PRE-SURGICAL HUDDLE AND EFFICIENCIES IN THE PERIOPERATIVE SETTING

DNP Final Project

Presented in Partial Fulfillment of the Requirements for the Doctor of Nursing Practice in the Graduate School at The Ohio State University

By

Alice Marie Krumm, MS, RN, CNOR, NEA-BC

Graduate Program in Nursing

The Ohio State University

2021

DNP Final Project Committee:

Chair: Dr. Sharon Tucker PhD, APRN-CNS, NC-BC, EBP-C, FNAP, FAAN

Dr. Joyce Karl DNP, APRN - CNP

Col (ret) Penelope F. Gorsuch, DNP, RN, NEA-BC, EBP-C, FACHE

Dr. Robin M. Rosselet, DNP, RN, CNP, AOCN

Abstract

Delays in surgery have a significant and compounding impact to OR efficiencies resulting in unused operating room time representing missed revenue generating opportunities. Delays can prolong the duration of a surgical case increasing a patient's risk for postoperative complications and prevent subsequent cases from timely entry to the OR. Reasons for delays are most frequently related to communication failures between members of the operating room team. The purpose of this quality improvement project was to implement an evidence-based checklist-guided pre-surgical huddle to decrease delays and increase OR efficiencies such as first case on-time starts (FCOTS), turnover time (TOT), and last case on-time end (LCOTE). During the 8-week project implementation period, 83% of the huddles were attended by all team members with cardiac fellows and nursing staff at 98%. With a pre-surgical huddle, the LCOTE cumulative deviation decline per day by 68 minutes resulted in a projected $435,000 opportunity cost savings. Specialty specific checklist guided pre-surgical huddles promoted teamwork, increased communication, and increased OR efficiencies.

Keywords: OR efficiency, OR utilization, process improvement, first cases on time starts, OR turnover, checklists, OR briefing, pre-surgical huddle

DEDICATION

I dedicate this work to my husband Richard.

Your love and encouragement motivated me. Your unwavering support inspired me. Your strength sustained me.

Section One: Nature of the Problem

Introduction to the Problem

Surgical care accounts for almost one-third of all U.S. health care expenditures which, in 2016, reached 3.3 trillion dollars (National Quality Forum [NQF], 2019). Representing up to 40% of a hospital's costs and 60% of revenue, operating room (OR) dollars are often the largest contributors to a hospital's financial success (Fong et al., 2016; Rothstein & Raval, 2018; Tagge et al., 2017). Notably, OR suites are the most expensive functional areas in a hospital and often a high priority for efficiency initiatives (Doebbeling et al., 2012; Fong et al., 2016; Tankard et al., 2018). Optimization of OR efficiencies is critical to expanding care capacity while meeting demands for high-quality and low-cost care (Doebbeling et al., 2012; Fong et al., 2016; Mathews et al., 2015; Rothstein & Raval, 2018; Tagge et al., 2017; Tankard et al., 2018). Tacit to efficiencies is the need to reduce delays in surgery (Wong et al., 2010). Delays in surgery represent a myriad of workflow disruptions that lengthen the amount of time it takes to complete a day of scheduled surgical cases (Tyler et al., 2003; Wong et al., 2010). Late starts to the day, extended turnovers between surgeries, and longer than anticipated non-surgical time in the OR are delays experienced daily and viewed as barriers to optimal perioperative patient throughput (Ellis et al., 2020; Henrickson et al., 2009; Tyerman et al., 2020; Wong et al., 2010; Zimlichman et al., 2013).

Impact of Delays in Surgery

Financial Impact. Delays in surgery have a significant and compounding impact to OR efficiencies resulting in unused operating room time representing missed revenue generating opportunities through surgical productivity (Mathews et al., 2015; Tankard et al., 2018). Delays in scheduled cases often push back add-on cases and extend the day creating additional costs for the hospital through overtime pay for surgical and support staff, and downstream throughput issues to hospital-wide efficiency (Bender et al., 2015; Doebbeling et al., 2012; Ellis et al., 2020; Rosenthal, 2018). Less measurable, but important, is the impact that delays can have on surgical care access, future referrals and the overall healthcare market (Rothstein & Raval, 2018).

As value-based reimbursement and alternative payment models continue to be viewed as a primary strategy to reducing the cost of quality care, improving OR efficiencies will continue to be vanguard (Doebbeling et al., 2012; Ellis et al., 2020; NQF, 2019). A fully staffed OR can cost up to $150/minute depending on case complexity (Cerfolio et al., 2019). Considering that delays are responsible for approximately 23% of unused OR hours, the financial impact can have significant implications to a hospital's bottom line (Fong et al., 2016; Tankard et al., 2018). Martin & Langell (2017) estimated a $976,456 opportunity cost savings after implementing pre-surgical huddles.

Patient Impact. Delays in the perioperative setting are an obstacle to effective perioperative throughput which has significant implications to patients such as case cancellations and long patient waiting lists (Antoniadis et al., 2014; Divatia & Ranganathan, 2015; Ibrahim et al., 2019). Intraoperative delays also prolong the planned duration of a surgical case which has been associated with increased rates of postoperative complications including surgical site infection, venous thromboembolism, bleeding, hematoma, and tissue necrosis (Cheng et al., 2018; Ibrahim et al., 2019; Parikh et al., 2010). Subsequent surgeries may also have to wait or be rescheduled which decreases patient and staff satisfaction and requires additional resources to coordinate (Fügener et al., 2017). Considered less than ideal, these cases often end after regular work hours resulting in staff overtime, or the need for the surgeon to complete the case with a team that may not be as familiar with the surgical procedure (Doebbeling et al., 2012; Fügener et al., 2017; Gillespie et al., 2019). For example, a recent study conducted at the University of Virginia found starting non-urgent cardiac cases later in the day to be associated with 2 times higher absolute and risk-adjusted mortality (Yountet al., 2015).

The negative impact of prolonged patient wait times on patient satisfaction has been well documented and linked to as much as a 10% decrease in patient satisfaction (Bleustein et al., 2014; Prentice et al., 2014). Also well documented is the impact to an organization's bottom line as patient experience and care coordination contribute to 25% of the overall hospital score in the U.S. value-based payment model (Health Services Advisory Group [HSAG], 2017).

Reasons for Delays in Surgery. Understanding reasons for surgical delays is an essential step to improving efficiencies in surgical care. The research points to system issues and human factors as two main categories under which most contributory factors fall (Fong et al., 2016; Lee et al., 2019; Tyerman et al., 2020). Factors can be related to missing or malfunctioning equipment, instrument unavailability, failed communication between members of the operating team, and lack of procedural preparation (Henrickson et al., 2009; Jain et al., 2015; Lingard et al., 2011; Weld et al., 2016; Wong et al., 2010). While there are common themes to the functional reasons for delays, the literature is clear that creating a shared mental model among the team members caring for surgical patients, empowers individuals to voice concerns and promotes proactivity in care coordination (Henrickson et al., 2009; Jain et al., 2015; S. J. Russ et al., 2015; Wong et al., 2010).

Purpose of Project

The purpose of this quality improvement project was to implement an evidence-based checklist-guided pre-surgical huddle to decrease delays in surgery and in turn increase OR efficiency. Delays in surgery have a negative impact to OR efficiency affecting hospital and staff resources, surgical volume and patient access to care (Fong et al., 2016; Mathews et al., 2015; Tagge et al., 2017; Tankard et al., 2018).

The setting is one of the largest academic medical centers in the Southeast, serving as the primary resource for specialty and primary care in hundreds of adult and pediatric specialties for patients throughout Tennessee and the Mid-South (Vanderbilt University Medical Center [UMC], 2019). The medical center is designated as a Level 1 trauma center, houses the only dedicated burn center in the state and operates an extensive multi-organ transplant program. The medical center campus includes pediatric, adult, psychiatric and rehabilitation hospitals as well a comprehensive cancer center.

The adult hospital has 864 in-patient beds which include acute care, medical, surgical, and neuro intensive care units (ICUs). On main campus, the perioperative department has a total of 56 operating rooms, 46 pre-op bays, and 51 post anesthesia care unit (PACU) bays in which nearly 40,000 surgical

procedures are performed annually. The department employs over 800 staff for direct care and perioperative support services. Surgical specialty areas include gynecology surgical oncology, plastic and reconstructive surgery, neurosurgery, thoracic, vascular, and cardiac surgery, orthopedics, urology, otolaryngology, trauma, transplant, and burn. The pediatric hospital has 267 inpatient beds and performs 18,000 surgical procedures annually with similar service lines.

The organizational focus on OR efficiency, as a driver for strategic surgical growth and increased profit margins, is continual. However, the financial consequences related to a decline in surgical volume, because of the recent COVID-19 pandemic, underscores OR efficiencies as essential to the organization's ability to continue providing surgical access to care. To that end, efforts to prevent delays to surgery start times, as well as improve other efficiency metrics, are a high priority. Decreasing delays in surgery will increase OR capacity and utilization, access to surgical care, and patient satisfaction (Bender et al., 2015; Healey et al., 2015; Tankard et al., 2018).

Project Objectives

1. Adapt an existing evidence-based presurgical checklist to incorporate items specific to cardiac surgery.
2. Establish a core implementation team and educate the cardiac surgical team (surgeons, anesthesia care providers, nursing, support staff, perfusionists and surgical resident house staff) on the process improvement initiative and implementation of a checklist-guided pre-surgical huddle.
3. Implement the evidence-based quality improvement project in the cardiac surgical specialty ORs.
4. Evaluate operating room (OR) efficiencies, as defined by first case on-time starts (FCOTS), turn over time (TOT). Secondarily, case durations, expressed as last case on-time end (LCOTE), evaluate before and after the implementation of a pre-surgical huddle.

Section Two: Review of the Literature

Clinical Practice Problem Statement

PICOT Question

To assist with the literature review and to guide project development and implementation the following PICO question was used to drive an exhaustive literature search: In the perioperative setting (P) how does a pre-surgical huddle (brief) (I) compared to no pre-surgical huddle (brief) (C) affect OR efficiencies (O)?

Evaluation/Summary of the Evidence from the Literature

Exhaustive Search Process

An exhaustive literature search was conducted, looking for the highest level of evidence, using the following databases: The National Library of Medicine Medline database (PubMed), Ovid Medline, Cumulative Index to Nursing & Allied Health Literature (CINAHL), and Cochrane Library. Other sources included Google Scholar and professional organizations' websites such as: The Joint Commission Accreditation Hospital Organization (JCAHO), Association of Perioperative Registered Nurses (AORN), American Society of Anesthesiologists (ASA), Association of Perianesthesia Nurses (ASPAN), American College of Surgeons (ACOS), Agency for Healthcare Research and Quality (AHRQ), and Institute for Healthcare Improvement (IHI).

MESH terms used included "operating room efficiencies," "teamwork and communication," "quality improvement/organization and administration," and "perioperative period/organization and administration." Keywords included: operating room efficiency and perioperative teamwork, and operating room utilization, process improvement, first cases on time starts, operating room turnover, checklists, OR process improvement, OR briefing, checklists, pre-surgical huddle, Pre-surgical briefing, and team training. In each database, MESH terms and key words were entered in various combinations.

The search was conducted searching for articles published from January 1, 2004, through July 1, 2020 Inclusion criteria included adults, all types of surgery, and both inpatient and ambulatory surgeries. Articles that answered the PICO question but contained a pre- or post-operative focus only, were eliminated. The search generated a total of 2,203 results which decreased to 1,633 after duplicates were removed (see Appendix A). Of these, 1,563 were excluded based on relevance leaving 70 full text articles

remaining. Of these, 29 articles were identified as meeting inclusion criteria, however 14 were eliminated due to quality concerns. The remaining 15 articles were included in summary and evaluation table for this project (see Appendix B). The articles reviewed were of moderate to low levels of evidence but provided clinical significance to this quality improvement project. As indicated in the level of evidence synthesis table (see Appendix C), quality improvement and descriptive study frameworks were the most prevalent study designs. Of the articles reviewed, there was one controlled trial without randomization, and no randomized control trials. The articles reviewed provided statistically and clinically significant findings, as outlined in the Outcome Synthesis table and were therefore included in the evidenced-based inquiry (see Appendix D). The evidence supports that pre-surgical huddles lead to increased efficiencies in the perioperative setting.

Critical Appraisal of the Evidence

There is a growing body of evidence supporting the premise that communication failures negatively impact patient safety outcomes and OR efficiencies (Pugel et al., 2015). In fact, Lingard et al. (2011), cited communication failure is the most frequent cause of adverse events across all healthcare settings, observing failures in 30% of team interactions. This explains why communication failures have been identified as the root cause in 80% of sentinel events and 77% of wrong-site surgeries (Makary et al., 2006). Acknowledging this as a gap concomitant with human factors within a complex clinical setting, The Joint Commission (TJC) made communication a critical focal point in the operating room by mandating Universal Protocol for surgical procedures (Makary et al., 2006). Universal Protocol involves a checklist guided pre-procedure verification process to address missing information or discrepancies before the start of a surgical procedure and has been established as a standard of care (Association of Perioperative Registered Nurses [AORN], 2019; Martin & Langell, 2017). Surgical safety checklist huddles, also known as briefings, have become a well-accepted strategy to provide a contextual framework for intraoperative communication associated with improving patient safety outcomes and operating room efficiency (Lingard et al., 2011; Paull et al., 2010). As noted in one study, the framework

promotes open communication, respect, and teamwork (Taylor et al., 2010). Moreover, researchers have found that huddles improve team interprofessional insight and cohesion increasing staffs' confidence in voicing concerns about potential safety issues (Leong et al., 2017; Weld et al., 2016). Concomitantly, a shared mental model enables teams to proactively manage errors because there is team engagement, awareness, and information sharing from the beginning of a surgical case (Ali et al., 2011; Forsyth et al., 2019; Henrickson et al., 2009). Ali et al. (2011) indicated that 89% of the study population described an increased awareness after the implementation of huddles, and 97% felt potential patient problems were highlighted. Studies have also identified significant improvement in operating room efficiency when a pre-surgical huddle is a part of an OR's workflow (Weld et al., 2016). Pre-surgical huddles have likewise been identified as valuable to decreasing surgical workflow disruptions that cause significant delays and decrease operating room efficiency. Nundy et al. (2008) linked pre-surgical huddles to a 31% reduction in OR delays, while Weld et al., (2016) demonstrated a 10% median reduction in overall case time.

In a pilot project, Jain et al., (2015) demonstrated that daily pre-operative huddles improved the flow of their day, while decreasing the rate of unexpected delays from 78.95% to 21.05%. Twenty-five percent of intraoperative delay time could be attributed to preventable disruptions, and 60% of those disruptions were for activities that should have been eliminated or done before the procedure (Al-Hakim & Yan Gong, 2012) . By reviewing equipment needs during a pre-surgical huddle, the cardiovascular team at Mayo Clinic decreased the number of times the circulating nurse had to leave the OR during a case by 50% (Henrickson et al., 2009). Reviewing anticipated flow, supply needs, and overall OR goals prior to the surgical case resulted in a 31% reduction in unexpected surgical delays for 11 surgeons when performing over 400 cases at Johns Hopkins University (Nundy et al., 2008).

Huddles have also been shown to have a positive impact in reducing delays at the start of the day. San Antonio Military Medical Center improved their on-time first-start rate by 21% within the urological service line for over 1,400 cases using the Team STEPPS tool for briefings (Weld et al., 2016). Introducing a morning huddle 30 to 45 minutes before the scheduled start time to set goals and identify

issues that could lead to a delay helped Vanderbilt University Medical Center to increase their first-case on-time start rate by 35% (Mathews et al., 2015).

Recommendations

The literature review has shown a positive impact to both surgical operations and patient care using the pre-surgical huddle process. Positive outcomes include reports of improved culture of safety, increased efficiency, and an increase in opportunity costs. This provides great opportunity for hospitals to increase their surgical revenue while providing efficient, safe, quality care.

Theoretical Basis

Conceptual Framework – Plan Do Study Act

The Plan Do Study Act performance improvement model (see Appendix E), was the framework used to guide this project. Performance improvement (PI) models are commonly used in health-care organizations. This is due to a major influence of governing agencies whose efforts focus on increasing quality of care while decreasing healthcare cost. Regulatory bodies such as the Centers for Medicare and Medicaid Services (CMS) continue to drive efforts to improve patient safety, quality outcomes, and operational efficiencies through initiatives. One such initiative is their quality strategy vision for improving health delivery. Tied to CMS's goals are programs designed to financially reward organizations for successful PI efforts. Such programs have accelerated the use of process improvement in healthcare.

While there are several PI models that have provided structure and guidance to healthcare improvement projects, the Plan-Do-Study-Act (PDSA) model, used in conjunction with the Institute for Healthcare Improvement's Model for Improvement, is one of the most frequently used tools in healthcare quality improvement (Christoff, 2018). The PDSA framework involves a four-step iterative approach to continuous process improvement exploring questions posed to specific project goals, successful changes, and measures of success. Fundamental to the model is the concept of using an iterative approach to evaluate small scale contextual changes over time. It involves testing potential solutions, assessing the

results, and applying or adapting changes according to how they impact the desired outcome (Christoff, 2018).

The literature reveals notable successes when using PDSA in clinical settings. Using the framework to implement standardized clinical care practices around ventilator-associated pneumonias, participants found that continuous measurement and feedback accelerated change as teams adapted the interventions (Pinto et al., 2011). Another study focused on the use of PDSA to optimize innovation in personal care by enhancing patient feedback systems for older adults. In addition to the parsimonious nature of this model, authors leveraged its practicality in the small-scale intervention approach to adopt, adapt, or abandon changes in the iterative approach to change (McGowan & Reid, 2018).

The PDSA framework was applied to this quality improvement project for the implementation of a pre-surgical huddle. The first step in the model is *plan*. In this step, team members identified goals for the project and the pre-surgical huddle implementation and began to develop a plan. During the planning stage, objectives were reviewed, and outcome metrics defined to drive data collection. The second step, *do*, involved plan implementation. The cardiac surgeons and surgical team received education to ensure process compliance and documentation of data. During the third step, *study*, evaluation of the data in relationship to the predictions, and previous learnings was a key component to building on contextual knowledge and anchors this iterative approach (Cheraghlou et al., 2017; Christoff, 2018; Kaplan et al., 2015). The last step, *act*, operationalizes the iterative approach and offers three paths for the intervention being tested: adopt, adapt, or abandon guiding teams to use their learning in the context of the environment (Christoff, 2018; Kaplan et al., 2015). The core team met weekly to review progress and determine if changes needed to be made to the process or the checklist.

Evidence-Based Practice Model

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Healthcare (Iowa Model Collaborative, 2017), was used to used guide Evidence-Based Practice (EBP) implementation for this project. It was selected for this project because of its intuitively understandable characteristics and

widespread use in in many academic healthcare organizations (Gawlinski & Rutledge, 2008). The Iowa Model is shown as an algorithm (See Appendix F) guiding a multiphase, yet practical approach to achieve quality outcomes and sustainable change (Buckwalter et al., 2017). The model, which focuses on collaboration and organization, encourages nurses to challenge current practices with research and applicability (White & Spruce, 2015). Using this model to guide implementation of this quality improvement project helped to assure that decisions were made with the best evidence, clinical expertise, and consideration to patient's preferences and values (Brown, 2014).

Vanderbilt University Medical Center's nursing professional practice model (VUMC PPM) is built on the tenants of interdisciplinary teams, surrounding the patient and family, to provide safe, quality evidence-based care (VUMC, 2021). It is underpinned by the organization's commitment to service quality, and innovation which drives their strategic planning. This model supports interdisciplinary, innovative evidence-based changes and helped the team focus on successful implementation and sustainability to achieve the desired outcomes of this project.

Utility and Feasibility

The evidence regarding pre-surgical huddles is consistent and supported applicability of this quality improvement project (AORN, 2019; Henrickson et al., 2009; Jain et al., 2015; Nundy et al., 2008; S. Russ et al., 2013; Weld et al., 2016). Presurgical huddles performed in the OR prior to the first patient entering the OR was the most frequent place and time identified in the literature (Henrickson et al., 2009; Jain et al., 2015; Mathews et al., 2015; Nundy et al., 2008; Russ et al., 2013; Weld et al., 2016). The literature also provided evidence to inform team composition citing the attending surgeon, anesthesia care provider, RN circulator, and surgical scrub personnel as essential (Ali et al., 2011; Henrickson et al., 2009; Jain et al., 2015; Nundy et al., 2008; Russ et al., 2013; Weld et al., 2016). Checklists used to guide the huddle varied but stayed consistent including team introductions, procedure specific information, related equipment and supplies, and patient specific concerns (Ali et al., 2011; Henrickson et al., 2009; Jain et al., 2015; Nundy et al., 2008; Russ et al., 2013; Weld et al., 2016). Also supported in the literature

was tailoring the checklist by surgical specialty to ensure specialty specific issues and concerns are addressed (Henrickson et al., 2009; Jain et al., 2015). The checklist used for this project is an adaptation of existing evidence-based presurgical huddle checklists that incorporated elements specific to cardiac surgery (see Appendix G). Based on the literature, core elements included are team introduction, review of planned procedures, equipment and instrument availability, antibiotics, patient or procedural risks and concerns (see Appendix H). The core group was asked to customize it according to the patient population served, operational needs, and other relevant items specific to cardiac surgery. They then conferred with stakeholder groups representing surgeons, anesthesia care providers, perfusions, nursing staff, and surgical schedulers until consensus was reached.

Benefits and Risks

Delays in surgery continue to have significant effects on resource utilization, patient flow and patient outcomes (Wong et al., 2010). Implementing a presurgical huddle has been shown to increase team communication, care coordination, and improve shared understanding concomitantly with reduced OR delays while increasing OR efficiencies (Henrickson et al., 2009; Jain et al., 2015; Leong et al., 2017). Benefits to implementing this project are increased team communication and OR efficiencies leading to staff, surgeon, and patient satisfaction. Additionally, increased efficiency was expected to improve surgical access to care and the organization's bottom-line. The risks associated with implementation were the potential for negative impacts to efficiencies and staffs' perception related to other EBP implementations.

Recommendation Summary

The implementation of a pre-surgical huddle has been identified as an important strategy to decreasing delays in surgery and increasing OR efficiency (Ali et al., 2011; Henrickson et al., 2009; Jain et al., 2015; Mathews et al., 2015). The OR represents a highly technical and demanding clinical environment involving teams of professionals who must coordinate their work with accuracy and timeliness to achieve optimal care(Forse et al., 2011). The complexity of the OR environment is

multifaceted, which can create a level of unpredictability when preparing for a surgical case (Rothstein & Raval, 2018). During a pe-surgical huddle, specific medical issues, the operative plan, staff, equipment, and instrumentation needs are discussed. Unfamiliarity with any of these aspects can pose a safety risk to the patient**,** as well as cause unnecessary delays (Weld et al., 2016). Direct verbal communication and interdisciplinary interaction through pre-surgical huddles has been shown to increase team cohesiveness resulting in fewer surgical delays (Henrickson et al., 2009; Jain et al., 2015; S. Russ et al., 2013; Weld et al., 2016). Incorporating a checklist guided huddle for the surgical team to review surgical cases for the day has been shown to reduce delays in surgery.

Key Stakeholders

The value of stakeholder engagement is well documented in the literature and identified as a key strategy to project implementation across the healthcare continuum (Goodman et al., 2017; Lu et al., 2020). When considering the implementation of pre-surgical huddles it will be essential to identify stakeholders, at multiple levels, who are both committed to the project's success, and have capacity to engage in its implementation (Goodman et al., 2017). Considered the first and most critical step is identifying a physician champion to endorse the initiative as a priority to both organizational leadership and clinical staff (Lu et al., 2020). Two cardiac surgeons, of which one is the department chair, were identified as physician champions. Using a two-pronged approach, one was actively involved engaging frontline clinical staff while the other worked to ensure that project goals were prioritized and supported at an organizational level. Other key stakeholders included anesthesia providers, perioperative staff, organizational leaders, leaders, and support staff. (see Table 11) Identifying who could be impacted by the change and how the project aligns with their interests offered valuable insight to inform strategies and remove barriers to implementation (Lu et al., 2020) Selection of this interdisciplinary team was based upon their expertise as it relates to the topic and their practice area. The literature is clear that early engagement of people affected by the change is the most successful approach to implementing evidence-based practice (White & Spruce, 2015). To garner support, the core team reported out to Perioperative

Operations team whose members reflect a broad representation of professionals having direct or contiguous relationships with perioperative services. Table 1 outlines other key stakeholders and strategies used to create awareness, build knowledge, promote action and adoption.

Table 1

Stakeholders and Engagement Strategies

Stakeholder	Strategies to Engage
Core Team Surgeon Champion RN Manager RN Clinical Staff Leader RNFA Facilitator	Create Microsoft Teams "Channel" to facilitate communication Involve team in reviewing evidence, implementation plan development and encourage them to identify educational content Encourage peer group discussions to identify barriers throughout the process
Physician champions	Identify key organizational meetings to attend with physician champion Review evidence with each stakeholder group Solicit input and support for elements of huddle checklist
Department Chair Cardiac Surgery and cardiothoracic surgeons	Set expectations within their areas and promote adoption Support and socialize to medical staff members including non-employed staff to achieve buy-in. Support new policy on expected documentation
Cardiac Surgery Fellows	Meet 1:1 with Cardiac fellow chief Solicit input and support for elements of huddle checklist Involve in huddle implementation debriefs Participate in Cardiac Fellow team meetings

Stakeholder	Strategies to Engage
Chief Anesthesiologist Cardiac Surgery and Cardiac Anesthesia Faculty Chief Cardiac Nurse Anesthetist and CRNA team	Actively engage in huddle checklist elements and determination of attendance compliance
Cardiac Surgery Nursing and Ancillary Support Staff	Engage in huddle checklist review Ask team members to lead huddles Provide timely data feedback
Cardiac Surgery Nursing Leadership Team	Send reminders & practice prompts Celebrate team progress Personalized staff messaging Engage in simulation and debriefs
Perioperative Operations Team and Executive Leadership Perioperative Data Analytics Team Cardiac Surgery Schedulers	Consistently report progress and key metrics Co-present with physician champions Engage team early for input on data collection Solicit input and support for elements of huddle checklist Involve in updates Create dedicated email for pre-surgical huddle communication

Section Three: Methods

Recommendations of Practice Change

Based on the evidence, a checklist-guided pre-surgical huddle for the day of surgical cases in an OR was implemented using the implementation strategies outline in Table 1. An 8-week pilot was conducted in operating rooms where the identified service line specialty area typically operates. Outcome measurements were first case on-time starts (FCOTS) and turn over time (TOT). Secondarily, deviations from last case on-time end (LCOTE), before and after the implementation of a pre-surgical huddle were examined.

Plan for Implementation and Evaluation

Evidence-based practice model-Iowa Model

The first step in this model is identifying triggering issues or opportunities that may indicate the need for a change (Buckwalter et al., 2017). These triggers illuminate improvement opportunities and may be in the form of new evidence, published scientific knowledge, or national initiatives (Melnyk & Fineout-Overholt, 2019). The question related to this project: What is the impact of pre-surgical huddles to operating room efficiencies? is brought about by national and organization pressures to become more efficient in the operating room and the considerable amount of new evidence related to the impact of huddles.

Determining the priority of the problem to the unit, department, and organization is the second step in the Iowa Model (Buckwalter et al., 2017). The organizational priorities for this health system identify safe, quality, and efficient care as top of hospital priorities. This includes expectations around team efforts to not just be fiscally responsible, but to use innovation to optimize resources, and decrease cost to provide optimal care for our patients. In line with these parameters, efficiency metrics such as first case on-time start (FCOTS) rates, turn-over times (TOT), and intraoperative case durations are metrics reviewed monthly as part of the organization's perioperative scorecard.

The third step is forming an interprofessional team whose members have the skill and enthusiasm to help plan, implement and appraise the project (Buckwalter et al., 2017). A core implementation team, consisting of a surgeon champion, perioperative leaders, nursing staff, and a huddle facilitator worked with key stakeholders representing information technology, data analytics staff, ancillary support, and surgical scheduling. Group members were selected based on their expertise related to the context of the project and level of engagement within the department. Considered the primary beneficiaries of this plan, the members representing these groups collaborated to help develop and evaluate an implementation plan. The core group met twice a week during pre-implementation period and once a week for the duration of project implementation. They also served as liaisons to disseminate information and help to create buy-in for the changes and to celebrate milestone changes.

The core team plays an intricate part in gathering and critiquing applicable research to determine the relevancy of the studies and ultimately whether sufficient research exists to support a practice change – step 4 (Brown, 2014). For this project, the literature review and appraisal were completed prior to forming the team. The core group was asked to review the evidence, weigh in on the proposed intervention, and to adapt an existing evidence-based checklist specifically for cardiovascular surgery.

Design and pilot of the practice change is the next step in the model. During this time the checklist and huddle process, implementation, and evaluation plan are developed (Buckwalter et al., 2017). Early in this process, it is important to consider patient input from stakeholders and team members (Melnyk & Fineout-Overholt, 2019). Feedback about delays can be solicited through face-to-face conversations and patient survey comments. Resources and constraints should also be evaluated during the planning phases. Given the context of the current healthcare landscape, the effects of the pandemic may have limited staffing resources or precluded cardiac surgeries which may have impacted implementation. The last steps of the model entail integrating and sustaining the change and disseminating results. Dissemination can be achieved in many ways such as presentations to committees or professional groups and sending briefs to other academic medical centers (Melnyk & Fineout-Overholt, 2019).

Sample and setting

The setting for this project was a large Level 1 trauma and academic medical center in the Southeast, with 864 in-patient beds which include acute care, medical, surgical, and neuro intensive care units (ICU). On its main campus the perioperative department has a total of 56 operating rooms, 46 pre-op bays, and 51 post anesthesia care unit (PACU) bays in which nearly 40,000 surgical procedures are performed annually. Surgical specialty areas include gynecology surgical oncology, plastic reconstructive surgery, neurosurgery, thoracic, vascular, and cardiac surgery, orthopedics, urology, otolaryngology, trauma, transplant, and burn.

The cardiac surgery service line performs surgery in 3 dedicated ORs with 6 cardiac surgeons, and 18 dedicated cardiac anesthesiologists. There are approximately 120 clinical staff including nursing staff, perfusion, and nurse anesthetists (CRNA). They perform complex cardiac and transplant surgeries in addition to providing emergency coverage for minimally invasive cardiac procedures done in the Cath Lab. Their transplant program, which is 10% of their annual volume (1,300), is ranked number one worldwide. This busy service line often shifts cases among the grouping of ORs to offer flexibility for unexpected complications, emergency procedures, and time dependent heart transplant cases. To that end, they had expressed interest in this project to increase their team communication and OR efficiencies.

Organizational Readiness

Implementing change requires thoughtful consideration to the influences that may affect the ability for change to occur (Burnes & Cooke, 2013). When evaluating the organization's readiness for change several factors were considered. The organization has adapted to significant leadership changes over the past year with many new key leaders coming in under a new structure. Additionally, the hospital's supply distribution center, as well as the homes of many employees, which were destroyed by a tornado earlier this year, place a substantial financial burden on the organization. Finally, the COVID-19 pandemic has challenged the organization to find unprecedented ways to acquire additional supplies and staffing resources to meet the needs of their patients. The totality of these costs combined with the uncertainty of the pandemic's duration has certainly influenced decisions around project prioritization. Understanding how individuals or groups may perceive this project, considering the organization's current landscape, was an important step in gaining support. As the project was socialized across the medical center, organizational values around culture of safety and surgical access to care were leveraged to gain consensus and increase collaboration. Departmental structure was another factor considered. Stakeholder groups are arranged by role or function which can make communication, coordination, and goal alignment challenging. For this project, it was important to have representation from each group,

both core team and as key stakeholders, to building relationships between the groups across the department for widespread participation (Burnes & Cooke, 2013).

Summary plan for implementation

Successful implementation requires leadership support and engagement from stakeholders across the organization. Considering the substantial recent organizational changes in leadership, including the author of this project at the project site, it was deemed important to create psychological safety to decrease learner anxiety and resistance to change (Schein & Schein, 2017). Schein & Schein (2017) underscore the importance of executing on eight activities to create psychological safety during the process of organizational change. The eight activities include providing a compelling vision of the "new way of working," ways to engage the end-user, group inclusion, opportunity to discuss problems, positive role models, formal training, resources, and removing barriers (Schein & Schein, 2017).

Creating a compelling vision was important for introducing the tenants of the project with key leaders and clinical staff. To build organizational support, the project plan, goals, and implementation timeline were reported out at the Cardiac Surgery Multidisciplinary Huddle. This group of decision-makers is led by the cardiac surgery chair and constituents include leadership roles such as chief nursing officer, adult hospital president and associate chief operating officer. In addition to the above, information and updates were routinely shared with other key leadership groups such as Perioperative Executive Board (PEC) and Perioperative Operations Committee (POC).

Presentations to clinical staff (see Appendix G) and other key stakeholder groups outlined the project, reviewed supporting evidence and current metrics, and highlighted advantages of implementation. To ensure learner involvement, presentation content was sent out via email soliciting additional feedback. In additional communications, any staff or physician involved in the pilot received an invitation to a newly created group in Microsoft Teams named "Cardiac Surgery Presurgical Team Huddle." This mobile platform provides easy access for teams to be more inclusive in discussing issues soliciting feedback or sharing information. Additional huddle specific education to the nursing and ancillary support

staff were included in a celebratory breakfast, comments from surgeon and nursing champions, and a one-hour education session regarding correct use of the surgical checklist and huddle cadence. During this formal training session, staff were encouraged to ask questions and identify any opportunities or barriers to the pilot. While not mandatory, attendance at this session was tracked. Staff who were not in attendance received one to one education from a core team member.

To ensure all groups were included in training and had an opportunity to provide feedback, physician and advanced practice provider engagement and education occurred in three ways. First, the huddle process was presented to each stakeholder participant group. At this time, physician, leader, and local champions were asked to circulate the presentation among their peer groups. Second, huddle checklists and cadence expectations were pushed out via e-mail, using the Teams app, and reinforced in person during leader rounds. Communications such as "count-down" to pilot and subsequent progress updates were also sent. A poster sized checklist was displayed on a white board at the designated huddle "spot." Blank checklists were available for staff to take and write on during the huddle period.

Finally, the team practiced the cadence and offered feedback in real time, a week prior to go live. After each simulation day, the core group debriefed to assess for any gaps in the process or cultural barriers within the team. Implementing change in a dynamic area, such as the OR, requires thoughtful consideration to the influences that may affect the ability for change to occur. Removing barriers and engaging facilitators is essential to achieving sustainable change (Schein & Schein, 2017).

Potential Barriers. Potential barriers to implementation included resistance from anesthesia care providers and surgeons to attend the briefing due to perceived time constraints, or lack of education related to the implementation. To address this, education regarding the briefing initiative, impact, data collection, and reporting was provided in staff in-services, anesthesia grand rounds, and OR operations meetings. Table 2 shows additional barriers and strategies planned to address them.

Table 2

Potential Barriers to Pre-surgical Huddle Implementation and Strategies to Address

Potential barriers	Strategy to address
Buy-in of attending and resident physicians	Identified physician and resident champions to include on core team. Called out total huddle time at the end of each huddle Communicated timeline and progress updates via email, and postings in attending and resident lounges.
Cardiac bed capacity huddle requires many of the same stakeholders' presence and follows at 0645 on a different floor.	Engaged clinical staff to determine best place to secure a space in an area with close to the subsequent huddle.
Nursing staff do not clock in until 0630	Adjusted nursing staff schedules to start at 0600 with expectation that nursing staff attendance is required.
Staffing resource limitations related to skill mix or decreased staffing related to pandemic.	Reviewed staffing schedules one week in advance to evaluate and adjust staffing.
Timing for surgeon to physically attend huddle	Provided technology to allow mobility. (i.e. Microsoft Teams for surgeons to conference into the huddle).
Anesthesiologists do not feel it is necessary for all of them to attend.	Engaged chief of anesthesia to determine alternative attendance plan.
Dynamic nature of case management related to urgent add-on cases, transplant surgeries	Engaged cardiac schedulers to ensure case movement was communicated in a timely manner as a part of the huddle.

Potential Facilitators. Potential facilitators to implementation include a solid plan, clear expectations, and outcome measurements, and strong buy-in from the surgeons and nursing team. Implementing strategies that achieve quality metrics and maintain the ability to provide learning in the operating room environment, was planned to support sustainability. Creating a trusting culture, and a shared mental model in the context of a strong framework, is necessary to implement sustainable changes (Pappas & McCauley, 2018). The DNP Essentials provide the structure and framework for DNP leaders to facilitate and enculturate change (American Association of Colleges of Nursing [AACN], 2006). Sustainable change will be strengthened by the continued dissemination of results and the impact of

outcomes to key stakeholders. Table 3 identifies potential facilitators and strategies planned to engage them.

Table 3

Potential Facilitators to Pre-surgical Huddle Implementation and Strategies to Engage

Potential Facilitators	Strategy to Engage
Significant interest from executive leadership	Outlined project vision, key metrics, and potential benefits to executive and participant stakeholder groups.
Strong support and buy-in from the surgeons, anesthesia providers	Partnered with physician champion to encourage involvement and engagement. Solicited input to checklist elements and workflow algorithm. Presented frequent updates outlining progress, providing recognition, and soliciting feedback in person, via email, and through Microsoft Teams posts.
Commitment and support from Core group	Highlighted project advantages solicited input on checklist and workflow and conducted weekly debriefs.
Strong support from surgical scheduling team	Engaged them in the checklist creation, informed them of milestones, and updated them on progress.
Perioperative nursing staff already very skilled	Included end-users in the process. Provided formal training, encouraged collaboration and knowledge sharing.
Nursing Staff's desire to improve and increase readiness for procedures	Personalized staff messaging offered public recognition for participation. Solicited input from individual staff when rounding in OR.

Measurement methods and tools

Outcome measurements. While there are several indicators that can be used to measure and monitor OR performance, Fong et al. (2016) identified time is the most used metric to evaluate efficiency. Multiple studies have used standardized time points that are already available as a part of the operative documentation to identify sources of inefficiency (Fong et al., 2016). Primary for this project, included

first case on-time start rates (FCOTS), turnover times (TOT), and last case on-time end (LCOTE) variances. These data were compared to processes times for the same patient population 8 weeks prior to implementation, and 6 weeks post implementation of pre-surgical huddles.

The rate of FCOTS measures the percentage of first cases that start in the OR on time. Because the organization has adopted a "five-minute grace" philosophy in their existing metrics, a first case is "on time" was defined as such (see Table 4). Additionally, turnover times greater than 90 minutes are excluded as they are assumed to be breaks or intended gaps in the schedule. LCOTE variances are analyzed both in aggregate and for individual ORs. To improve these times, a checklist guided presurgical huddle was implemented.

Recognizing the continuous case movement among the 3 dedicated cardiac ORs, the huddle was designed so that all cases in all cardiac ORs for each day were reviewed. The huddle began with a role call followed by the facilitator calling out the first OR to be reviewed and its team members. The facilitator then reviewed the patient demographic portion of the huddle sheet. Next, the surgeon outlined the surgical plan of care, followed by perfusion, and finally the anesthesia care plan was outlined by the provider. Blank huddle sheets were used by team members as a worksheet throughout the day. The cadence of the huddle incorporated a call out and acknowledgement when an action item was reviewed by the facilitator. For example, if the facilitator called out "consent" the fellow responded stating that he or she completed it or acknowledged that it was not complete and took it as an action item. After each patient's plan of care was reviewed, a call for questions, or concerns was issued before moving on to the next review. The manager or CSL completed a compliance section responding to four elements: attendance of team members, completion of checklist items, review all surgical cases scheduled in cardiac ORs for that day, and completion of briefing prior to first patient in OR. Data were extracted from charts of surgical cases included in the pilot specifically focusing on process times.

Table 4

Outcome Measure Definitions

Measure	Definition
First Case on Time Starts (FCOTS)	The percentage of first cases that start on time versus the total number of first cases for the day.
On time	The patient is in the operating room within 5 minutes of their scheduled start time.
Turnover Time (TOT)	The time from when a patient exits the OR to the time a consecutive patient enters the same OR. [a]
Last Case on Time End (LCOTE)	The actual end of the last scheduled case of operative day
LCOTE duration	The difference between the completion of the actual and scheduled last case of the day in an OR.

[a] Excludes time gaps of over 90 minutes

Compliance with the huddle process was assessed using four criteria outlined in Table 5. Based on feedback from all stakeholders, consideration to team member's roles and current workflow was considered to define attendance compliance. The huddle facilitator documented compliance using an electronic survey system, logging a binary response to each of the four elements each day (see Appendix J) Compliance rates were calculated for each element separately using the number of days compliant over the total number of huddle days.

Table 5

Pre-surgical Huddle Compliance Criteria

Compliance Element	Compliance Criteria by Role		
1. Attendance of team members	Where team members present?		
	In-person or Call-in	In-person	In-person for each OR
	Attending Surgeon First Call Anesthesiologist Lead CRNA	Cardiac Fellow Cardiac CSL/Manager On Call Perfusionist Anesthesia Tech Periop Tech (ORTA)	RN Circulator RN/ST RNFA

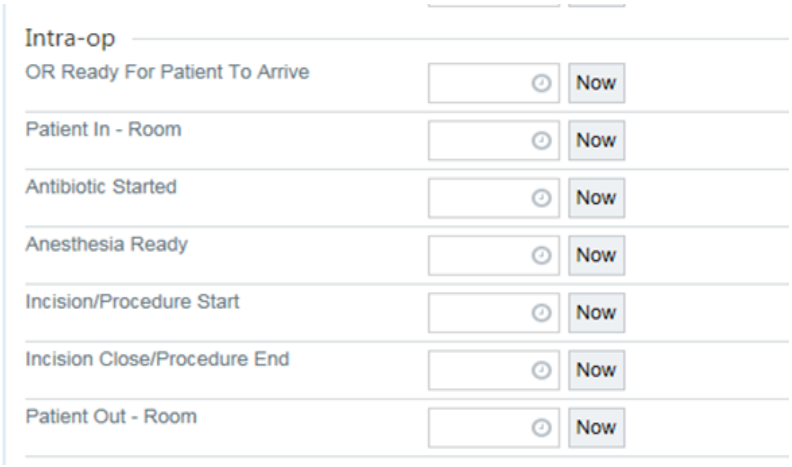
2.	Completion of huddle prior to first patient in OR	Was the Pre-surgical huddle completed before first case starts?
3.	Review surgical cases scheduled in the OR for that day	Were all cases scheduled before 06:00 reviewed?
4.	Discussion of checklist items	Were all checklist items reviewed for each boarded case?

Data Collection Process and Logistics

Time stamps for process measures are documented by the circulating nurse as a part of required documentation in a patient's operative record (see Figure 1). Data analysis, and reporting, is provided by the organization's perioperative data analytics department who provides routine analysis time data for the department. Process times and efficiency metrics are readily available and consistently reviewed by clinical and operational leaders, across the perioperative platform, to inform decision-making. Data collection for huddle compliance were captured, in real time, using a web-based questionnaire created by the core group using a secure web-based survey program.

Figure 1

Time Stamps in Electronic Medical Record



Plan for Data Analysis

Data were collected for cardiac surgery cases performed in any of the three cardiac ORs, on non-holiday weekdays, and only cases that entered OR between 7 am and 7 pm between August 2020 – January 2021 considered. Prior to the implementation of this project, a pre-surgical huddle was not conducted for cardiac surgical cases. Data analysis included descriptive statistics for comparisons during the time periods between pre-implementation (8-weeks), implementation (8-weeks), and post-implementation(6-weeks). It is important to note that the post implementation duration is shorter because of the current pandemic impact to the organization and the needs of leader engagement during this time-period. Time data were retrieved and analyzed and validated by the senior director of perioperative analytics as it relates to FCOTS, TOT, and LCOTE durations. Huddle compliance data were exported from the secure online survey program and validated by the organization's process engineering team.

Proposed Budget and Resources Plan

The return on investment (ROI) for this project was deemed important, despite that ROI calculation can become complicated in healthcare (Arora et al., 2015). In the OR, expenses can be widely varied based on complexity of surgery and cost of supplies and equipment (Arora et al., 2015; Macario, 2010; Rosenthal, 2018). Acknowledging costing variations in the literature, data from the organization's finance department were reviewed to determine the potential gross revenue capture for each OR minute. When determining surgical charges, the organization uses a leveling system based on the number of staff needed, complexity of the set up and equipment needed for the case. Using internal micro-algorithms, cases are then assigned costing levels. Levels are from 1-5, with 5 having the most complexity, needing the most resources, and bill at the highest rate. The level charge used most frequently for cardiac surgical cases is level 3 which is billed at approximately $160 per minute and is the number that was used for this analysis. The revenue potential can quickly add up with every minute an OR improves their efficiency. Using the example of Weld et al. (2016) at San Antonio Military Medical where a 19 minutes improvement per orthopedic case, on average was realized, the same improvement for cardiac surgery was estimated to potentially increase revenue opportunities by $450,000 per month.

Expenses for the project are approximately $7,500 for the 2-month pilot. Table 6 outlines the proposed budget and resources needed to implement and sustain a Pre-surgical huddle.

Table 6

Proposed budget and resource plan

	Staffing Expense			Total
	RN	RNFA	ST	
No. of Staff	3	3	3	
Hrs. Per Day	0.5	0.5	0.5	
# of Days	40	40	40	
Total Hours	60	60	60	
RN Avg Salary	40	62	24	
Cost by Role	$2,400	$3,720	$1,440	$7,560
	Equipment/Supplies			
Mobile computer workstation	No cost-using one from center core			
Dry Erase Board	$200			$200
Mobile software program	No cost - software license owned by medical center			
	Other			
Breakfast for 25 people	$218			$218
Grand Total				$7,978 [a]

Note. Fiscal Year 2021 Budget for Perioperative Services

[a] Budget total is for 2-month pilot

Education Plan. Initial education and training of teams was provided specific to the elements of the checklist, how to complete the checklist and how to document compliance. Additionally, dry-run simulation sessions prior to first cases of the day for the week prior to implementation provided an opportunity for participants to practice, provide feedback, and identify any barriers to their learning. Training time was approximately 60 minutes for each staff member and learning objectives for staff

participating in the training included verbalizing an understanding of the checklist elements, demonstrating how to complete the huddle process and how to complete the huddle checklist.

Timeline for Implementation. The timeframe for implementation was outlined to keep the team on track and identify milestones of key strategies for EBP implementation (Figure 2). below

Figure 2

Timeline for implementation

`

Activity	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21
Define EBP purpose and team														
Assemble, appraise and synthesis evidence														
Design practice change														
Plan, pilot, and create resource materials														
Collect baseline data														
Prepare change agents														
Prepare clinicians														
Implement					10.05.20	11.30.20								
Evaluate post-pilot														
Begin project reporting														
Begin project integration and continue monitoring														
	Strategy 1 **C**reating Awareness and Interest		**Strategy 2** Build Knowledge and Commitment		**Strategy 3** Implement Strategies to Promote Action and Adaptation					**Strategy 4** Implement Strategies to Pursue Integration and Sustainability				

Note. FULD Framework for EBP Implementation adapted from Melnyk, Gallagher-Ford & Fineout-Overholt (2017) and Cullen, Hanrahan, Farrington, DeBerg, Tucker & Kleiber (2018)

Section Four: Findings

Results/Outcomes

The purpose of this quality improvement project was to implement a checklist-guided pre-surgical huddle in the Cardiac Surgery OR's, from October 5, 2020 through November 30, 2020 prior to the start of the OR day. The objectives of this project were:

1. to adapt an existing evidence-based presurgical checklist to incorporate items specific to cardiac surgery,
2. establish an implementation team and educate the cardiac surgical team on the process improvement initiative and implementation of a checklist-guided pre-surgical huddle,
3. implement the evidence-based quality improvement project in the cardiac surgical specialty ORs, and
4. evaluate operating room (OR) efficiencies as defined by first case on-time starts (FCOTS), turn over time (TOT). Secondarily, case durations, expressed as last case on-time end (LCOTE), were evaluated before and after the implementation of a pre-surgical huddle.

The primary outcome measures for this quality improvement project were to determine the change in FCOTS and TOT metrics, and the secondary measure of LCOTE. Statistical comparisons using nonparametric median and interquartile range tests, were made between cases with a pre-surgical huddle versus before a pre-surgical huddle. Elements of huddle compliance were evaluated using basic descriptive statistics during and after implementation.

During the data collection period, a total of 492 cardiac surgical procedures were performed in three dedicated cardiac ORs. As shown in Table 7, number of cases are specific to the time measurement. For example, even though there were 492 total cases, only 217 started as the first case of the day. The FCOTS rates were similar before and with a pre-surgical huddle at 60% and 62% respectively. Equally, the median late interval, in minutes, for first-start cases was similar before and with a pre-surgical huddle as shown in Figure 3. TOT did not significantly vary with implementation (median 66 min pre-intervention vs. versus 58 minutes post-intervention).

Table 7

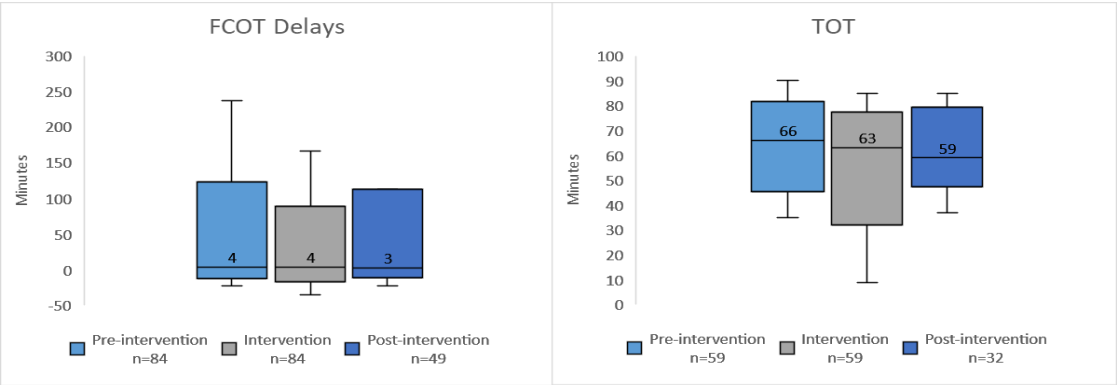
Pre-surgical Huddle Outcome Measurement Case Numbers

	Pre-intervention (n)	Intervention (n)	Post-Intervention (n)	Total (N)
Cardiac Surgical Procedures	191	186	115	492
FCOTS	84	84	49	217
TOT	59	59	32	150

	Pre-intervention (n)	Intervention (n)	Post-Intervention (n)	Total (N)
LCOTE Avg Deviation per OR	39	39	27	105
LCOTE - Cumulative	39	39	27	105

Figure 3

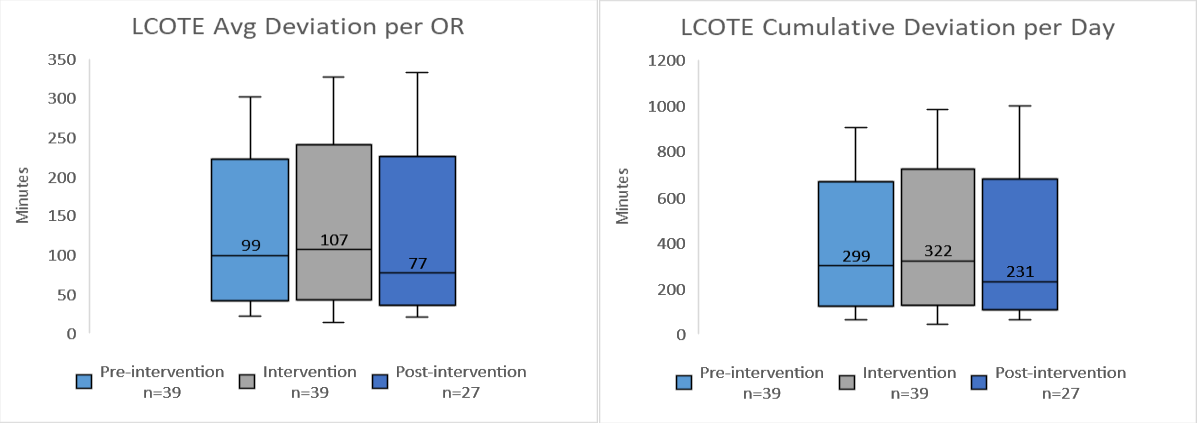
First Case On-time Start (FCOTS) and Turnover Time (TOT) Efficiency Data



LCOTE durations were analyzed first by looking at the median average deviation for the three OR's each day and second examining the median cumulative deviation per day. As shown in Figure 4, the median average deviation per OR each day decreased by 22 minutes and the cumulative deviation per day by 68 minutes with implementation of a pre-surgical huddle.

Figure 4

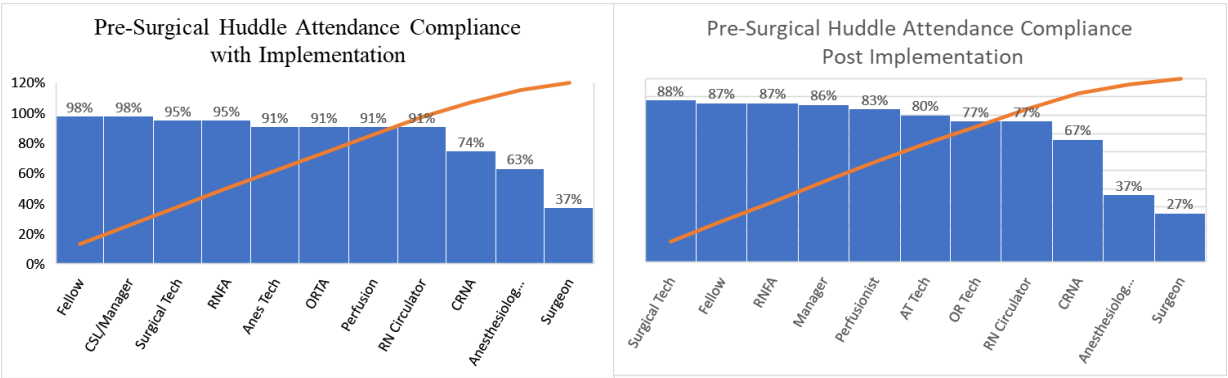
Last Case On-time End (LCOTE)



Compliance related to the huddle process specific to reviewing all checklist items, for all cases, prior to the first case start was 100% during and after the implementation period. Over-all attendance compliance was 83% during implementation and dropping to 73% post-implementation. As shown in Figure 5, attendance was highest for fellows, nursing and support staff ranging between 91 and 98% during implementation and dropping by 10% during the post implementation period (see Figure 5).

Figure 5

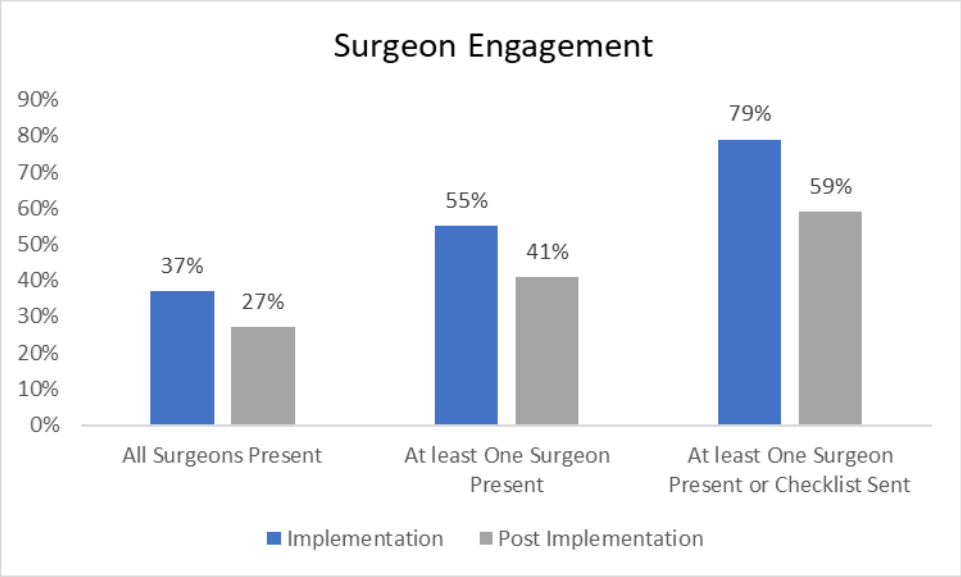
Pre-surgical huddle Attendance Compliance



All surgeons were present at the huddle only 37% of the time during implementation and 27% post implementation. However, there was at least one surgeon was present for 55% of the huddles during implementation, there was some level of surgeon engagement for 79% of the huddles (see Figure 6).

Figure 6

Pre-surgical Huddle Overall Surgeon Engagement



Discussion/Conclusions

Delays in surgery are barriers to optimal perioperative patient throughput and operating room efficiency. Delays throughout the day have been shown to have a significant and compounded impact to patients as well as an organization's bottom line (Bender et al., 2015; Doebbeling et al., 2012; Ellis et al., 2020; Rosenthal, 2018). In this evidence-based quality improvement project the intervention centered on using a checklist guided huddle as a contextual intervention for interdisciplinary intraoperative communication to decrease delays.

Participation in the huddle demonstrated engagement and an increase in team communication with an overall participation rate of 84%. The cardiac fellows had a significant presence in the huddles and were often able to provide input into the patients plan of care in the absence of the attending surgeon. In a post project debrief, nursing teams expressed that identifying which fellow was assigned to their OR and reviewing the plans of care was beneficial when planning for a subsequent case or with case movement. Surgeon attendance was the lowest both during and after implementation. This may be, in part, a result of unrealistic attendance expectations in that not all surgeons had a first case start. Another

factor was the surgeons' rapid adoption of the checklist as a tool they used when scheduling a case. Surgeons were scanning completed checklists to the cardiac nurse manager, 24 and 31% of the time during the implementation and post-implementation periods, respectively, as an alternative to attending the huddle.

With the implementation of a cardiac checklist guided presurgical huddle, there was a 68-minute decrease in the median variation in last case end time among all three ORs each day. Ending an OR day on time maximizes efficiency. The consequences of extending the day beyond the LCOTE is an over-utilized OR requiring overtime or resulting in rescheduling of cases. Equally, ending the day sooner than anticipated results in under-utilized idle OR and support staff.

Decreasing end time variation by 68 minutes each day saved cumulative total of 2,720 minutes, that would have otherwise been spent in delays. Factoring in the gross cost of an OR minute at $160, estimated savings for this project is $435,000. Using the same assumptions, Table 8 shows the estimated annual ROI for this project.

Table 8

Estimated ROI for Pre-surgical Huddle Implementation

	Pilot [a]	Annualized
Cost Savings	$435,000	$2,610,000
Expense	$7,978	$47,868
Total	$427,022	$2,562,132

[a] 2-month pilot for 3 cardiac ORs

We expected to see improvements with FCOTS, but there was no appreciable change. One of the factors that could have impacted this was momentum from the previous project outlined in Matthews et al. (2015) as the median delay to first case starts prior to implementation was only 4 minutes. TOT showed marginal changes but may have been impacted by case movement. Moving cases to another OR eliminates the need for turnover therefore time savings would only be captured in LCOTE.

The results of implementation of a pre-surgical huddle are in line with the literature supporting that huddles promote teamwork and a shared mental model and increase OR efficiencies (Einav et al., 2010; Fong et al., 2016; Gillespie et al., 2019; Henrickson et al., 2009; Jain et al., 2015). To that end, the objectives of this project were achieved. A cardiac specific pre-surgical huddle checklist was developed using a focus group approach and achieving consensus within the multidisciplinary team. A multidisciplinary core implementation team was established and assisted in developing and providing education about the quality improvement initiative. This team also provided training and assisted with implementation of the cardiac pre-surgical huddle. An analysis of time stamp data revealed no significant changes to FCOTS or TOT but demonstrated an operationally and clinically relevant decrease in the average median deviation for LCOTE which could have a substantial final impact. The outcome accentuates how a pre-surgical huddle, used as a framework for team communication, can improve coordination of care to increase efficiencies.

Limitations

There were a few limitations during the pilot. First, the pre-op nurse was not included in the huddle process. Delays in the preoperative phase related to information covered in the huddle were only captured anecdotally. Including the pre-operative RN in the huddle would provide details related to points of contact and plan of care that would decrease delays in transitioning to the OR. Second, the pilot only included 3 ORs in a specialty specific setting. In the future, it will be important to understand the value of a huddle across surgical specialties. Lastly, the length of the pilot produced a limited data set that started to show directional decrease of length of day which could have an enormous economic consequence.

Barriers

The biggest barrier was trying to implement a performance improvement project during a pandemic. Dealing with high levels of unexpected absenteeism related to illnesses, quarantines, school closures, and deaths was something we were wrestling at the time. As the hospital filled up with Covid patients our nurses and CRNAs were re-assigned to assist on inpatient units and ICU's. OR teams

continued to work long hours to fill in the gaps to continue providing surgical access to care. Equally as challenging was the mental exhaustion expressed by the teams which made it challenging to keep them focused on the initiative. To help keep them engaged conversations with staff from all disciplines were personal and ongoing, seeking feedback and providing individuals with progress updates.

Facilitators

Throughout this process, surgeon champions were encouraging and attended the weekly core meeting debriefs to provide feedback input. The cardiac fellows helped us to change how we were calling out items so that an action could be associated with the checklist item. For example, instead of saying *a type and cross needs completed*, they were suggested to state whether there was or was not an order for a type and cross so that they could act upon it. The core team worked to be innovative about how they engaged the teams, providing doughnuts, posting issues, concerns, or suggestions on bulletin boards, and engaging with the teams in one on one discussions. Support from the surgeons, fellows and core team helped to bridge communication gaps, disseminate information, and keep the team focused on the goals.

Section Five: Recommendations and Implications for Practice

Project Summary

This quality improvement project evaluated the impact on OR efficiencies with the implementation of a checklist-guided presurgical huddle in the cardiac surgery service line. The huddle was conducted for all scheduled cardiac surgical cases prior to the start of the OR day to promote intraoperative communication and create a shared mental model among the team members caring for surgical patients. This huddle promoted proactivity in care coordination, which resulted in a 68-minute decrease in the cumulative median end time variance for three cardiac ORs. The reduction in end time deviation resulted in a projected $435,000 opportunity cost savings for three OR's for the 2 month duration of the project Although FCOTS or TOT did not change appreciably, the ability to complete a very complex day's work within the cardiovascular operating rooms was clearly in a shorter course of time and was a substantial success. This success enhances both the direct delivery of care as well as

providing a buoyancy to the professional staff who were able to reduce the amount of unexpected late stays to finish cases.

Implications for Practice

This evidence-based quality improvement project illuminates how the DNP uses knowledge, and innovative leadership to influence sustainable change in a complex and multitiered healthcare environment. This pilot project is one example of how organized approaches to care planning can improve efficiency on a much larger scale. All health care professionals relish and take pride in the ability for their assigned cases to progress smoothly. The outcome of this project demonstrated the impact of increasing OR efficiency by conducting a pre-surgical huddle. Expanding to additional service lines will require multidisciplinary collaboration, leadership support and end-user engagement.

Recommendations for the future include expanding the huddle process to additional specialty service lines to determine if the positive outcomes observed within cardiac surgery can be replicated. Acknowledging the organic and innovative use of the surgical checklist as a scheduling tool during this pilot has led to discussions for a future project: To evaluate the impact of integrating a specialty checklist into the EMR to capture specialty specific and relevant information regarding a surgical case at the point of scheduling.

Methods for Dissemination

Project updates and findings were communicated to key stakeholders. Updates to senior physician executives and cardiac surgical chair as well as nursing leadership occurred during the project implementation. As the project scales, compliance with the pre-surgical huddle will be assessed through audits and identified as a goal in employee performance appraisals. The huddle process will also be included in new employee and department orientation. Publication of findings will be pursued to benefit broadly journal readers who can transfer this approach and investigate the evidence as it relates to their patient population.

Conclusion

Delays in surgery have a negative effect on patients and operating room efficiency. A pre-surgical huddle to enhance preparedness through communication will ensure better preparation and efficient use of precious time –reducing cost, enhancing access, and driving greater patient satisfaction.

References

AACN. (2006). The Impact of the Essentials of Doctoral Education for Advanced Nursing Practice. *American Association of Colleges of Nursing*, 3–28. https://www.aacnnursing.org/DNP/DNP-Essentials

Al-Hakim, L., & Yan Gong, X. (2012). On the day of surgery: how long does preventable disruption prolong the patient journey? *International Journal of Health Care Quality Assurance*, *25*(4), 322–342. https://doi.org/10.1108/09526861211221509

Ali, M., Osborne, A., Bethune, R., & Pullyblank, A. (2011). Preoperative surgical briefings do not delay operating room start times and are popular with surgical team members. *Journal of Patient Safety*, *7*(3), 139–143. https://doi.org/10.1097/PTS.0b013e31822a9fbc

Antoniadis, S., Passauer-Baierl, S., Baschnegger, H., & Weigl, M. (2014). Identification and interference of intraoperative distractions and interruptions in operating rooms. *Journal of Surgical Research*, *188*(1), 21–29. https://doi.org/10.1016/j.jss.2013.12.002

AORN. (2019). *AORN Guidelines for Perioperative Practice* (2019th ed.). Association of Perioperative Nurses (AORN).2018. https://aornguidelines.org/

Arora, V., Moriates, C., & Shah, N. (2015). The challenge of understanding health care costs and charges. *AMA Journal of Ethics*, *17*(11), 1046–1052. https://doi.org/10.1001/journalofethics.2015.17.11.stas1-1511

Bender, J. S., Nicolescu, T. O., Hollingsworth, S. B., Murer, K., Wallace, K. R., & Ertl, W. J. (2015). Improving operating room efficiency via an interprofessional approach. *American Journal of Surgery*, *209*(3), 447–450. https://doi.org/10.1016/j.amjsurg.2014.12.007

Bleustein, C., David B. Rothschild, B., Andrew Valen, M., Eduardas Valaitis, P., Laura Schweitzer, M., & and Raleigh Jones, M. (2014). Wait Times, Patient Satisfaction Scores, and the Perception of Care - See more at: http://www.ajmc.com/journals/issue/2014/2014-vol20-n5/wait-times-patient-satisfaction-scores-and-the-perception-of-care/P-1#sthash.qOCJ0Emg.dpuf. *American Journal of*

Managed Care, *20*(May 2014 5), 393–400. http://www.ajmc.com/journals/issue/2014/2014-vol20-n5/wait-times-patient-satisfaction-scores-and-the-perception-of-care/P-1

Brown, C. G. (2014). The iowa model of evidence-based practice to promote quality care: An illustrated example in oncology nursing. *Clinical Journal of Oncology Nursing*, *18*(2), 157–159. https://doi.org/10.1188/14.CJON.157-159

Buckwalter, K. C., Cullen, L., Hanrahan, K., Kleiber, C., McCarthy, A. M., Rakel, B., Steelman, V., Tripp-Reimer, T., & Tucker, S. (2017). Iowa Model of Evidence-Based Practice: Revisions and Validation. *Worldviews on Evidence-Based Nursing*, *14*(3), 175–182. https://doi.org/10.1111/wvn.12223

Burnes, B., & Cooke, B. (2013). Kurt Lewin's field theory: A review and re-evaluation. *International Journal of Management Reviews*, *15*(4), 408–425. https://doi.org/10.1111/j.1468-2370.2012.00348.x

Cerfolio, R. J., Ferrari-Light, D., Ren-Fielding, C., Fielding, G., Perry, N., Rabinovich, A., Saraceni, M., Fitzpatrick, M., Jain, S., & Pachter, H. L. (2019). Improving Operating Room Turnover Time in a New York City Academic Hospital via Lean. *Annals of Thoracic Surgery*, *107*(4), 1011–1016. https://doi.org/10.1016/j.athoracsur.2018.11.071

Cheng, H., Clymer, J. W., Po-Han Chen, B., Sadeghirad PhD, B., Ferko, N. C., Cameron, C. G., & Hinoul, P. (2018). Prolonged operative duration is associated with complications: a systematic review and meta-analysis. *Journal of Surgical Research*, *229*, 134–144. https://doi.org/10.1016/j.jss.2018.03.022

Cheraghlou, S., Kuo, P., & Judson, B. L. (2017). Treatment delay and facility case volume are associated with survival in early-stage glottic cancer. *Laryngoscope*, *127*(3), 616–622. https://doi.org/10.1002/lary.26259

Christoff, P. (2018). Running PDSA cycles. *Current Problems in Pediatric and Adolescent Health Care*, *48*(8), 198–201. https://doi.org/10.1016/j.cppeds.2018.08.006

Collaborative, I. M. (2017). Iowa model of evidence-based practice: Revisions and validation.

Worldviews on Evidence-Based Nursing, *14*(3), 175–192. https://doi.org/doi:10.1111/wvn.12223

Divatia, J., & Ranganathan, P. (2015). Can we improve operating room efficiency? *Journal of Postgraduate Medicine*, *61*(1), 1. https://doi.org/10.4103/0022-3859.147000

Doebbeling, B. N., Burton, M. M., Wiebke, E. A., Miller, S., Baxter, L., Miller, D., Alvarez, J., & Pekny, J. (2012). Optimizing perioperative decision making: improved information for clinical workflow planning. *AMIA ... Annual Symposium Proceedings / AMIA Symposium. AMIA Symposium*, *2012*, 154–163. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3540545&tool=pmcentrez&rendertype=abstract

Einav, Y., Gopher, D., Kara, I., Ben-Yosef, O., Lawn, M., Laufer, N., Liebergall, M., & Donchin, Y. (2010). Preoperative briefing in the operating room: Shared cognition, teamwork, and patient safety. *Chest*, *137*(2), 443–449. https://doi.org/10.1378/chest.08-1732

Ellis, D. B., Santoro, J., Spracklin, D., Kurzweil, V., Sylvia, S., Fagenholz, P., & Agarwala, A. (2020). Improving and Maintaining On-Time Start Times for Nonelective Cases in a Major Academic Medical Center. *Joint Commission Journal on Quality and Patient Safety*, *46*(2), 81–86. https://doi.org/10.1016/j.jcjq.2019.09.007

Fong, A. J., Smith, M., & Langerman, A. (2016). Efficiency improvement in the operating room. *Journal of Surgical Research*, *204*(2), 371–383. https://doi.org/10.1016/j.jss.2016.04.054

Forse, R. A., Bramble, J. D., & McQuillan, R. (2011). Team training can improve operating room performance. *Surgery*, *150*(4), 771–778. https://doi.org/10.1016/j.surg.2011.07.076

Forsyth, K. L., Hildebrand, E. A., Hallbeck, M. S., Branaghan, R. J., & Blocker, R. C. (2019). Characteristics of team briefings in gynecological surgery. *Applied Ergonomics*, *78*(6), 263–269. https://doi.org/10.1016/j.apergo.2018.02.012

Fügener, A., Schiffels, S., & Kolisch, R. (2017). Overutilization and underutilization of operating rooms - insights from behavioral health care operations management. *Health Care Management Science*,

20(1), 115–128. https://doi.org/10.1007/s10729-015-9343-1

Gawlinski, A., & Rutledge, D. (2008). Selecting a model for evidence-based practice changes: A practical approach. *AACN Advanced Critical Care*, *19*(3), 291–300. https://doi.org/10.1097/01.AACN.0000330380.41766.63

Gillespie, B. M., Harbeck, E., Lavin, J., Gardiner, T., Withers, T. K., & Marshall, A. P. (2019). The impact of improved surgical safety checklist participation on or efficiencies: A pretest-post test analysis. *Journal of Perioperative Nursing*, *32*(1), 9–18. https://doi.org/10.26550/2209-1092.1039

Goodman, M. S., Thompson, S., & L., V. (2017). The science of stakeholder engagement in research: classification, implementation, and evaluation. *Translational Behavioral Medicine*, *7*(3), 486–491. https://doi.org/10.1007/s13142-017-0495-z

Healey, T., El-Othmani, M. M., Healey, J., Peterson, T. C., & Saleh, K. J. (2015). Improving operating room efficiency, part 1: General managerial and preoperative strategies. *JBJS Reviews*, *3*(10), 1–10. https://doi.org/10.2106/JBJS.RVW.N.00109

Health Services Advisory Group. (2017). *Understanding My Value-Based Purchasing Report 2018*.

Henrickson, S. E., Wadhera, R. K., ElBardissi, A. W., Wiegmann, D. A., & Sundt, T. M. (2009). Development and Pilot Evaluation of a Preoperative Briefing Protocol for Cardiovascular Surgery. *Journal of the American College of Surgeons*, *208*(6), 1115–1123. https://doi.org/10.1016/j.jamcollsurg.2009.01.037

Ibrahim, A., Ndeti, K., Bur, A., Sykes, K., Shnayder, L., Tsue, T., Westbrook, A., & Kakarala, K. (2019). Association of a Lean Surgical Plan of the Day With Reduced Operating Room Time for Head and Neck Free Flap Reconstruction. *JAMA Otolaryngology–Head & Neck Surgery*, *66160*. https://doi.org/10.1001/jamaoto.2019.2250

Jain, A. L., Jones, K. C., Simon, J., & Patterson, M. D. (2015). The impact of a daily pre-operative surgical huddle on interruptions, delays, and surgeon satisfaction in an orthopedic operating room: A prospective study. *Patient Safety in Surgery*, *9*(1), 1–9. https://doi.org/10.1186/s13037-015-0057-6

Kaplan, G., Lopez, M. H., & McGinnis, J. M. (2015). Transforming Health Care Scheduling and Access: Getting to Now. In G. Kaplan, M. H. Lopez, & M. McGinnis (Eds.), *National Academy of Sciences*. The National Academies Press. http://www.nap.edu/20220

Lee, D. J., Ding, J., & Guzzo, T. J. (2019). Improving Operating Room Efficiency. *Current Urology Reports*, *20*(6). https://doi.org/10.1007/s11934-019-0895-3

Leong, K. B. M. S. L., Hanskamp-Sebregts, M., Van Der Wal, R. A., & Wolff, A. P. (2017). Effects of perioperative briefing and debriefing on patient safety: A prospective intervention study. *BMJ Open*, *7*(12), 1–7. https://doi.org/10.1136/bmjopen-2017-018367

Lingard, L., Regehr, G., Cartmill, C., Orser, B., Espin, S., Bohnen, J., Reznick, R., Baker, R., Rotstein, L., & Doran, D. (2011). Evaluation of a preoperative team briefing: A new communication routine results in improved clinical practice. *BMJ Quality and Safety*, *20*(6), 475–482. https://doi.org/10.1136/bmjqs.2009.032326

Lu, A. D., Kaul, B., Reichert, J., Kilbourne, A. M., Sarmiento, K. F., & Whooley, M. A. (2020). Implementation Strategies for Frontline Healthcare Professionals: People, Process Mapping, and Problem Solving. *Journal of General Internal Medicine*. https://doi.org/10.1007/s11606-020-06169-3

Macario, A. (2010). What does one minute of operating room time cost? *Journal of Clinical Anesthesia*, *22*(4), 233–236. https://doi.org/10.1016/j.jclinane.2010.02.003

Makary, M. A., Holzmueller, C. G., Thompson, D. A., Rowen, L., Heitmiller, E. S., Maley, W. R., Martinez, E. A., Black, J. H., Freischlag, J. A., Stegner, K., Ulatowski, J. A., & Pronovost, P. J. (2006). Operating Room Briefings: Working on the Same Page. *The Joint Commission Journal on Quality and Patient Safety*, *32*(6), 351–355. https://doi.org/10.1016/S1553-7250(06)32045-4

Martin, L., & Langell, J. (2017). Improving on-time surgical starts: the impact of implementing pre-OR timeouts and performance pay. *Journal of Surgical Research*, *219*, 222–225. https://doi.org/10.1016/j.jss.2017.05.092

Mathews, L., Kla, K. M., Marolen, K. N., Sandberg, W. S., & Ehrenfeld, J. M. (2015). Measuring and improving first case on-time starts and analysis of factors predicting delay in neurosurgical operating rooms. *Journal of Neurosurgical Anesthesiology*, *27*(3), 203–208. https://doi.org/10.1097/ANA.0000000000000131

McGowan, M., & Reid, B. (2018). Using the Plan, Do, Study, Act cycle to enhance a patient feedback system for older adults. *British Journal of Nursing*, *27*(16), 936–941. https://doi.org/10.12968/bjon.2018.27.16.936

Melnyk, B. M., & Fineout-Overholt, E. (2019). *Evidence-Based Practice in Nursing & Healthcare: A Guide to Best Practice* (M. Foss & R. Ward (eds.); 4th ed.). Wolters Kluwer.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., Atkins, D., Barbour, V., Barrowman, N., Berlin, J. A., Clark, J., Clarke, M., Cook, D., D'Amico, R., Deeks, J. J., Devereaux, P. J., Dickersin, K., Egger, M., Ernst, E., … Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7). https://doi.org/10.1371/journal.pmed.1000097

NQF. (2019). *Cost and Efficiency , Spring 2018 : CDP Report*. Department of Health and Human Services. National Quality Forum. https://www.qualityforum.org/Publications/2019/01/Cost_and_Efficiency_Final_Report_-_Spring_2018_Cycle.aspx

Nundy, S., Mukherjee, A., Sexton, J. B., Pronovost, P. J., Knight, A., Rowen, L. C., Duncan, M., Syin, D., & Makary, M. A. (2008). Impact of preoperative briefings on operating room delays: A preliminary report. *Archives of Surgery*, *143*(11), 1068–1072. https://doi.org/10.1001/archsurg.143.11.1068

Pappas, S., & McCauley, L. (2018). Nursing Integration and Innovation Across a Multisystem Enterprise: Priorities for Nurse Leaders. *Nursing Administration Quarterly*, *42*(1), 54–61. https://doi.org/10.1097/NAQ.0000000000000265

Parikh, S. N., Grice, S. S., Schnell, B. M., & Salisbury, S. R. (2010). Operating Room Traffic: Is There Any Role of Monitoring It? *Journal of Pediatric Orthopaedics*, *30*(6), 617–623. https://doi.org/10.1097/BPO.0b013e3181e4f3be

Paull, D. E., Mazzia, L. M., Wood, S. D., Theis, M. S., Robinson, L. D., Carney, B., Neily, J., Mills, P. D., & Bagian, J. P. (2010). Briefing guide study: preoperative briefing and postoperative debriefing checklists in the Veterans Health Administration medical team training program. *The American Journal of Surgery*, *200*(5), 620–623. https://doi.org/10.1016/j.amjsurg.2010.07.011

Pinto, A., Burnett, S., Benn, J., Brett, S., Parand, A., Iskander, S., & Vincent, C. (2011). Improving reliability of clinical care practices for ventilated patients in the context of a patient safety improvement initiative. *Journal of Evaluation in Clinical Practice*, *17*(1), 180–187. https://doi.org/10.1111/j.1365-2753.2010.01419.x

Prentice, J. C., Davies, M. L., & Pizer, S. D. (2014). Which Outpatient Wait-Time Measures Are Related to Patient Satisfaction? *American Journal of Medical Quality*, *29*(3), 227–235. https://doi.org/10.1177/1062860613494750

Pugel, A. E., Simianu, V. V., Flum, D. R., & Patchen Dellinger, E. (2015). Use of the surgical safety checklist to improve communication and reduce complications. *Journal of Infection and Public Health*, *8*(3), 219–225. https://doi.org/10.1016/j.jiph.2015.01.001

Rosenthal, T. (2018). *What Is a Minute Worth in the OR?* OR Management News. https://www.ormanagement.net/Clinical-News/Article/06-18/What-Is-a-Minute-Worth-in-the-OR-/48791

Rothstein, D. H., & Raval, M. V. (2018). Operating room efficiency. *Seminars in Pediatric Surgery*, *27*(2), 79–85. https://doi.org/10.1053/j.sempedsurg.2018.02.004

Russ, S., Arora, S., Wharton, R., Wheelock, A., Hull, L., Sharma, E., Darzi, A., Vincent, C., & Sevdalis, N. (2013). Measuring safety and efficiency in the operating room: Development and validation of a metric for evaluating task execution in the operating room. *Journal of the American College of*

Surgeons, *216*(3), 472–481. https://doi.org/10.1016/j.jamcollsurg.2012.12.013

Russ, S. J., Sevdalis, N., Moorthy, K., Mayer, E. K., Rout, S., Caris, J., Mansell, J., Davies, R., Vincent, C., & Darzi, A. (2015). A qualitative evaluation of the barriers and facilitators toward implementation of the who surgical safety checklist across hospitals in England. *Annals of Surgery*, *261*(1), 81–91. https://doi.org/10.1097/SLA.0000000000000793

Schein, E., & Schein, P. (2017). *Organizational Culture and Leadership* (5th ed.). John Wiley & Sons, Inc.

Silva, L. (2017). *PDSA Graphic*. Association of State and Territorial Officials - Experts Blog. https://www.astho.org/The-Iowa-Department-of-Public-Health-Uses-Quality-Improvement-Tools-to-Improve-Programs/6-20-17/

Tagge, E. P., Thirumoorthi, A. S., Lenart, J., Garberoglio, C., & Mitchell, K. W. (2017). Improving operating room efficiency in academic children's hospital using Lean Six Sigma methodology. *Journal of Pediatric Surgery*, *52*(6), 1040–1044. https://doi.org/10.1016/j.jpedsurg.2017.03.035

Tankard, K., Acciavatti, T. D., Vacanti, J. C., Heydarpour, M., Beutler, S. S., Flanagan, H. L., & Urman, R. D. (2018). Contributors to Operating Room Underutilization and Implications for Hospital Administrators. *The Health Care Manager*, *37*(2), 118–128. https://doi.org/10.1097/HCM.0000000000000214

Taylor, B., Slater, A., & Reznick, R. (2010). The surgical safety checklist effects are sustained, and team culture is strengthened. *Surgeon*, *8*(1), 1–4. https://doi.org/10.1016/j.surge.2009.11.012

Tyerman, Z., Mehaffey, J. H., Hawkins, R. B., Diop, M., Carroll, N. D., Howell, A. M., Kern, J. A., Ailawadi, G., & Teman, N. (2020). Nightly Preoperative Huddle Email Improves Perioperative Efficiency. *Annals of Thoracic Surgery*, *109*(2), 445–451. https://doi.org/10.1016/j.athoracsur.2019.05.086

Tyler, D. C., Pasquariello, C. A., & Chen, C. H. (2003). Determining optimum operating room utilization. *Anesthesia and Analgesia*, *96*(4), 1114–1121.

https://doi.org/10.1213/01.ANE.0000050561.41552.A6

VUMC. (2021). *Vanderbilt University Medical Center Vanderbilt Nursing*. https://www.vumc.org/vanderbilt-nursing/professional-practice-model

Weld, L. R., Stringer, M. T., Ebertowski, J. S., Baumgartner, T. S., Kasprenski, M. C., Kelley, J. C., Cho, D. S., Tieva, E. A., & Novak, T. E. (2016). TeamSTEPPS Improves Operating Room Efficiency and Patient Safety. *American Journal of Medical Quality*, *31*(5), 408–414. https://doi.org/10.1177/1062860615583671

White, S., & Spruce, L. (2015). Perioperative Nursing Leaders Implement Clinical Practice Guidelines Using the Iowa Model of Evidence-Based Practice. *AORN Journal*, *102*(1), 50–59. https://doi.org/10.1016/j.aorn.2015.04.001

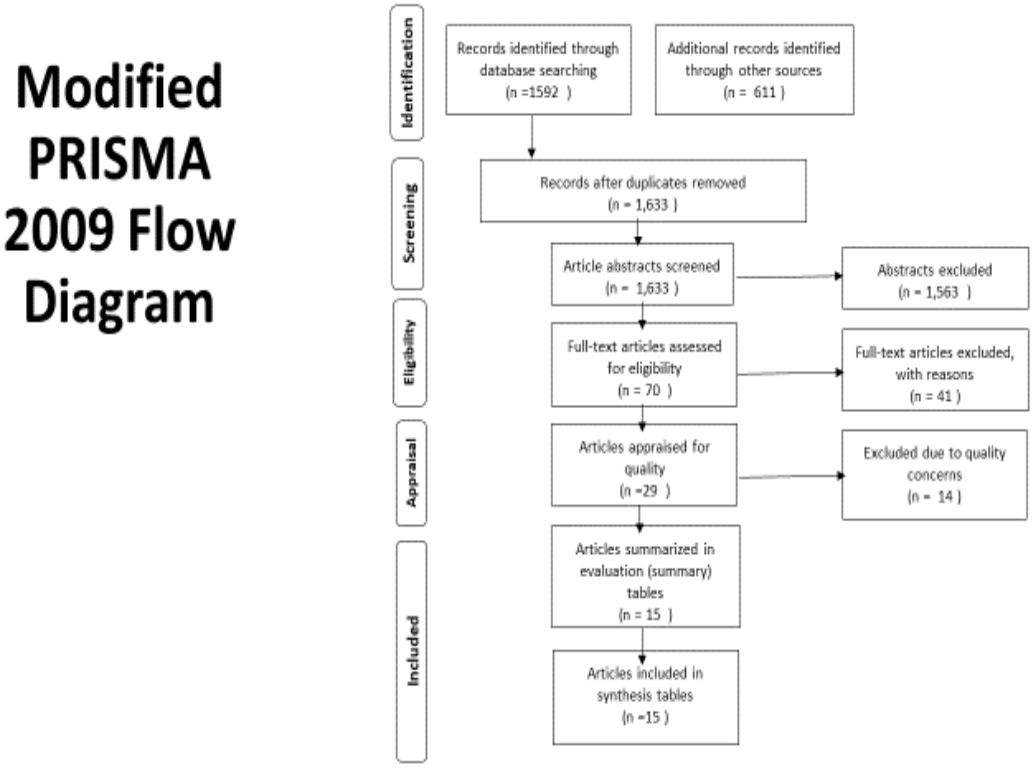
Wong, J., Khu, K. J., Kaderali, Z., & Bernstein, M. (2010). Delays in the operating room: Signs of an imperfect system. *Canadian Journal of Surgery*, *53*(3), 189–195.

Yount, K. W., Lau, C. L., Yarboro, L. T., Ghanta, R. K., Kron, I. L., Kern, J. A., & Ailawadi, G. (2015). Late operating room start times impact mortality and cost for nonemergent cardiac surgery. *Annals of Thoracic Surgery*, *100*(5), 1653–1659. https://doi.org/10.1016/j.athoracsur.2015.04.131

Zimlichman, E., Henderson, D., Tamir, O., Franz, C., Song, P., Yamin, C. K., Keohane, C., Denham, C. R., & Bates, D. W. (2013). Health Care–Associated Infections. *JAMA Internal Medicine*, *173*(22), 2039. https://doi.org/10.1001/jamainternmed.2013.9763

Appendix A

Modified Prisma Flow Chart



(Moher et al., 2009)

Appendix B

Evaluation Table of Pre-surgical Huddle Level of Evidence Table

#	Citation	Design/ Meth	Sample/ Setting	Major Variables Studied and Definitions	Outcome Measurement	Findings	Level of Evidence	Quality of Evidence: Critical Worth to Practice
1	Ali, M. et al. (2011). Preoperative Surgical Briefings Do Not Delay Operating Room Start Times and Are Popular with Surgical Team Members	Retrospective Descriptive Study pre/post intervention Data Collection: Pre 2 months - 4 ORs - 27 OR Post -2 months - 4 ORs - 34 OR lists Questionnaire - 100% response (n=37)	North Bristol NHS trust (UK), 2 teaching hospitals	To evaluate the introduction of preoperative safety briefings on operating theater start times and to assess staff attitudes toward the safety briefings.	1 - OR start time after induction 2 - Attitudes toward the safety briefing	↑ OR start time after induction (not statistically significant) ↑ positive attitudes toward safety briefings. 97% replied that safety briefing highlighted potential patient problems 89% believed it improved communication.	VI	Strength -strong Supports PICOT Feasibility - The preoperative safety briefing can result in an efficient start to an operating list and is popular with staff. Study conducted in a setting where operational definitions align with induction rooms and different OR processes than mainstream US OR's

2	Hendrickson, S. et al. (2009). Development and Pilot Evaluation of a Preoperative Briefing Protocol for Cardiovascular Surgery	Pilot Descriptive study Convenience sample Pre – 10 on-pump cardiac surgical cases Post – 6 on-pump cardiac surgical cases Observations and data extraction from EMR	Mayo Clinic Rochester MN Cardiac division of surgery	Implementation of service line specific team briefing.	1 - Surgical flow disruptions 2 - Circ RN trips to the core 3 - Time spent in the core 4 - Cost-waste reports	**↑FCOTS** **↓miscommunication- 53% fewer miscommunication events per case (2.5 vs. 1.17, p=0.03)** **↓in equipment preparation disruptions intraoperative (unexpected delays)** **↓circulator trips to core** **↓total time spent in core**	VI	Strength - moderate Supports PICOT Feasibility: Small sample size, sample only first cases of day, observer not blinded to whether teams had been briefed Results demonstrate development and implementation of a specialty-specific briefing is it feasible and has the potential to diminish surgical flow disruptions.

3	Jain et al. (2015). The impact of a daily pre-operative surgical huddle on interruptions, delays, and surgeon satisfaction in an orthopedic operating room: A prospective study	Quality Improvement Project -6-week implementation Baseline (n=19 days/65 cases) Post - intervention (n=19 days/62 cases) PDSA - Methodology Observation, qualitative and quantitative data collection	Pediatric orthopedic service line Huddle implemented for 6 weeks	Implementation of pre-operative huddle	1 - Day's Flow - Surgeon rating of Flow of days cases 2 - # of intraop interruptions 3- # of unexpected delays between cases	1 - Day's Flow rating ↑5 to 9 ↑Surgeon perception of improved flow of a surgeon's day ↑Surgeon's satisfaction 2 - ↓# of intraop interruptions by 77% 3 – Rate of unexpected delays 78.95% to 21.05%	VI	Strength - strong Supports PICOT Feasibility Supports rational the huddle will increase efficiencies. Although, surgeon Rating is global and not specific to elements in huddle

4	Weld, L. et al. (2016). TeamSTEPPS Improves Operating Room Efficiency and Patient Safety	PI Project Preoperative briefing conducted prior to first case for each OR's surgical schedule Pre-implementation sample (n=1513 cases) Post-implemtation sample (n=1481 cases)	GU and Orthopedic service lines San Antonio Military Medical Center, Fort Sam Houston, TX	Preoperative Briefings Postoperative Briefings using TeamSTEPPS. ↑communication among OR team • Preop briefings • Post op briefings OR efficiency & OR safety	1 - Time stamps Anes start-in-room, In room-to surgeon, surgeon-Inc, Inc-close, Case time (W-in to W-out) 2 - FCOTS% 3 - Turnover 4 - Intraoperative patient safety issues	↓In room time 10% (p<001) ↑ Anes start-in-room ↓*In room-to surgeon ↓*Surgeon-Inc ↓*Inc-close ↓*Case time ↑FCOTS rate by 21% (p<.001) Intraoperative patient safety issues ↓from 16% to 6%	VI	Strength - strong Supports PICO Feasibility - Implementation was scaled to second service line with similar results.

5	Martin, L., & Langell, J. (2017). Improving on-time surgical starts: the impact of implementing pre-OR timeouts and performance pay	Retrospective study of prospectively collected data Implementation of pre-surgical timeout in late 2008 - Jan. 1st 2009 Data collection began prior to implementation through 2015	A single Veterans Affairs Medical Center Across 9 surgical divisions Data collection period (8 years) Total # first case starts (n=7,677)	1. Safety Briefing Checklist 2. Modest pay incentive for on-time starts >90%	FCOTS	FCOTS ↑15%-72% over 6 years Cost Savings ↑ monetizing an estimated 37,566 minutes of avoided delays	IV	Strength - Strong Feasibility - Sustained improvements noted 6 years post implementation Pay incentive for attending surgeons 1-2K/annually for FCOTS>90% may be a confounder

6	Mathews L. et al. (2015) Measuring and Improving First Case On-Time Starts and Analysis of Factors Predicting Delay in Neurosurgical Operating Rooms	PI project with retrospective analysis Implementation of project elements in two phases	Main OR at Vanderbilt University Medical Center Tertiary care academic medical center 6 NS ORs N= 2328 elective neurosurgical first case starts Control group - 25 non-NS OR's (N=22,985)	1. Team huddle prior to start time 2. Daily emails re FCOTS % 3. Anesthesia immediate to OR in am unless exception 4. Streamlined pre-admission process	Rate First case on-time start (FCOTS)	FCOTS in NS OR's ↑33%-68% FCOTS for control group 29%	VI	Strength - moderate Supports PICOT Feasibility - Success of initiative was scaled to all 35 OR's.

7	Nundy, S. et al. (2008). Impact of Preoperative Briefings on Operating Room Delays	Nonrandomized controlled trial; 422 survey respondents. OR Briefing Assessment Tool (ORBAT) used Pre- (2mo); Intervention – (3 mo); Post – (3 mo) Statistical analyses performed using SPSS - t test	Tertiary academic medical center (Johns Hopkins Bayview Medical Center) 11 surgeons/OR's and surgical teams Survey respondents (n=422)	1 - Implementation of OR briefing tool 2 - Caregiver assessment of unexpected delays during each procedure and communication breakdowns	1 - Unexpected delays during each procedure 2 – Communication breakdowns leading to delays is common	↓ unexpected delays (31% P<.04) ↓Communication breakdowns that lead to delays (19% P<.006)	III	Strength - strong Supports PICOT Validated OR Briefing Assessment Tool (ORBAT) Feasibility: The use of OR briefings was associated with a reduction in delays and communication failures that led to delays.

8	Phadnis, J. & Templeton-Ward, O. (2018). Inadequate Preoperative Team Briefings Lead to More Intraoperative Adverse Events	Prospective case-control study assessing the association between preoperative briefings and minor, potentially major, and major adverse intraoperative events Phase 1 - 41 surgical lists Phase 2 - 47 surgical lists, 6 mos after interventions	Royal Surrey County Hospital Guildford, Surrey, United Kingdom. All orthopedic subspecialties including spine, pediatrics, and trauma - 14 providers	Phase 1 The association between preoperative briefings and adverse intraoperative events Phase 2 Education regarding observations in phase one Development of checklist template and implementation of briefing	1 - Was a preoperative team briefing performed completely, incompletely, or not at all; 2 - Team familiarity questionnaire results 3 - Recording of intraoperative adverse events.	↑quality and completeness of team briefings ↑Team familiarity 54% to 96% ↓adverse events* (for this article refers to disruptions and/or delays to care There was a significant association between the occurrences of intraoperative adverse events (n = 37) when a briefing was not performed (P = < 0.01) Team familiarity also improved significantly as a result of better preoperative briefings (P =0.02).	IV	Strength - strong Supports PICO Feasibility - Adaptation of briefing for clinical setting consistent with evidence.

9	Russ, et al. (2013) Do Safety Checklists Improve Teamwork and Communication in the Operating Room?	Systematic Review Databases searched for systematic reviews MEDLINE, EMBASE, PsycINFO, Google Scholar, and the Cochrane Database. 315 articles were screened for inclusion by 2 researchers	22 Articles Criteria 1- Original Empirical Studies Only 2 - Surgical Checklists only 3 - Safety Checklists applied to individual cases only 4 - Should describe impact of checklist on measures of teamwork, communication in the OR 5 - Checklist was the primary intervention	All articles described an empirical study relating to a case-specific safety checklist for surgery as the primary intervention, with some measure of change/improvement in teamwork and/or communication relating to its use.	Type of Checklist Teamwork/Communication Measures Impact of Checklist on Teamwork and Communication Self-reported Teamwork/Communication	↑ Teamwork climate and communication ↓Surgical delays ↓Communication failures ↓unexpected/non-routine events ↑Decision-making	VI	Strength - moderate Supports PICOT Feasibility - Evidence consistent with literature, Although some weakness with articles reviewed such as heterogeneity of study methodology - Pre/post survey and observation with data collection and one RCT. Five of the 20 studies reviewed included no baseline/control assessment of teamwork/communication.

10	Ellis, D. et al (2020) Improving and Maintaining On-Time Start Times for Nonelective Cases in a Major Academic Medical Center	QI project Implementation of a six-step process to increase FCOTS including time parameters to complete case booking, H&P and consents and the implementation of pre-surgical huddle Pre 15 weeks, implementation 3 months, post 5 months	Massachusetts General Hospital Nonelective, nonemergent general surgeries Phase 1 - (n=37 cases) Phase 2 - (n=89 cases) Phase 3 (n=40 cases)	Implementation of a six-step process to increase FCOTS including time parameters to complete case booking, H&P and consents and the implementation of pre-surgical huddle	Outcome metric - FCOTS Process metrics - Compliance with completing each of the six elements	↑FCOTS 65% to 85% Compliance with process measures pre/post intervention Huddle - ↑ 44% Case schedule > 2 hours prior to start ↑ 17% Surgical consent - ↑ 20% Anesthesia consent - ↑7% H&P - ↑ 11% H&P update - ↑ 27%	VI	Strength - moderate Supports PICO Feasibility: Multidisciplinary team using process measures that include pre-surgical huddle. Literature corroborates evidence

11	Leong, K. et al (2017) Effects of perioperative briefing and debriefing on patient safety: A prospective intervention study	Prospective intervention study with one pretest and two post-test measurements: 1 month before and 4 months and 2.5 years after the implementation of perioperative briefing and debriefing, respectively.	5 surgical teams (7 specialties) tertiary care hospital with 875 beds in the Netherlands	Pre-operative briefing	Primary - Changes in the team climate, measured by the Team Climate Inventory (TCI)	↑ team climate The overall TCI scores 2.5 years after the implementation increased on a scale of 1–5, p=0.05 (0.18; 95% CI −0.01 to 0.38)	VI	Strength - strong The TCI is a reliable and valid questionnaire Feasibility - literature supports evidence; Second post measurement 2.5 years after implementation - long term effects
12	Tyerman, Z., et. al (2020). Nightly Preoperative Huddle Email Improves Perioperative Efficiency. Annals of Thoracic Surgery	Retrospective Study n= 1080 first starts Pre-Huddle - n=643 Huddle - n= 437	University of Virginia Nonemergent, cardiac surgery cases performed from January 1, 2013, to January 1, 2017.	Nightly “Huddle” email	1 - FCOTS 2 - In-room time vs incision time 3 - Actual in-room time to out-of- room time (OR minutes used) Ontime Starts= zero-minute delay Long delay= delay >15 minutes	FCOTS % ↑by 46% (5.0% to 9.2%, P ¼ .007) ↓ median delay time by 2 minutes (p<.001)	IV	Strength - moderate Supports PICOT Feasibility - This study is limited by its retrospective nature, and its relatively limited scope, focusing on a single institution’s cardiac surgery division.

13	Zhu, J., et. al (2020). Standardizing nightly huddles with surgical residents and nurses to improve interdisciplinary communication and teamwork. *American Journal of Surgery*	Standardized nightly huddles were established on two surgical units at UWMC over the 15-month study period. There were 121 surveys completed by nurses pre-intervention, and 155 completed post-intervention	University of Washington Medical Center	Checklist guided Nightly huddle involving residents & nurses, Face to face The huddle was evaluated with pre/post surveys of nurses and residents, as well as analysis of paging volume and rapid response events Interview - Factors contributing to poor collaboration Physical distance Nursing and resident handoffs occurring in silos Lack of timely and consistent communication from residents Over-reliance on pager-based	1 - Perception of Interdisciplinary teamwork	↑ RN perception of interdisciplinary teamwork, Communication, Understanding of Patient Plan, Timeliness of resident response ↑Communication	VI	Strength - moderate Supports PICOT Feasibility - Supports evidence related to briefings and enhancing teamwork.

				rather than in-person communication Paging messages lacking information or context regarding clinical urgency.				

14	Einav, Y., et al (2010). Preoperative briefing in the operating room: Shared cognition, teamwork, and patient safety.	To develop a briefing protocol and evaluate its effect on patient safety. Two-stage comparative study Observation of: 130 surgeries w/o briefing 102 with briefing Over a 3 - month period 232 observed surgeries 474 non routine events used to compare surgeries with and without a briefing.	Hadassah-Hebrew University Medical Center, a tertiary care hospital in Jerusalem, Orthopedic and GU Service Lines	The impact of implementing a pre-surgical briefing on Non- routine events - defined as deviations from optimal clinical care or from standard procedure	Number of non-routine events	↓ incidence of nonroutine events - mean # of events /surgery with briefings was 25% lower than mean # of events/surgery w/o briefings	VI	Strength - strong Supports PICOT Feasibility - Clinically relevant observations noting all intraoperative activities. Independent analysis of events on random sample.

15	Bethune, R., et. al (2011). Use of briefings and debriefings as a tool in improving team work, efficiency, and communication in the operating theatre.	Quality Improvement Project Pre-intervention (3mo) Intervention 3 mo) Post implementation survey	General hospital in Bristal UK - two surgical pavilions	1 - To determine the effect briefings had on theatre start times and theatre list length 2 - To study the effect of briefings on the staff 's attitude to safety and team work. Ideally	First case start times Length of day in minutes Staff perception	↑ FCOTS ↓ total cumulative length of OR day by 26 min (p =.11)	VI	Strength - moderate Supports PICOT Feasibility - Supports evidence related to briefings and enhancing teamwork and increase efficiency

Appendix C

Implementation of Pre-surgical Huddle Level of Evidence Table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Level I: Systematic review or meta-analysis															
Level II: Randomized controlled trial															
Level III: Controlled trial without randomization							X								
Level IV: Case-control or cohort study								X				X			
Level V: Systematic review of qualitative or descriptive studies															
Level VI: Qualitative or descriptive study (includes evidence implementation projects)	X	X	X	X	X	X			X	X	X		X	X	X
Level VII: Expert opinion or consensus															

1 = Ali, M. et al. (2011); 2 = Hendrickson, S. et al. (2009); 3 = Jain et al. (2015); 4 = Weld, L. et al. (2016); 5 = Martin, L., & Langell, J. (2017); 6 = Mathews L. et al. (2015); 7 = Nundy, S. et al. (2008); 8 = Phadnis, J. & Templeton-Ward, O. (2018); 9 = Russ, S. et al. (2013); 10 = Ellis et al (2020); 11= Leong, K. et al. (2017); 12 = Tyerman, Z. et al.(2020); 13 = Zhu, J., et. al (2020); 14 = Einav, Y., et al (2010); 15 = Bethune, R., et. al (2011).

Appendix D

Outcomes Synthesis Table of the Implementation of Pre-surgical Huddle

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FCOTS	↑	↑		↑	↑	↑				↑		↑			↑
UD		↓	↓		↓		↓	↓	↓					↓	
SFD		↓	↓					↓	↓						
II		↓	↓												
ORE				↑											↑
RNCore		↓													
TIC		↓													
TW&C	↑			↑			↑	↑	↑		↑	↑	↑		
TWPerc									↑		↑				
MisComE		↓					↓	↓	↓				↓	↓	

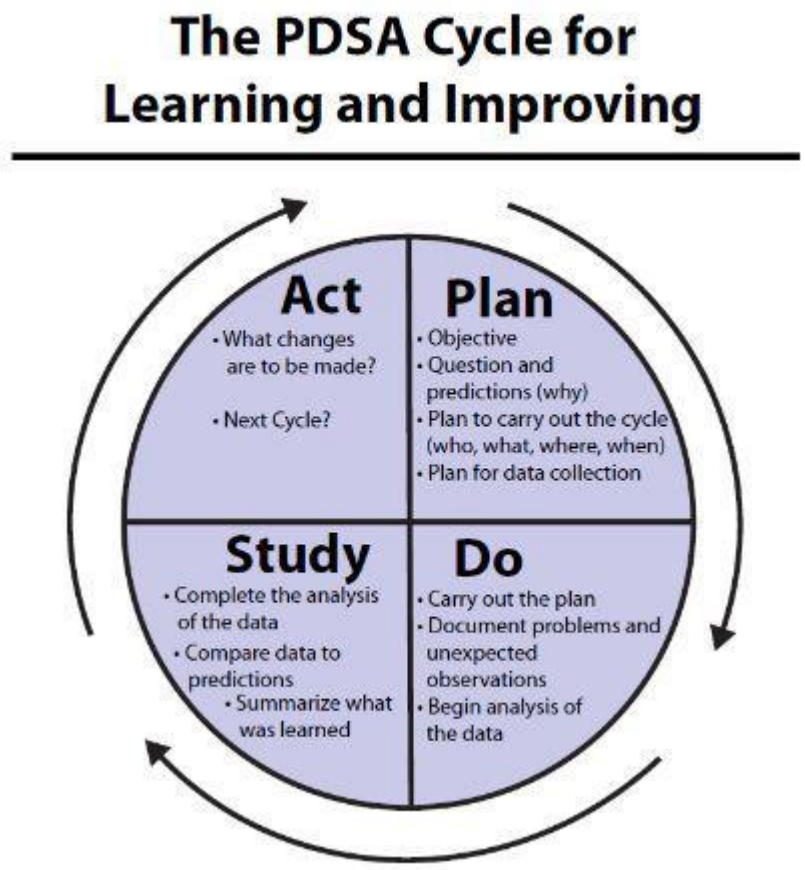
Legend:

FCOTS = Rate of first case on time starts; UD = Unexpected Delays; SFD = Surgical Flow Disruptions; III = Interoperative Interuptions; ORE = OR Efficiency (Time Stamps); RNCore = RN trips to core; TIC = Time in Core; TW&C = Teamwork and Team Communication; TWPerc = Teamwork Perception; MisComE = Miscommunication related events.

1 = Ali, M. et al. (2011); 2 = Hendrickson, S. et al. (2009); 3 = Jain et al. (2015); 4 = Weld, L. et al. (2016); 5 = Martin, L., & Langell, J. (2017); 6 = Mathews L. et al. (2015); 7 = Nundy, S. et al. (2008); 8 = Phadnis, J. & Templeton-Ward, O. (2018); 9 = Russ, S. et al. (2013); 10 = Ellis et al (2020); 11= Leong, K. et al. (2017); 12 = Tyerman, Z. et al.(2020); 13 = Zhu, J., et. al (2020); 14 = Einav, Y., et al (2010); 15 = Bethune, R., et. al (2011).

Appendix E

The PDSA Cycle

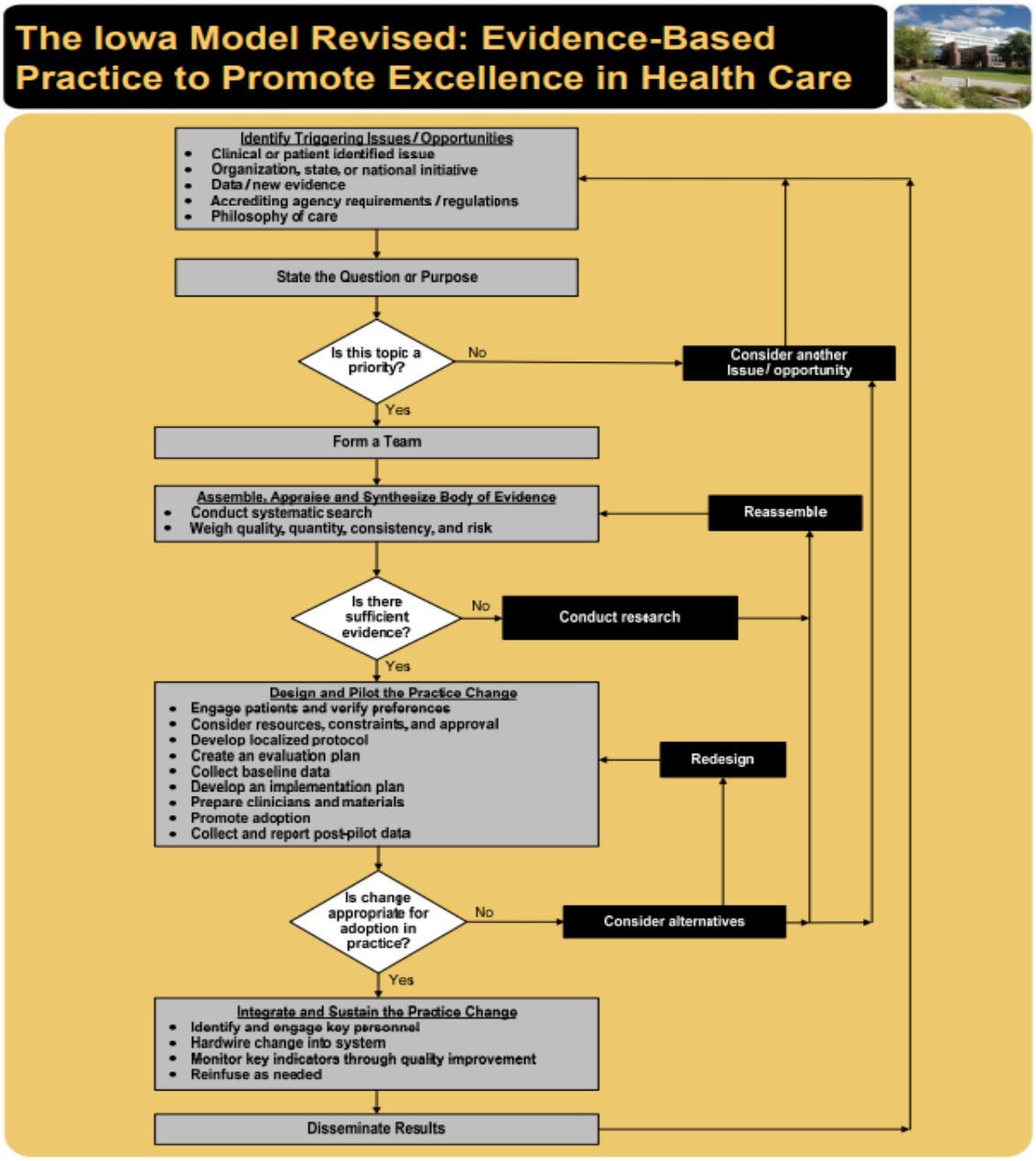


(Silva, 2017)

Appendix F

Iowa Model and Permission for Reproduction

(Iowa Model Collaborative. (2017)



Krumm, Alice M

From: Kimberly Jordan - University of Iowa Hospitals and Clinics <survey-bounce@survey.uiowa.edu>
Sent: Monday, November 23, 2020 3:47 PM
To: Krumm, Alice M
Subject: Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

The Iowa Model Revised (2015)

Copyright is retained by University of Iowa Hospitals and Clinics. **Permission is not granted for placing on the internet.**

Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

In written material, please add the following statement:
Used/reprinted with permission from the University of Iowa Hospitals and Clinics, copyright 2015. For permission to use or reproduce, please contact the University of Iowa Hospitals and Clinics at 319-384-9098.

Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.

[**WARNING** : This email came from an external source. Please treat this message with additional caution.]

Appendix G

Cardiac Pre-surgical checklist

Booking Information		
OR:	Date:	Time Pref:

Cardiac Surgery Huddle Checklist

Demographics

Name:		Surgeon:	
BMI:		Resident:	
Allergies:		MR#	
Beta Blocker: ☐ Yes ☐ No		ATB: ☐ Ancef ☐ Vanco ☐ Other:	
Type&scrn ☐ Yes ☐ No	Antibiod: ☐ Yes ☐ No		
Contact: ☑ Yes ☐ No	Consent? ☐ Yes ☐ No	COVID? ☐ Pos ☐ Neg ☐ Pending	

Surgery

Procedure:			
Approach: ☐ Sternotomy ☐ Mini-Stern ☐ Mini ☐ right ☐ left		☐ Thoracotomy	☐ right ☐ left
Conduit:	# Grafts:	☐ LIMA ☐ RIMA ☐ Radial ☐ right ☐ left ☐ Vein ☐ EVH ☐ Open	
Special Positioning:			
Implants:			
Special Equip/Instr:			

Perfusion

Cannulation			
Arterial:	☐ Aorta ☐ Axillary ☐ Femoral		Size:
Venous:	☐ Atrium ☐ Bicaval ☐ Femoral ☐ IJ		Size:
Vent:	☐ Root ☐ LV ☐ PA		Size:
Plegia: ☐ Antegrade ☐ Retrograde ☐ Hockey Stick ☐ Spencer Malet ☐ del Nido			
Circ Arrest: ☐ Yes ☐ No			

Anesthesia

Blood Needed:	Units:		Block: ☐ Yes ☐ No
Swan: ☐ Yes ☐ No	Artline: ☐ Yes ☐ No	Echo: ☐ Yes ☐ No	
Airway: ☐ Lung Isolation	☐ Dual Lumen	☐ Bronchial Blocker	

Misc. Notes

Appendix H

Pre-surgical Huddle Checklist Elements Level of Evidence Table

Implementation of Pre-Surgical Huddle Level of Evidence Table												
	1	2	3	4	5	6	7	8	9	10	11	12
Level I: Systematic review or meta-analysis												
Level II: Randomized controlled trial												
Level III: Controlled trial without randomization							X					
Level IV: Case-control or cohort study								X				X
Level V: Systematic review of qualitative or descriptive studies												
Level VI: Qualitative or descriptive study (includes evidence implementation projects)	X	X	X	X	X	X			X	X	X	
Level VII: Expert opinion or consensus												

1 = Ali, M. et al. (2011); 2 = Hendrickson, S. et al. (2009); 3 = Jain et al. (2015); 4 = Weld, L. et al. (2016); 5 = Martin, L., & Langell, J. (2017); 6 = Nundy, S. et al. (2008); 7= Phadnis, J. & Templeton-Ward, O. (2018); 8 = Leong, K. et al. (2017); 9= Lingard, L. et al. (2011); Hildebrand, E. et al. (2014).

Appendix I

Pre-surgical Huddle Checklist Elements Synthesis Table

Pre-Surgical Huddle Checklist Elements Synthesis Table										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Team Introduction	X			X		X	X	X	X	X
Planned Procedures/Review of specific procedures	X		X	X		X	X	X	X	X
Equipment availability	X		X	X	X		X	X	X	
Instruments availability/sterility	X		X	X	X		X	X	X	
ATB			X		X	X	X		X	
Patient positioning			X				X			
Potential procedural risks and critical portion of the case or expected deviations		X				X				X
Concerns	X	X	X							
Patient specific needs intraop	X							X		
Intra op imaging or Xray			X						X	
Nerve Block			X							
Expected Specimens				X						
Staffing issues							X			
Other Patient Considerations, language,cognitive/communication, special requests										X
Post op considerations									X	

1 = Ali, M. et al. (2011); 2 = Hendrickson, S. et al. (2009); 3 = Jain et al. (2015); 4 = Weld, L. et al. (2016); 5 = Martin, L., & Langell, J. (2017); 6 = Nundy, S. et al. (2008); 7= Phadnis, J. & Templeton-Ward, O. (2018); 8 = Leong, K. et al. (2017); 9= Lingard, L. et al. (2011); Hildebrand, E. et al. (2014).

Appendix J

Pre-surgical huddle presentation

VANDERBILT UNIVERSITY
MEDICAL CENTER

Checklist
Guided
Pre-Surgical
Huddle
A. Krumm

VANDERBILT UNIVERSITY
MEDICAL CENTER

Pre-Surgical Huddle
Cardiac Surgery

When
- 0630 each day

Where
- Outside of ORs

Using a specialty specific checklist, surgical teams will meet prior to the start of the day to review all scheduled cardiac cases for the day.

Who
- Attending Surgeons who have cases on that day
- First call Cardiac Attending Anesthesiologist
- Lead Cardiac CRNFA or designee CRNA
- On-call Perfusionist
- RN circulators, Surgical Technologists, and First Assists- all ORs included in the pilot
- Anesthesia & OR support service Technicians
- Clinical Staff Leaders (CSL) & Service Line Manager
- Huddle Facilitator & Recorder

Before Huddle
- Checklist elements are completed by attending surgeon or surgical scheduler at time of case booking
- Checklist elements are confirmed by CSLs using the EMR day prior to cases

During Huddle
- Facilitator will review all surgical cases using SOP and script and record huddle compliance
- RNs circulators use checklist as worksheets to record relevant information by filling out checklist

After Huddle
- Checklists are used for reference when preparing for cases
- Checklists are used for reference throughout the intraoperative phase

VANDERBILT UNIVERSITY MEDICAL CENTER

Expected Outcomes (lit. review syn.)

Outcomes Synthesis Table of the Implementation of Pre-Surgical Huddle												
	1	2	3	4	5	6	7	8	9	10	11	12
FCOTS	↑	↑		↑	↑	↑				↑		↑
UD		↓	↓		↓		↓	↓	↓			
SFD		↓	↓					↓	↓			
Int		↓	↓									
OREffTS				↑								
RNCore		↓										
TIC		↓										
TW&C	↑			↑			↑		↑		↑	
TWPerc									↑		↑	
MisComE		↓						↓	↓			

Legend:
FCOTS = Rate of first case on time starts; UD = Unexpected Delays; SFD = Surgical Flow Disruptions; Int = Interruptions; OREffTS = OR Efficiency time stamp; RNCore = RN trips to core; TIC = Time in Core; TW&C = Teamwork and Team Communication; TWPerc = Teamwork Perception; MisComE = Miscommunication related events.
1 = Ali, M. et al. (2011); 2 = Hendrickson, S. et al. (2009); 3 = Jain et al. (2015); 4 = Weld, L. et al. (2016); 5 = Martin, L., & Langell, J. (2017); 6 = Mathews L. et al. (2015); 7 = Nundy, S. et al. (2008); 8 = Phadnis, J. & Templeton-Ward, O. (2018); 9 = Russ, S. et al. (2013); 10 = Ellis et al (2020); 11= Leong, K. et al. (2017); 12 = Tyerman, Z. et al.(2020).

VANDERBILT UNIVERSITY MEDICAL CENTER

Checklist

- Confirmed and completed at pre-surgical huddle.
- Accessible by all team members for reference.

Booking Information

OR: Date: Time Pref:

Cardiac Surgery Huddle Checklist

Demographics

Name: Surgeon:
BMI: Resident:
Allergies:
Beta Blocker: ATB:
Contact: Consent? COVID-?

Surgery

Procedure:
Approach:
Conduit: #Grafts:
Special Positioning:
Implants:
Special Equip/Instr:

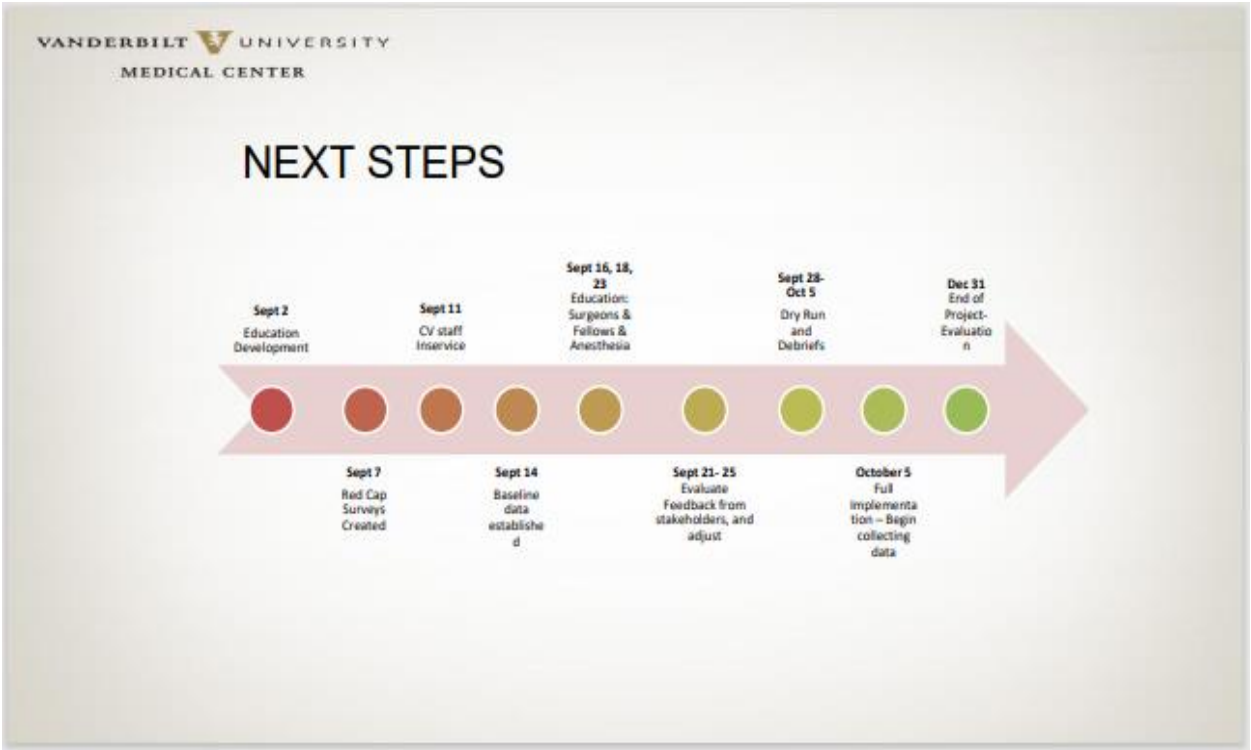
Perfusion

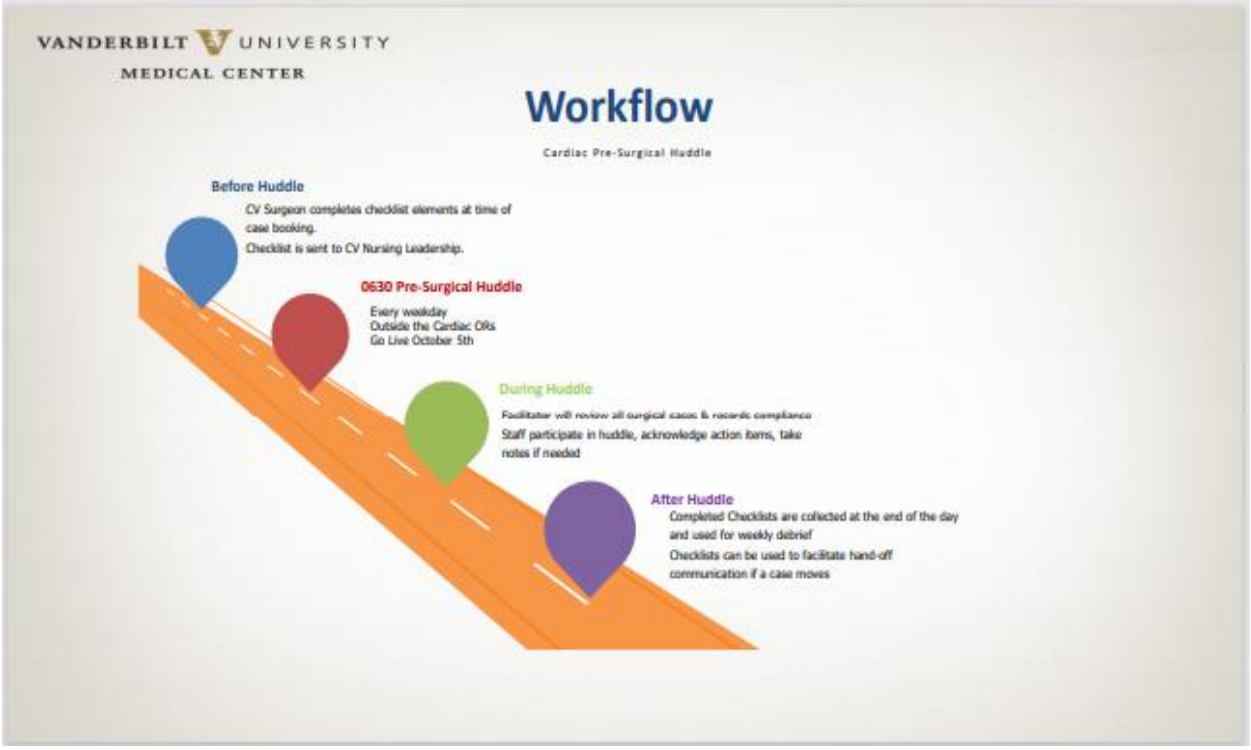
Cannulation
Arterial: Size:
Venous: Size:
Vent: Size:
Plegia:
Circ Arrest:

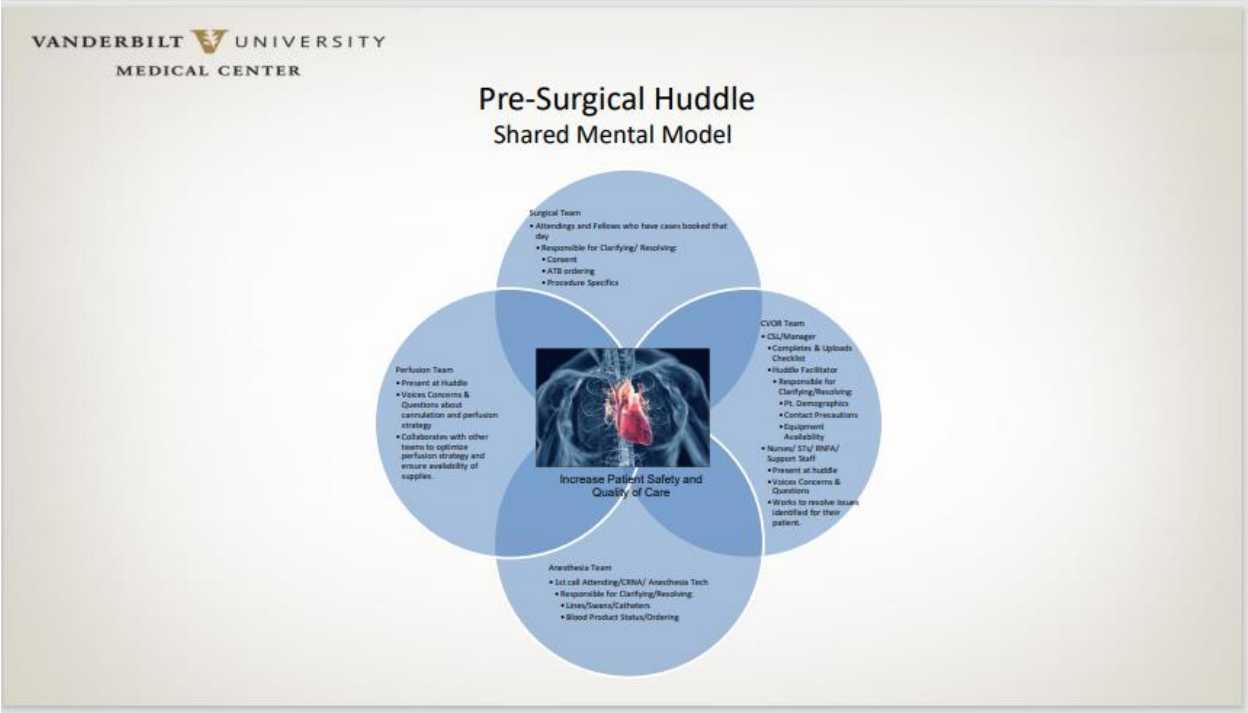
Anesthesia

Type&Screen: Units Ordered:
Swan: Art line: Echo:

Misc. Notes


VANDERBILT UNIVERSITY
MEDICAL CENTER
NEXT STEPS
Sept 2
Education Development
Sept 7
Red Cap Surveys Created
Sept 11
CV staff Inservice
Sept 14
Baseline data established
Sept 16, 18, 23
Education: Surgeons & Fellows & Anesthesia
Sept 21- 25
Evaluate Feedback from stakeholders, and adjust
Sept 28- Oct 5
Dry Run and Debriefs
October 5
Full Implementation – Begin collecting data
Dec 31
End of Project- Evaluation


VANDERBILT UNIVERSITY
MEDICAL CENTER
Workflow
Cardiac Pre-Surgical Huddle
Before Huddle
CV Surgeon completes checklist elements at time of case booking.
Checklist is sent to CV Nursing Leadership.
0630 Pre-Surgical Huddle
Every weekday
Outside the Cardiac ORs
Go Live October 5th
During Huddle
Facilitator will review all surgical cases & records compliance
Staff participate in huddle, acknowledge action items, take notes if needed
After Huddle
Completed Checklists are collected at the end of the day and used for weekly debrief
Checklists can be used to facilitate hand-off communication if a case moves


VANDERBILT UNIVERSITY
MEDICAL CENTER
Pre-Surgical Huddle
Shared Mental Model
Surgical Team
• Attendings and Fellows who have cases booked that day
• Responsible for Clarifying/ Resolving:
• Consent
• ATB ordering
• Procedure Specifics
CVOR Team
• CSL/Manager
• Completes & Uploads Checklist
• Huddle Facilitator
• Responsible for Clarifying/Resolving:
• Pt. Demographics
• Contact Precautions
• Equipment Availability
• Nurses/ ST/ RNFA/ Support Staff
• Present at huddle
• Voices Concerns & Questions
• Works to resolve issues identified for their patient.
Perfusion Team
• Present at Huddle
• Voices Concerns & Questions about cannulation and perfusion strategy
• Collaborates with other teams to optimize perfusion strategy and ensure availability of supplies.
Increase Patient Safety and Quality of Care
Anesthesia Team
• 1st call Attending/CRNA/ Anesthesia Tech
• Responsible for Clarifying/Resolving:
• Lines/Swans/Catheters
• Blood Product Status/Ordering

Appendix K

Huddle compliance questionnaire

Pre-surgical Huddle Questionnaire

Please complete the survey below.

Thank you!

Please select all members in attendance:	☐ Attending Surgeon (For each case in person or call in) ☐ Cardiac Fellow (in person) ☐ First Call Anesthesiologist (In person or call in) ☐ Lead CRNA (In person or call in) ☐ Anesthesia Tech (in person) ☐ Cardiac CSL/Manager (In person) ☐ On Call Perfusionist (In person) ☐ RN Circulator (At least one circulator present for each room - 3 total) ☐ RN/ST (At least one ST or RN scrub present for each room - 3 total) ☐ RNFA (At least one FA scrub present for each room - 3 total) ☐ ORTA/PST (in person)
Please note who was not in attendance and why:	_____
Was the Pre-surgical Huddle completed before first case starts?	◯ Yes ◯ No
If no, why?	_____
Were all cases boarded before 06:00 reviewed?	◯ Yes ◯ No
If no, why?	_____
Were all checklist items reviewed for each boarded case?	◯ Yes ◯ No
If no, what checklist items were not reviewed, why?	_____

Was a helpful response provided by each member for the following checklist sections:

(Definition of helpful response: The member speaking is prepared and able to provide information for most checklist items they are responsible for. If a member is unable to provide information on more than 2 checklist items the question should be marked no)

Appendix L

Ohio State University Human Subject Research Determination Form

Confidential

Record ID 69
Page 1 of 3

Human Subject Research Determination Form

Please complete the survey below.

Thank you!

Response was added on 07/19/2020 3:15pm.

Instructions:
1. Please complete the requested project information, as this form may be used for documentation that neither IRB review nor an exemption is required.

2. Please select the appropriate answers to each question in order as they appear. If all of the questions are answered without receiving an error message, the form must be printed AND signed as certification that the project is "not human subjects research," and does not require IRB review or exemption.

If you are unsure how to answer any of the questions, please contact ORRP for additional guidance at ORRPDeterminations@osu.edu.

PROJECT INFORMATION	
Name of PI, advisor, or mentor	Dr. Timothy Landers, PhD, RN, APRN-CNP, CIC, FAAN
Advisor Email	landers.37@osu.edu
Student Name:	Alice M. Krumm
Project Title	Pre-Surgical Huddle and Efficiencies in the Perioperative Setting
Brief Description of Project/Goals:	My proposed project objective is to evaluate operating room (OR) efficiencies, as defined by first case on-time starts (FCOTS) and turn over time (TOT) and non-surgical intra-operative time before and after the implementation of and evidence-based pre-surgical huddle. (This information is important and provides the necessary information to determine if the project requires IRB review.)

QUESTIONS	
1. Will the project involve testing an experimental drug, device (including medical software or assays), or biologic?	◯ Yes ⊗ No (This question determines if additional federal regulations, like FDA regulations, apply to the project. This information is based on the Common Rule (45 CFR 46.102(d)) that states "Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge." If the answer to this question is 'YES' - IRB review is likely required.)

Confidential

Record ID 69

Page 2 of 3

2. Has the project received funding (e.g. federal, industry) to be conducted as a human subjects research study?	◯ Yes ⊗ No (This question is to determine if the project received funding to be conducted as a research study, quality improvement, or program evaluation. If the funding source requires a specific level of IRB review and oversight or considers the project to constitute human subjects research, you may be required to submit an IRB application.)
3. In addition to any other purposes, is the project intended to develop or contribute to generalizable knowledge (e.g. testing a hypothesis) AND/OR has the project been designed in such a way that the findings will be generalizable (e.g. randomization of subjects; comparison of case vs. control)?	◯ Yes ⊗ No (This question is to evaluate project intent and design. The project design plays a key role in determining intent. If the project uses standardized research methods like testing a hypothesis or randomization to determine results, then it is research. If the intended outcome is simply to report on what happened at the institution/program, even if another site does something similar and sees benefit, this does not indicate research design or intent.)
4. Will the results of the project be published, presented or disseminated outside of the institution conducting it?	⊗ Yes ◯ No (The purpose of this question is to determine if and how project results will be disseminated. Note that program evaluation and QI projects can be published or presented without being considered research projects; not all information that is published or presented represents generalizable knowledge. Lack of intent to disseminate the information is generally a strong indicator that a project does not constitute research.)
5. Will the project occur exactly as proposed regardless of whether individuals conducting it may benefit professionally from it?	⊗ Yes ◯ No (This question is not focusing solely on whether an individual will professionally benefit, but rather whether they would conduct the project (or conduct it in the exact same way) regardless of the potential for professional benefit (e.g. adding it to a CV or getting funding based on the results).)
6. Is the project intended to improve or evaluate the practice or process within a particular institution or a specific program?	⊗ Yes ◯ No (If the intention upon designing and conducting the project is not to improve or evaluate a specific practice/program, then the answer should be "No" indicating research intent and IRB review is likely required. If the project is intended to create knowledge or draw conclusions applicable beyond the particular institution or specific program, then the project is likely research as defined by the federal regulations and IRB review or exemption is required.)

Confidential

Record ID 69

Page 3 of 3

If no message appears above indicating the certification is not valid, IRB Review is not required because, in accordance with federal regulations, the project does not constitute human subjects research as defined under 45 CFR 46.102(d).

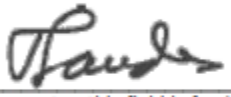
Student: Sign this form below attesting to the accuracy. Download and save a copy of the completed form, print or email the form to your advisor for signature. This serves as record that IRB review is not required for this project.

Student: I certify that the information provided is accurate.

Student Signature date: 07-19-2020

The following information is to be completed by the student's advisor once the student has completed and submitted the form. Please note - once the form is formally 'Submitted' the student should save a PDF copy of the form and forward the PDF to their advisor for review and signature.

Advisor: I have reviewed the student project and agree to the information provided.



(Please note - this field is for Advisor completion)

Advisor Signature date: 8/21/2020

Appendix M

Vanderbilt University IRB QI Determination

Human Research Protections Program – HRPP
Supporting the work of the IRB and Providing HRPP Oversight

VANDERBILT

RE: IRB #201699 "Pre-Surgical Huddles and Perioperative Efficiencies"

Dear Alice M Krumm, MS:

A designee of the Institutional Review Board reviewed the research study identified above. The designee determined the project does not qualify as "research" per 45 CFR §46.102(l).

(l) Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. Activities which meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program which is considered research for other purposes.

The purpose of this quality improvement project is to implement an evidence-based daily pre-surgical huddle to decrease delays in surgery.

As this does not meet the "criteria for research" as described in 45 CFR §46.102(l), IRB approval is not required.

Please note: Any changes to this proposal that may alter its "non-research" status should be presented to the IRB for approval prior to implementation of the changes. In accordance with IRB Policy III.J, amendments will be accepted up to one year from the date of approval. If such changes are requested beyond this time frame, submission of a new proposal is required.

Sincerely,

Molly A Shiflet MPH
Institutional Review Board
Health Sciences Committee #1

Electronic Signature: Molly A Shiflet/VUMC/Vanderbilt : (ed97a413861c06ffd8f0e2688fce5a7b)
Signed On: 08/31/2020 10:12:41 AM CDT

1313 21st Ave., South, Suite 505
Nashville, TN 37232
www.vanderbilt.edu/irb

VANDERBILT UNIVERSITY MEDICAL CENTER

Perioperative Services

Letter of Support from Clinical Site

Project Title: *"Pre-Surgical Huddle and Efficiencies in the Perioperative Setting"*

DNP Student: Alice M. Krumm

This letter is written to certify the student named above has permission from Vanderbilt University Medical Center to conduct a scholarly project *"Pre-Surgical Huddle and Efficiencies in the Perioperative Setting"* in the Adult Perioperative Services Department.

Roger Dmochowski, MD, MMHC, FACS
Professor of Surgery, Associate Surgeon-In-Chief
Professor of Urology
Professor of Obstetrics and Gynecology
Vice Chair, Section of Surgical Sciences
Vanderbilt University Medical Center
Executive Medical Director for Patient Safety and Quality (Surgery)
Associate Chief of Staff
Vanderbilt University Hospital

Signature: 

Date: February 27, 2021

1211 Medical Center Drive
Room 3109 VUH
Nashville, TN 37232-7545

tel 615.322.3354
fax 615.875.2900