11. Patient Identification Errors in the Operating Room

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Introduction

In the first Making Health Care Safer report, authors reviewed two types of patient safety practices (PSPs) to prevent misidentifications—bar coding and strategies to avoid wrong-site surgery. While scant literature existed documenting evidence regarding healthcare applications of bar coding, that report documented four areas in which bar coding showed promise for improving patient safety: patient identification, medication dispensing and administration, specimen handling, and medical recordkeeping. For strategies to avoid wrong-site surgery, the report reviewed evidence regarding the PSP of marking the operative site and involving the patient in the process, and found that signing the site had no evidence but was a low-tech solution with high face validity. In 2004, based on expert consensus, the Joint Commission (JC) developed the Universal Protocol principles and steps for preventing wrong-site, wrong-procedure, and wrong-person surgery. In the Preoperative Checklist and Anesthesia Checklists chapter of the second Making Health Care Safer report, authors found "no literature to substantiate the effectiveness of the current Joint Commission Universal Protocol in decreasing the rate of wrong site, wrong-level surgery." Authors noted that combining signing the site and verification protocols for operating team members might be effective but resource intensive to implement.

Key Findings:

- Drawing meaningful statistical comparisons is difficult because wrong-site surgeries are rare.
- Protocols should be implemented with activities to convince and educate providers of their necessity and effectiveness.

After convening its Partnership for Health Information Technology Patient Safety workgroup and related Patient Identification workgroup, the ECRI Institute performed a literature review to better understand how to address patient identification errors in clinical care.[1] The review included 106 articles, and found that 0.9 percent to 1.86 percent involved wrong-patient procedures. During surgery, communication errors and problems during diagnostic processes were the primary causes for wrong-site/wrong-patient surgery. Wristband errors (wristbands removed during surgery and not replaced) also contributed to the wrong-patient errors. Interventions included improving design for physical, electronic, and assigned patient identifiers (e.g., through using 2 wristbands on patients undergoing procedures), and new technology and automated systems-level safety checks (e.g., bar coding technology systems for transfusions, 2-sample confirmations for blood typing).

JC has continued to emphasize the importance of patient identification, including naming it as the most important National Patient Safety Goal starting in 2014 and releasing a *Quick Safety* issue in October 2018 focused on "People, processes, health IT and accurate patient identification." The issue discusses how health information technology is one component of successful patient identification in a cross-section of healthcare settings, including the operating theater. A successful approach to patient identification must also be patient-centric, collaborative, comprehensive, and systematic, and include people in development and implementation of patient identification processes.

This review's key findings are presented in the box above.

References for Introduction

1. ECRI Institute. Patient Identification Errors. 2016. https://www.ecri.org/Resources/HIT/Patient%20ID/Patient_Identification_Evidence_Based_Literature_final.pdf.

11.1 Practice Description

Operating room processes, systems, and culture impact patient care and safety of surgical procedures. Patient identification, one component of patient safety, requires that patients, caregivers, clinicians, and providers work together to ensure accuracy and consistency, and awareness of the intent of the healthcare procedure. Patient identification errors can impact anyone and cause irreparable damage—wrong treatment to the right individual, wrong treatment to the wrong individual, delays in treatment, or serious harm or death—and errors are preventable. The estimated rate of wrong-site surgery varies from 0.0 to 4.5 per 10,000 surgeries performed.[1] Contributing factors to wrong-site surgery include incorrectly documented patient consent or lack of patient consent, failure to use site-markings, multiple surgeons, multiple procedures on the same patient, overall poor communication, and patient or family providing incorrect information.[1]

PSPs related to patient identification can help healthcare providers quickly identify the patient, the site of surgery, or correct medication to administer. This review focuses on PSPs related to patient identification errors in surgery or the operating room, specifically analyzing marking techniques and verification protocols related to performing the correct surgery for the right people. Research examining outcomes focuses primarily on compliance with protocols and procedures, as reported wrong-site events are limited in number.

11.1.1 Methods

The review intended to answer one primary question, “What PSPs can assist in decreasing patient identification error before surgery or entering the operating room?”

Two databases, CINAHL® and MEDLINE®, were searched for articles published from the past 10 years, using terms for patient identification errors specifically for healthcare provided in the operating room, the outcomes of interest (wrong patient, wrong site), and several terms for related strategies.

General methods for this report are described in the Methods section of the full report.

For this patient safety practice, a PRISMA flow diagram and evidence table, along with literature-search strategy and search-term details, are included in the report appendixes C.

The initial search yielded 381 unique abstracts. All 381 citations were screened, from which 22 studies were reviewed for full text. Five evidence reviews and four systematic reviews met the inclusion criteria.

The review included observational studies and prospective audits. The search found no randomized controlled trials, studies with control groups, or experimental studies. Most studies had small sample sizes, with few having enough power to conduct significance testing. The strength of the evidence is low due to the observational and prospective nature of studies reviewed.

Studies were excluded if the outcomes were not relevant to this review (e.g., focused only on clinician outcomes such as knowledge, perceptions, or culture), if the article was out of scope, or if the report did not describe an intervention.

General methods for this report are described in the Methods section of the full report.

For this patient safety practice, a PRISMA flow diagram and evidence table, along with literature-search strategy and search-term details, are included in the report appendixes A through C.

11.1.2 Review of Evidence

11.1.2.1 Study Settings and Interventions

Four of the five evidence reviews and all four of the systematic reviews focused on patient identification errors in operating rooms. One evidence review examined errors in intensive care units.

Examined interventions included implementation protocols and checklists, site-marking (patient participation in site-marking and surgical site-marking by providers), and use of verification protocols and forms by healthcare providers.

11.1.2.1.1 Implementation Protocols and Checklists

Three systematic reviews and one retrospective study examined the JC Checklist Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery and the World Health Organization's Safe Surgery Checklist. All found no evidence that application of checklists decreased wrong-site surgery, but both noted the difficulty in determining this, based on the low rate of wrong-site surgery and the need for a large study size to demonstrate a statistically significant decrease in wrong-site surgery.

Devine et al. (2010) found no evidence to support the effectiveness of the JC Checklist or other preventive measures in preventing a wrong-site surgery.[1] Ragusa et al. (2016) reported that the literature shows an effect of the checklists on improving patient safety and likely on preventing wrong-site surgery, but the authors noted that no systematic research knowledge supports using the checklists to prevent wrong-site surgery.[2] Hempel et al. (2015 found five studies that analyzed the effect of the Universal Protocol as a patient safety intervention.[3] One study was based on a time series of events reported to the American Board of Orthopedic Surgery database, and although it found a reduced incidence of wrong-site skin incision, wrong-site surgical exposure, incomplete operation, and wrong procedure 6 years after the implementation of the JC Universal Protocol, the trend was statistically significant.[3] Another study found a trend of reduced surgical confusion 14 months after Universal Protocol implementation, but the trend was not statistically significant. Hempel et al. also identified 25 studies that evaluated various methods of operationalizing components and alternatives to the Universal Protocol, and none of the studies reported a statistically significant effect on wrong-site surgery events. In a retrospective study, Moshtaghi et al. (2017) examined 142 cases of wrong-site surgery to evaluate the prevalence and causation of wrong-site surgery.[4] The study identified the three most common causes of wrong-site surgery as leadership (30.9%), human factors (23.4%), and miscommunication (10%), also cited by the JC as the most common causes of wrong-site surgery. Overall, the study did not demonstrate a reduction in wrong-site surgery prevalence since the implementation of the JC Universal Protocol.

11.1.2.1.2 Site-Marking

Two prospective audit studies by Masud et al. and Bergal et al. explored the use of surgical markings to limit patient identification errors.[5,6] Both studies showed high rates of compliance with the practice of using surgical markings as a tool to decrease patient identification errors and no incidence of wrong-site surgery.

In these two studies, health providers marked the surgical site with arrows drawn directly on the patient's body and signed the location using an indelible pen. A prospective audit of 500 surgical markings for a range of elective surgery sites found extremely high compliance with the process: 99.4 percent of operating surgeons marked the correct location (Masud et al., 2010).[1] The researchers also found that an indelible marker pen was used for 88 percent of correct marking cases and an arrow was used for 64 percent of correct marking cases.

Bergal et al. (2010) examined patient involvement in independently marking the surgical site in addition to the activities conducted by healthcare providers. Their study found that 68 percent of the 200 enrolled patients were compliant with marking before surgery, in all instances patients marked the correct side, and no wrong-site surgery occurred during the study.[2]

11.1.2.1.3 Use of Verification Protocols and Forms

Two studies—one qualitative survey and one observational study—examined the use of different verification protocols to limit patient identification errors. Neither study examined causation between protocols and wrong-site surgery.

The anatomic marking form (AMF) was developed in response to a 2001 JC review of the Sentinel Event Database, which found 150 cases of wrong-site, wrong-person, or wrong-procedure surgery.[7] Of these, 76 percent, or 126 cases, were related to surgery on the wrong body part or site. The JC partnered with key organizations to research the issue and, in response, developed the AMF.

The AMF has been used in more than 112,500 surgical procedures at the University of Illinois College of Medicine.[7] Key activities of this practice included:

- Hospital staff submitted an AMF, which engaged the patient in confirming the surgical site.
- JC and hospital staff established an administrative policy to guide the use of the form as an alternative process for site-marking by the surgeon.

Since the implementation of the AMF and overarching process at the College of Medicine, only one case of documented wrong-site surgery has occurred. Knight and Aucar surveyed surgeons and nursing staff regarding their use of and satisfaction with the AMF process, and found that 65 percent of 66 survey respondents indicated they used the AMF for "most or all" procedures, and 23 percent indicated they regularly followed standard site-marking practices (not including the AMF). Seventy-seven percent of respondents indicated they were very satisfied with the AMF, 16 percent were satisfied or neutral, and 7 percent were very dissatisfied and preferred traditional site-marking.[7]

In a study examining the use of a protocol to prevent wrong-site, wrong-procedure, and wrong-person surgery, researchers examined the use of a verification protocol involving the patient, and examined performance audits conducted to measure compliance and provide feedback to providers.[8] The verification protocol included the following:

1. The anesthetist or nurse anesthetist in charge of a patient performed checks on identity and site of surgery before administering the anesthetic.
    a. If the patient participated in the verification process, the patient was asked to provide his or her first and last names, date of birth, and, when applicable, the site of the surgery.
2. Following the patient identity verification, the identity data were compared with three other pieces of information:
    a. Information on the patient's wristband.
    b. Data provided in the operating theater schedule.
    c. Patient's medical record.
3. After the surgery, the site of surgery was compared with:
    a. Surgeon's mark.
    b. Information provided in the operating theater schedule.
    c. Patient's medical record.

Audits were conducted throughout the 9-month period of the intervention. Audits consisted of direct observations of the first contact between a patient and the anesthetist or nurse anesthetist, during which identity and site of surgery checks had to take place. The observational study examined compliance with the verification protocol in 1,000 interactions between patients and anesthetists or nurse anesthetists. Researchers recorded the percentage of observations that satisfied each audit criterion. Inclusion of patients in the compliance process was high (98.5% of the 1,000 interactions). With one exception, compliance with all audit criteria in the verification protocol improved significantly over time: for example, full compliance with the protocol when performing the patient identification check was at 9.7 percent in the fourth quarter of 2003 and rose to 58.7 percent in the follow-up period. The percentage of cases in which all identity data were obtained went from 19.4 percent in the fourth quarter of 2003 to 70.9 percent in the follow-up period. The one exception was the surgical site being signed by the surgeon: this was at 75.8 percent in the fourth quarter of 2003 and rose only to 83.5 percent in the follow-up period. During the follow-up period, over 90 percent compliance was reported for the two audit criteria: patient wearing wristband and check of surgical site performed.[8]

11.1.3 Implementation Findings

In a systematic review of surgery safety practices, Kim et al. (2015) concluded that the patient safety guidelines in surgery are too general and that more standardization is needed for effective and consistent implementation.[9] Kim et al. found that, when developing guidelines, the following phases and activities should be implemented:

- Receive all surgery requests in writing.
- When scheduling, verify patient documentation.
- During the preoperative visit, obtain patient's informed consent and mark the procedure site with patient involvement.
- Prior to the procedure, use a safety checklist such as the Universal Protocol.
- In post-surgery, discuss the discharge plan with the patient and caregivers before leaving the facility.

Kim et al. also found that some interventions cannot be implemented in isolation—protocols should correspond with appropriate information technology, processes should be implemented with activities to convince and educate providers of the necessity and effective use of the protocol or checklist, and checklists should be used with participatory planning. While a single change to the patient identification procedures could improve discrete processes and likely decrease the incidence of patient identification errors, a single change is not sufficient to eliminate errors.[9]

References for Section 11.1

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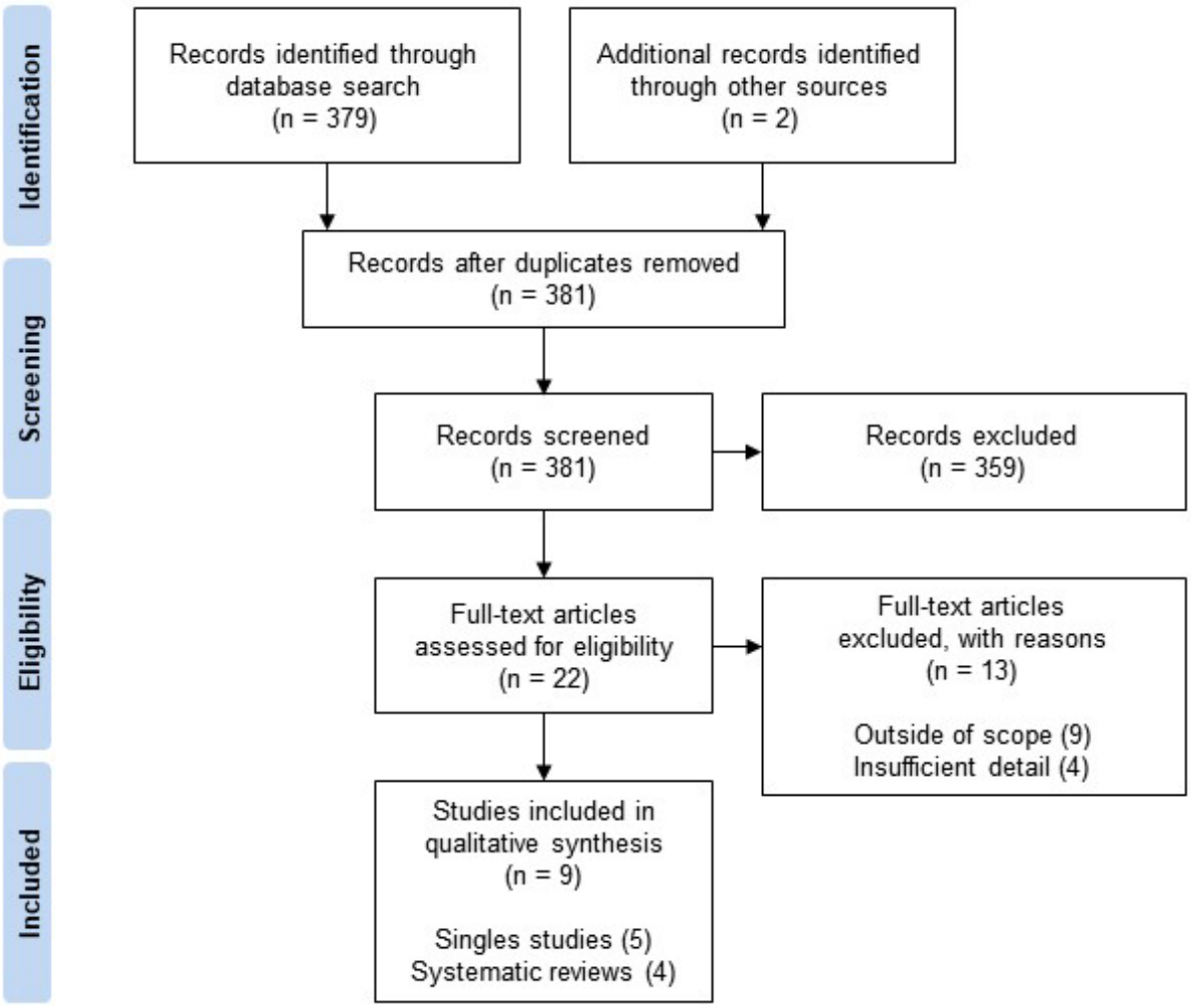
6. Bergal LM, Schwarzkopf R, Walsh M, et al. Patient participation in surgical site marking: can this be an additional tool to help avoid wrong-site surgery? J Patient Saf. 2010;6(4):221-5. PMID: 21500609.
7. Knight N, Aucar J. Use of an anatomic marking form as an alternative to the Universal Protocol for Preventing Wrong Site, Wrong Procedure and Wrong Person Surgery. Am J Surg. 2010;200(6):803-7; discussion 7-9.10.1016/j.amjsurg.2010.06.010.
8. Garnerin P, Ares M, Huchet A, et al. Verifying patient identity and site of surgery: improving compliance with protocol by audit and feedback. Qual Saf Health Care. 2008;17(6):454-8.10.1136/qshc.2007.022301.
9. Kim FJ, da Silva RD, Gustafson D, et al. Current issues in patient safety in surgery: a review. Patient safety in surgery. 2015;9:26-.10.1186/s13037-015-0067-4

Gaps and Future Directions

The prevalence of reported wrong-site surgeries is currently low, and patient identification errors are preventable. The studies found that health professionals use checklists, verification protocols, forms, and site-marking, and that these interventions limit the incidence of patient identification errors. Studies reviewed were observational in nature, and strength of evidence is low compared with in randomized controlled studies; therefore, future randomized controlled studies are needed to determine effectiveness. Most studies to date have had small sample sizes, limiting the ability to determine the statistical significance of observed outcomes. Interventions focused on provider and patient use of site-marking, and implementation checklists and verification protocols. The rarity of wrong-site events, one form of patient identification error, requires studies to be extremely large to demonstrate statistically significant results. Future studies should examine combining the use of checklists and protocols with supplemental interventions, correct information being shared by the patient or family member, and processes to provide multiple procedures on patient outcomes and team communication.

Appendix A. Patient Identification Errors in the Operating Room PRISMA Diagram

Figure A.1: Patient Identification Errors in the Operating Room—Study Selection for Review



PRISMA criteria described in Moher D, Liberati A, Tetzlaff J, et al. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009 Jul 21;6(7): e1000097. doi:10.1371/journal.pmed1000097.

Appendix B. Patient Identification Errors in the Operating Room Evidence Table

Table B.1: Patient Identification Errors in the Operating Room–Single Studies

Note: Full references are available in the Section 11.1 reference list.

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Bergal et al., 2010[6]	Patient participation in preoperative site-marking procedure	Study involved 200 patients scheduled to undergo orthopedic surgery. On the day of their surgery, patients were assessed as to their compliance with the instructions. The Fischer exact test for categorical data and the standard t test for continuous data were used to test differences in patient characteristics between those who did and did not mark their surgical site. The level of significance was 0.05.	Preoperative room/ operating room	Out of the 200 patients in the study, 135 patients (68%) were compliant with marking before the surgery. Of the 135 patients who completed a mark, 133 patients (67.2%) placed some mark on the correct surgical site and 123 patients (62.1%) marked the site using "yes," per instructions. Sixty-three patients did not place any mark at all. No wrong-site surgery occurred during the study. Compliance was statistically significant when ages were compared. Patients with a mean age of 46.8 versus 51 years were more likely to comply. Compliance was also statistically significant from enrollment to time of surgery—10.4 days (more likely to comply) versus 23.1 days.	Not provided	Per Joint Commission on Accreditation of Healthcare Organizations recommendations, a physician personally explained the study to the patient, acquired written consent, and encouraged safety compliance. The patient also received written instructions with the same information the physician had provided. The approach provides a more effective outcome and increased compliance and does not rely on the patient to read and comply with written instructions. Only 68% of patients complied, so the protocol probably needs to be used in combination with another wrong-site prevention protocol.	Moderate

Garnerin et al., 2008[8]	Verification protocol and periodic audits to measure compliance while also providing feedback	Verification protocol: (1) Anesthetist or nurse anesthetist in charge of patient performed checks on identity and site of surgery before administering the anesthetic. Patients who participated in the verification process were asked to provide their first and last names, date of birth, and, when applicable, the site of the surgery. (2) Following the checks, the identity data were compared with the information on the patient's wristband and with the data provided in the operating theater schedule and the patient's medical record. (3) The site of surgery had to be compared with the surgeon's check and with the information provided in the operating theater schedule and the patient's medical record. Audits were conducted throughout the 9-month period of the intervention. Audits consisted of direct observations of the first contact between a patient and the anesthetist or nurse anesthetist, during which checks on identity and site of surgery had to take place. Observational: compliance with the verification protocol was assessed over time as the percentage of observations that satisfied each audit criterion. The 95% confidence interval (CI) was computed assuming binomial	Intensive care unit	Of the 1,000 total interactions, in 985 interactions, patients participated in the verification process. Overall compliance with all audit criteria significantly improved over time ($p<0.001$), except for surgical site signed (77.5% CI, 80.6–83.5). During the followup period, over 90% compliance was reported for the two audit criteria: "patient wearing wristband" and "check of surgical site performed."	Not provided	Barriers to overcome: convincing providers to complete the protocol and improve collaboration with the surgical services. Verification protocol along with information technologies should be used. The verification protocol by itself is not sufficient.	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
		distribution. During the intervention, 1,000 interactions between patients and anesthetists or nurse anesthetists were observed.					
Knight et al., 2010[7]	Anatomic marking form (AMF) to prevent wrong-site, wrong-procedure, and wrong-person surgery	Hospital staff submitted an AMF, which engaged the patient in confirming the surgical site, to the Joint Commission's Standard Interpretation Group. In addition to the AMF, an administrative policy was established to guide the appropriate use of the form as an alternative process for site-marking by the surgeon. Surgeon and nursing staff satisfaction with AMF was assessed through a qualitative electronic survey sent to 205 potential users (43 nurses responded and 23 surgeons responded).	Preoperative room/ operating room	The AMF has been used in more than 112,500 surgical procedures at the University of Illinois College of Medicine. Since the implementation of the AMF, there has only been one case of documented wrong-site surgery. Sixty-five percent of survey respondents indicated they used the AMF regularly for "most or all" procedures, and 23% indicated they regularly followed standard site-marking practices. Seventy-seven percent of respondents indicated they were very satisfied with the AMF, 16% were satisfied or neutral, and 7% were very dissatisfied and preferred traditional site-marking.	Not provided	Because of the rarity of wrong-site events, meaningful statistical comparisons are elusive. Authors mention they have not been able to find specific evidence that the Universal Protocol decreases incidence of wrong-site surgery. AMF, like the Universal Protocol, should be combined with participatory planning, checklists and redundant communication.	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Masud et al., 2010[5]	Surgical site-marking	Prospective audit of 500 surgical markings for elective procedures carried out by surgeons between June 2008 and May 2009. Visibility pre and post draping was noted along with arrow markings and the use of an indelible pen. The location, laterality, and person marking were also noted. Total markings included: 204 inguinal hernias, 35 umbilical hernias, 48 varicose veins, 50 toenail removals, 123 excisions of skin lesions, 10 femoral artery procedures, and 40 breast procedures.	Preoperative room/ operating room	Three procedures (.6%) were not marked prior to theater; 497 procedures were all marked correctly for location and laterality and were marked by an operating surgeon present in the surgical procedures. An indelible marker pen was used for 88% of cases. An arrow was used for 64% of cases. Only 59% of markings remained visible after draping, and 31.4% of markings were placed where draping covered the markings.	Not provided	Incidents may be underestimated by at least a factor of 20 because they are self-reported.	Not provided
Moshtaghi et al. 2017[4]	Universal Protocol	Retrospective study of wrong-site surgery reports investigated by California's Department of Public Health between 2007 and 2014. A total of 142 cases were reviewed.	Operating room	The Joint Commission mandated the use of a timeout prior to each surgical procedure. Common causes of wrong-site surgery: lack of leadership (30.9%), human factors (23.4%), and miscommunication (10%).	Not provided	JC reporting is not mandatory; therefore, it is difficult to assess the true prevalence of wrong-site surgery. Although only 60% of patients correctly mark their surgery sites, it is still determined to be the most effective way of preventing wrong-site surgery. The analyzed data did not show any downward trend or reduction in wrong-site surgery since the implementation of the Universal Protocol	Not provided

Table B.2: Patient Identification Errors in the Operating Room–Systematic Reviews

Note: Full references are located in the Section 11.1 reference list.

Author, Year	Description of Patient Safety Practice	Setting	Summary of Systematic Review	Implementation Themes	Notes
Devine et al., 2010[1]	Joint Commission Checklist Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery	Operating room	The estimated rate of wrong-site surgery varies, ranging from 0.09 to 4.5 per 10,000 surgeries performed. Many studies do not allow for the calculation of an event rate. Contributing factors to wrong-site surgery include incorrect patient positioning or preparation of operative site, patient or family providing incorrect information, incorrect or lack of patient consent, failure to use site-markings, surgeon fatigue, multiple surgeons, multiple procedures on same patient, unusual time pressures, emergent operations, unusual patient anatomy, and overall poor communication. No evidence exists to support the Joint Commission checklist, North American Spine Society checklist, or other preventive measures and their effectiveness in preventing a wrong-site surgery.	North American Spine Society and Joint Commission checklists are insufficient on their own to minimize wrong-site surgery.	Strength of evidence for the questions is very low (incidence/frequency of wrong-site surgery and what preoperative measures are effective in preventing wrong-site surgery) and low (what are the causes of wrong-site surgery?).
Hempel et al., 2015[3]	Joint Commission Universal Protocol	Operating room	Review examined the incidence, root cause of. and interventions to prevent wrong-site surgery, surgical fires, and retained objects since the implementation of the Universal Protocol. Authors reviewed 138 studies. and the most common cause for wrong-site surgery was miscommunication. Five studies examined the effect of the Universal Protocol intervention and, although there was a downward trend in wrong-site surgery, it was statistically insignificant.	Review identified 25 studies that evaluated operationalizing components of and alternatives to the Universal Protocol, but none of the studies reported a statistically significant effect on wrong-site surgery.	None
Kim et al., 2015[9]	Surgery safety practices	Operating room	Healthcare workers should use the following to reduce wrong-site surgeries: (1) When scheduling the procedure, schedulers should verify patient documentation and receive all surgery requests in writing. (2) During the preoperative visit, patient should provide informed consent, and should be involved in marking the procedure site. (3) Before the procedure, a safety checklist such as the World Health Organization (WHO) checklist should be fully implemented. (4) A discharge plan should be discussed before leaving the facility.	According to the author, patient safety guidelines in surgery are too general and need more standardization.	None

Author, Year	Description of Patient Safety Practice	Setting	Summary of Systematic Review	Implementation Themes	Notes
Ragusa et al., 2016[2]	Joint Commission Universal Protocol and WHO Safe Surgery Checklist	Orthopedic surgeons/ operating rooms	Surgical checklist compliance varies, and additional measures like audits or monitoring were necessary to maintain compliance. No reviewed study reported a 100% compliance rate. Literature shows that the use of the WHO surgical safety checklist in the operating room improves patient safety in the operating room by decreasing postoperative complications and mortality. This approach is also shown to improve processes such as the timely use of prophylactic antibiotics; and after the implementation of checklists, which help to improve team communication and decrease communication failures. Reporting of wrong-site surgery is voluntary and those that are reported represent only a portion of those that occur, so it is difficult to draw conclusions about the frequency of occurrence. Wrong-site surgeries are rare, and showing any statistically significant reduction in occurrences with the implementation of checklists would require a very large study.	Five implementation barriers: (1) unfamiliarity with checklist, (2) hierarchal style in operating room, (3) problems with timing of the time-out portion, (4) duplication or repetition of items on checklist, (5) inclusion of items on the checklist that were not relevant. Literature also showed that some key team members limited the successful implementation of checklists. Literature shows that some surgeons were not supportive, while anesthesiologists and nurses tended to be more supportive.	None

Appendix C. Patient Identification Error in the Operating Room Search Terms

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
Search 2008-Present, English Only MedLine Publication Types: • Clinical Trial • Clinical Trial, Phase I • Clinical Trial, Phase II • Clinical Trial, Phase III • Clinical Trial, Phase IV • Comparative Study • Controlled Clinical Trial • Corrected and Republished Article • Evaluation Studies • Guideline • Journal Article • Meta-Analysis • Multicenter Study • Practice Guideline • Published Erratum • Randomized Controlled Trial	Operating Room/Surgery Specific Practices	(((MH "Patient Identification" OR "Operating Room Information Systems" OR "Patient Record Systems") OR (AB "Patient Identification System*" OR "Patient Identification Card" OR "Patient ID System" OR "Patient ID Card" OR "Operating Room Information System*" OR "Debriefing" OR "Identification Process" OR "Safeguard" OR "Patient Wristband" OR "Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery" OR "Structured Communication" OR "Bar Coding" OR "Consent Form" OR "Patient Safety Checklist" OR "Electronic Health Record" OR "CPOE" OR "Computerized Physician Order Entry" OR "Bar Code Scanner" OR "Identification Method" OR "ID Method" OR "Identification Alert*" OR "ID Alert*" OR "SAFER Checklist" OR "Structured Communication T	(((MH "Patient Identification Systems" OR "Operating Room Information Systems") OR (AB "Patient Identification System*" OR "Patient Identification Card" OR "Patient ID System" OR "Patient ID Card" OR "Operating Room Information System*" OR "Debriefing" OR "Identification Process" OR "Safeguard" OR "Patient Wristband" OR "Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery" OR "Structured Communication" OR "Bar Coding" OR "Consent Form" OR "Patient Safety Checklist" OR "Electronic Health Record" OR "CPOE" OR "Computerized Physician Order Entry" OR "Bar Code Scanner" OR "Identification Method" OR "ID Method" OR "Identification Alert*" OR "ID Alert*" OR "SAFER Checklist" OR

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
• Review • Scientific Integrity Review • Technical Report • Twin Study • Validation Studies CINAHL Publication Types: • Clinical Trial • Corrected Article • Journal Article • Meta-Analysis • Meta Synthesis • Practice Guidelines • Randomized Controlled Trial • Research Review • Systematic Review		ool*" OR "Radiofrequency Device")) AND ((MH "Treatment Errors") OR (AB "Surgical Error*" OR "Wrong Patient Surger*" OR "Wrong-Patient Surger*" OR "Wrong Procedure Error*" OR "Wrong-Procedure Error*" OR "Wrong Site Surger*" OR "Wrong-Site Surger*" OR "Surger*, Wrong-Site" OR "Surger*, Wrong Site" OR "Medical Mistake*" OR "Disclosure of Error*" OR "Mental Error*" OR "Action Error*")))	"Structured Communication tool*" OR "Radiofrequency Device")) AND (AB "Surgical Error*" OR "Wrong Patient Surger*" OR "Wrong-Patient Surger*" OR "Wrong Procedure Error*" OR "Wrong-Procedure Error*" OR "Wrong Site Surger*" OR "Wrong-Site Surger*" OR "Surger*, Wrong-Site" OR "Surger*, Wrong Site" OR "Medical Mistake*" OR "Disclosure of Error*" OR "Mental Error*" OR "Action Error*") AND ((MH "Operating Rooms") OR (AB "Operating Room*" OR "Surger*")))

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