/a | Team performance improved in code blue in situ simulation scenarios after team training. | VA |
| 372 | Shear TD, Deshur M, Benson J et al. The effect of an electronic dynamic cognitive aid versus a static cognitive aid on the management of a simulated crisis: a randomized controlled trial. J Med Syst. 2018;43(1):6 | Quasi-experimental | 34 residents<br>19 sCA<br>15 dCA | Cognitive aids were used during simualated experience. Static cognitive aid (laminated checklist) sCA and decision support cognitive aid (computor driven prompts on checklist) | sCA vs dCA | performance in completion of the checklist and Anesthesia Non-Technical skills (ANTS) | The decision support cognitive aid group performed the checklist items correctly. The medication prompts on dosage for the patient was most helpful in the simulation scenario. | IIB |
| 373 | Strandbygaard J, Dose N, Moeller KE et al. Healthcare professionals' perception of safety culture and the Operating Room (OR) Black Box technology before clinical implementation: a cross-sectional survey. BMJ Open Qual. 2022;11(4):e001819 | Qualitative | N=100 | n/a | n/a | SAQ;Clance imposter phenomenon scale;diposition privacy score | The different healthcare professional groups had diverse perceptions about safety culture, but were mainly concerned about safety climate and teamwork in the OR. Impostor phenomenon decreased with age. Al groups were unconcerned about digital information sharing. The Canadian study had similar findings in terms of impostor phenomenon, but a variety within the SAQ and were more concerned about data safety, which could be due to medical litigation per Se and is not widespread in Scandinavia compared with North America. | IIIB |
| 374 | Bui AH, Guerrier S, Feldman DL et al. Is video observation as effective as live observation in improving teamwork in the operating room? Surgery. 2018;163(6):1191–1196 | Qualitative | 1,410 brief, 1398 debriefs | n/a | n/a | compliance to TeamSTEPPS skills during surgical briefs and debriefs | Briefs and debriefs were observed by video and live performance. Video observaitons may not be as effective as evaluating live performance in promoting team work in the OR. Live observation enables immediate feedback. | IIIB |
| 375 | Fridrich A, Imhof A, Staender S, Brenni M, Schwappach D. A quality improvement initiative using peer audit and feedback to improve compliance. Int J Qual Health Care. 2022;34(3):mzac058 | Qualitative | 11 hospital in Switzerland | n/a | n/a | Observational Tool deveoped to observe compliance with SSC | 715 observations were documented. Trained observers provided peer feedback to the team after observations. Peer observation facilitated the identification of weaknesses regarding the SSC process and SSC application at item level. | IIIA |
| 376 | Bui AH, Shebeen M, Girdusky C, Leitman IM. Structured feedback enhances compliance with operating room debriefs. J Surg Res. 2021;257:425–432 | Qualitative | 45 panelists across 5 disciplines (cardiac surgeons, perfusionists, circulating nurses, surgical technicians, and cardiac anesthesia) | n/a | n/a | identifyand rank critical pause points (PP) in cardiac surgery | There is a high degree of variablilty within and beween disciplines as to the importance of the distinct critical time points. This could represent a lack of a shared mental model aong disciplines caring for cardiac surgical patient durign the perioperative period. A lack of a shared mental model could be on of the factors conributing to prevenable errors in cardac operating rooms. | IIIB |
| 377 | Merry AF, Weller JM. Communication and team function affect patient outcomes in anaesthesia: getting the message across. Br J Anaesth. 2021;127(3):349–352 | Expert Opinion | n/a | n/a | n/a | n/a | The author discusses the data that supports an expectation that engagement in initiatives and techniques to enhance communiation and teamwork should not be optional. | VB |