

Running head: PROPOSAL NEURO SURGICAL SCHEDULING

Classification of Surgical Case Descriptions for Surgical Scheduling Improvement in

Neurosurgery

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Classification of Surgical Case Descriptions for Surgical Scheduling Improvement in Neurosurgery

Background and Significance

The neurosurgery department of a large tertiary care referral center is consistently reorganizing the surgical schedule the day of surgery. There is a constant movement of patients, including the addition of unscheduled patients, cancelation of patients, and the declaration of patients who are evaluated as needing surgery urgently or emergently. This constant rearranging of the surgical schedule the day of surgery imposes patient safety concerns as well as financial implications.

These frequent schedule changes, compounded with poor communication, create concurrent process defects not only in the neurosurgery and neuro endovascular intraoperative environment, but also in the Neuro Surgery Post Anesthesia Care Unit (PACU) and with the in-patient care units, where staffing of qualified nurses and other interdisciplinary staff may require a change in patient assignments based on staff knowledge and competence. These patient care units both depend on the surgical schedule to determine needed resources to care for expected patients, both in the number of patients and the types of procedures. Change to a surgical schedule creates a domino effect, which adversely impacts all units that care for these neurosurgery patients, either preoperatively, intraoperatively, or postoperatively, impacting the existing safety processes. In addition, and of significance, changes to the surgical schedule create expenses in opened and unused surgical supplies, instruments, and manpower when expected procedures are canceled.

Healthcare Perioperative Services (POS) include preoperative, intraoperative, and postoperative services. Preoperative services involve nursing actions that prepare a patient for

the surgical procedure. Most importantly, they are continuations of the focus on patient safety, most notably the verification of the patient's identity and the planned surgical/radiology procedure. Other important tasks include validation of the anesthesia plan and implementation of physician orders, a nursing assessment, and patient and family teaching. The time that the preoperative nurse spends with the patient assures that the patient meets all safety standards for an uneventful surgical experience. The intraoperative phase includes the actual surgical procedure and all activities involved with a safe surgical experience. This phase may include, but is not limited to, identification and availability of the correct surgical instruments, surgical supplies, positioning devices, needed medications, surgical implants if indicated, and staff with the necessary knowledge and skills for the scheduled procedure. This phase of the process begins the day prior to surgery, once the surgical schedule is finalized and published. This complex coordination of multispecialty components must be accurate and complete prior to the patient coming into the operating room. Nurses verify that all necessary items are functional and available for the planned surgical procedure. Immediately prior to the surgical procedure, the circulating RN initiates a "Time Out," or surgical pause, during which all team members verify and confirm a minimum of three elements: correct patient with two facility-approved patient identifiers, the correct site for the surgical procedure, and the intended procedure to be performed.

The postoperative phase involves critical nursing care in the safe treatment and monitoring of patients as the effects of anesthesia medications and gases are reversed. Services provided in the postoperative phase of care include the immediate assessment and support of basic airway, breathing, and circulation needs of the postoperative patient. In addition, the control of pain, the

emersion from anesthesia, and the stabilization of the physical, emotional, and physiological needs of the patient occur in the postsurgical period.

Problem Statement and Purpose

When the surgical schedule is altered the day of surgery, it increases the chance of an adverse event and creates unnecessary risk in a nonemergency surgical procedure. The neurosurgery service is composed of many varied surgical procedures, each one requiring unique equipment, instruments, supplies, positioning devices, and implants. The items made available for one surgery often do not meet the needs of another surgical procedure. When the surgical schedule is altered, it means that one patient is substituted for another patient who will usually undergo a different planned surgical procedure on the surgical schedule. This disruption in the planned surgical/radiological schedule stresses the systems by providing less time to prepare adequately for the newly posted case, which in turn may compromise patient safety. This change often involves tasking an unassigned individual, one who may not be the most knowledgeable regarding the newly assigned case, to gather information and items in a short period of time, which creates logistical challenges. Further, the risk of errors in communication present opportunities for mistakes. Documented electronic medical records (EMR) communication versus verbal communication of last-minute information provides greater availability and definitive information to all of the team members associated with the care of the patient.

The neuro surgery team members believe that numerous daily schedule changes and communication challenges cause patient safety concerns in the Neurosurgery Operating Rooms (OR) as well as the financial implications associated with unused staffed operating room resources.

Current State

The current practice for scheduling patients for neurosurgery procedures is for the surgeons or their support staff to contact the scheduling staff of the hospital and “post the case.” Posting a case involves providing the name of the patient, the planned surgical procedure, and name of the surgeon and assisting personnel, as well as any notification of specific equipment, instruments, supplies, positioning devices, and implants needed. In addition, in some cases, equipment, instrument, supply, and/or implant industry representatives are coordinated to be present during the procedure to provide technical support to the surgeon and clinical staff. This information is expected to be provided no later than 1600 the working day prior to the scheduled procedure.

The rationale for such a deadline to post a case is primarily to begin a process of patient safety measures. By providing information to the operating room prior to the day of the scheduled procedure, key members of the nursing and support staff can verify that the specified equipment, instruments, supplies, and/or implants are present, functional, and available preventing a conflict where demand exceeds supply. In addition, the nurse and support staff ensure there are no conflicts with these limited resources with other scheduled cases, an important component in assuring a safe surgical experience for the patient.

The project setting is a community hospital certified by the Joint Commission as a Comprehensive Stroke Center. As a result of rapid growth in the neurosurgery service in the past three years (2016-2019), the need for improved surgical schedule management is necessary. Currently there is no policy for the scheduling of surgical procedures in the neurosurgery operating room. There are medical staff bylaws that suggest that if a surgeon would like to perform a surgery due to an undefined emergency, surgeons communicate in an unofficial

manner to determine which surgical case should be performed first. Current practice has been demonstrated to be unpredictable and driven by physician preference, causing uncertainty for the surgical team and the bypassing of many established safety measures in place for electively scheduled surgery. While some deviation from the published surgical schedule to accommodate emergency surgeries is inevitable, a clear definition for the classification of emergency levels will provide for a common understanding and defined decision making categorization to schedule and prepare the neurosurgery operating rooms safely and efficiently.

Definition of Terms

STAR Reporting.

The Safety Trending and Action Report (STAR) is a part of the study organizations patient safety evaluation system for collecting and evaluating patient safety events. The STAR reporting system records events that cause patient harm; near misses, defined as events that if reaching a patient, could cause harm. Other reportable events are complaints and grievances from patients, customers, and staff members, and any other perceived unsafe conditions. STAR reporting is a part of the study organizations patient safety evaluation system for collecting and evaluating patient safety events. These reports may be submitted electronically by any member of the facility organization. The reports are categorized and reported internally to the study organization and to regulatory bodies such as the Florida Patient Safety Organization (FPSO). The STAR safety reporting system is confidential and protected software.

OPI Team

The Operational Performance Improvement (OPI) Team functions under the Departments of Quality and Operational Performance (see Appendix A for OPI Project Charter). OPI focuses on value and stewardship. OPI uses a systematic, continuous improvement approach called Lean

Six Sigma to identify and reduce waste and variation. The internal OPI team analyzed data from the STAR program for the time period of April 2018 to August 2018. The analysis of data suggested several process defects (Appendix B), which verified the weaknesses in the scheduling system. The weaknesses included the changes to the published schedule including when planned neurosurgery cases were cancelled and replaced with other surgeries, the published case order was changed, and added cases to the schedule were not emergencies. Careful review by the OPI team showed that few guidelines existed regarding the scheduling and ordering of surgical cases and the process for adding urgent/emergent cases to the schedule. The daily surgical schedule was determined to be primarily based upon physician preference

Surgical Services Dashboard

The surgical services dashboard is a compilation of data across the study organization's four hospital health system that compares metrics between surgical services in the system. These monthly metrics include number of available operating rooms, number of cases performed, percentage of on-time starts, room turnover times, man hours per operating room hour, man hours per case, block time utilization, and added cases. According to the July 2018 surgical services dashboard report, 47% of the neurosurgery and neuro endovascular cases were added to the schedule after the surgical schedule was finalized for the following day. Adding to the patient safety issues were the number of new cases posted after the deadline, as well as the multiple changes to the sequence or ordering of scheduled patients that occurred.

Current Process for Scheduling of Surgical Procedures (Cases) in the Neuro OR

Currently there are no policies or structured classifications of surgery and their definitions for scheduling surgical procedures in the Neuro OR. There is a non-formalized, generally accepted agreement related to the posting of surgical cases. Elective cases are those

planned surgeries scheduled into a surgeon's reserved operating time, which changes based on the day of the week. This is known as "blocked time," during which the assigned surgeon has first refusal of the surgical resources. If a surgeon fails to schedule a case in the "blocked time," the time is released for use by any credentialed neurosurgeon/ neuro-radiologist. Cases scheduled after the official closing of the scheduling office, which in this organization is 1600, are referred to as "add-on" cases. Add-on cases are considered elective cases and are placed on the schedule in unused times or during non-operational hours where the on-call staff are the only members present to perform the surgery. Urgent cases are add-on cases, which the surgeon deems to be clinically necessary within a determined timeframe, usually within 24 hours. Emergent cases are add-on surgeries that require immediate addition to the surgical schedule and are placed into the next available operating room or neuro-endovascular room. Often, emergent cases require an elective surgery case to be postponed or "bumped" to later in the schedule. It is for these reasons that physicians and their designees as well as clinical staff may schedule surgical cases on an *ad hoc* basis without clear patient prioritization through clinically agreed upon criteria.

Neurosurgical/Neuro-Radiology Scheduling

Routine scheduling of neurosurgery and neuro-radiology surgical cases is a complicated process. Patients are seen in the neurosurgeon's office or in the hospital. Diagnostic tests are ordered, and the surgeon and patient review them to determine a surgical plan of care. Once the patient consents to the planned surgical procedure, the surgical posting office is notified, and the case is scheduled utilizing the neurosurgical scheduling tool (Appendix C). Additional safety steps in the scheduling process include a pre-anesthesia clinical evaluation during which the anesthesiologists order additional testing or specialty physician consults, as necessary.

The organization utilizes an internal health information system, Cerner®, and the sub product, Surginet® which is a surgical scheduling software product. Surginet provides for consistency, accuracy, and communication of the surgical schedule. The multispecialty team utilizes these Surginet tools to coordinate the care of the patient on the day of surgery. The Surginet schedule produces information related to surgeon preferences in all aspects of the intraoperative care of the patient. The finalized surgical schedule is then published at the end of the day when surgical posting closes for elective cases.

The publishing of the surgical schedule triggers other departments within the organization to begin preparation for the next day's surgery. Needed instrumentation is sterilized, and industry representatives provide specialty instrumentation and implants that require in house sterilization. For safety purposes, the facility requires outside instrumentation and/or implants to be present in the surgical department 24 hours in advance of the planned surgery. This is to assure that these items from outside the facility are sterilized according to national and hospital standards. The facility maintains a specific inventory of supplies. Patient-specific items often require a week's notice to order, receive, and distribute to the surgical unit. Each surgeon has unique preferences regarding instruments, specialty supplies, positioning devices, implants, and suture. These preferences, documented and stored on electronic "preference cards," are stored in the Cerner surgical computer program, which OR personnel can easily access. These preference cards allow the nurses and other key OR personnel to verify the physician preferences for each surgical case, as well as prescriptive and anecdotal notes to assist the team during the surgical procedure.

Literature Review

The purpose/objective of the literature review was to search current literature which explores evidence-based processes to improve patient safety and throughput in the surgical scheduling processes in a neurosurgery unit. Another purpose was to explore benchmark surgical scheduling polices and processes from reputable organizations similar to the study organization. Lastly, the literature review was to search current literature for future state considerations related to surgical scheduling. Findings will assist in the development of an evidence-based process change to improve patient safety and throughput in a neurosurgery unit.

Literature Search Criteria and Strategies

The literature search was conducted utilizing the Jacksonville University (JU) Carl S. Swisher Library resource provided to Jacksonville University students. Using the library catalog, the A-Z database ($n = 156$ databases) was narrowed to two databases for nursing. The Nursing and Allied Health Database (ProQuest) and CINAHL database were searched using the keywords below with the search result numbers listed in parentheses. The date range selected was 2010 to 2019.

Keywords

Key words were utilized to search the databases identified. These words included classification of surgical schedule ($n = 17,852$), surgical schedule ($n = 10,062$), surgical schedule classification ($n = 2268$), scheduling of surgical procedures by urgency (156), daily schedule for surgery ($n = 6490$), surgical services emergency schedule ($n = 8041$), surgical schedule elective urgent emergent ($n = 2677$), scheduling of neuro operating room ($n = 279$), neurosurgery or management ($n = 1023$), rapid improvement event ($n = 28$), Lewin's theory ($n = 73$).

Professional peer organizations such as AORN, as well as surgical services leadership professional peer(s) provided electronic benchmark data. International references were not excluded as the identified problem statement is relevant globally.

Literature Appraisal

Through a review of current literature, four distinct themes emerged related to scheduling of surgical procedures. These themes included: quality improvement methodology in healthcare, theories and models of change, system and culture improvement research, and benchmarking documents.

The literature reviewed noted that rising healthcare costs, declining reimbursement, increasing expenses of technology, and competing resource allocation priorities are global economic concerns for POS in such countries as the Netherlands, Portugal, Canada, Taiwan, and the United Kingdom (Aij, Visse, & Widdersoven, 2015; Azari-Rad, Yontef, Aleman, Eng, & Urbach, 2013; Ferreira, Gomes, & Yasin, 2011; Heng & Wright, 2013; Jeang & Chiang, 2010; Robertson et al., 2015). The reviewed literature highlighted the need for efficiency in surgical scheduling to balance the demand and resources in the provision of safe patient care (Aij et al., 2015; Azari-Rad et al., 2013; Ferreira et al., 2011; Heng & Wright, 2013; Jeang & Chiang, 2010; Robertson et al., 2015). The literature provided insight into the quality improvement efforts of various countries to address safe surgical scheduling.

Quality Improvement Methodology, Theory, and Models of Change

This project is based upon Lean principles and Lewin's Theory of Change. Authors reported that quality improvement methodology, which includes computer simulation models and Lean Six Sigma business principles of creating value and minimizing waste, has influenced change in healthcare successfully (Aij et al., 2015; Ferreira et al., 2011; Heng & Wright, 2013;

Robertson et al., 2015). Lean methodology improves standard workflow, efficiency, and creates a highly reliable product (Woiciechowski, Pearsall, Murphy, & French, 2016). This workflow included the safe scheduling of surgical procedures. According to Woiciechowski et al. (2016), utilizing Lean methodology adds value by eliminating excess waste such as inventory, over- and underproduction of surgical procedure time, surgical team member redundant activities and motion, and operating room productive time, all providing for a safe surgical environment. This process begins with surgical scheduling. According to Liang, Guo, and Fung (2015), applying quality improvement methodology addressed a process defect in surgical scheduling. These process improvements led to improved production in POS by optimizing the surgical schedule as evidenced in performance measures and enhanced patient safety.

Mixed methodology began in the social science field by combining the findings of qualitative, quantitative, and case study data (Gallo, 2017). Using a mixed methodological approach, the research reviewed demonstrated improvements in efficiency, productivity, and outcomes that included safety in healthcare by utilizing change theory and Lean methodology (Aij et al., 2015; Ferreira et al., 2011; Heng & Wright, 2013; Robertson et al., 2015). In a case review, the authors implemented a Continuous Quality Improvement (CQI) process that integrated Lewin's Model for Change and a Lean system approach during a 6-month period in 2015 (Woiciechowski et al., 2016). This study emphasized the need for interdisciplinary change management as it related to bedside report. The facilities executives, nursing leaders, educators and performance improvement professionals sought a model that would remove barriers of interdisciplinary communication. This case study acknowledged that the complexity of healthcare requires not only interdisciplinary but inter-professional collaboration.

Two common frameworks were utilized in this project to improve communication critical to the transition of patient care, much like that needed when scheduling a surgical procedure. Lewin's Three-step Model of Change was found to work very well with the quality methods of Lean. The authors presented a very concise and clear demonstration of how these two theories and methods work together in change management related to interdisciplinary communication between healthcare team members (Wojciechowski et al., 2016).

System and Culture Improvement Research

As continued efforts are made to seek solutions to improve POS and surgical scheduling efficiencies, computerized simulation is an evolving science that has entered the healthcare industry (Liang et al., 2015). In the review of the current literature, little evidence has been found to support that simulation can fully control for the highly complex and variable nature of the scheduling of surgical cases. Research has indicated that the ability for simulation models to control for predictable variables in elective surgical scheduling is attainable. After reviewing 11 studies under the theme of system and culture improvement methodology, there was evidence to support the concept that computerized simulation models may prove to be a highly reliable tool in the management of the operating rooms of surgical services. Though the models ranged from simple to complex mathematical designs, none were without limitations. The suggested models in the research were stand-alone and not yet generalizable. In addition, the models presented in the literature did not address the scheduling of emergency surgeries into an elective surgical schedule.

Soh, Walker, and O'Sullivan (2017) suggested that as healthcare rapidly changes in an organization, assumptions included in the simulation model may no longer be valid. These authors suggested that future simulation models must include multiple patient pathways through

surgical services. The scenarios should include the variables of availability and scheduling of medical staff, nurses, and nonmedical staff, which are vital to the process. This finding was also noted in other studies reviewed.

One study by Liang et al. (2015) recognized that there are multiple operational research-based approaches and mathematical models related to surgical scheduling proposed in the literature. These authors suggested that “extremely dynamic and unexpected events make ‘off-line’ optimization unrealistic and impractical” (p. 2). One simulation model presented in the literature made no consideration for the addition of urgent and emergent cases to the daily surgical schedule. Further, in this model, there is no accounting for last case start time mandates often included in the daily management of the surgical schedule (Jeang & Chang, 2010).

In a single specialty/single facility, a complex case study described a “simulation-based optimization for surgery scheduling” (Liang et al., 2015, p. 6). This study applied Software Arena to build the simulation model to optimize a surgical schedule. The aim of this paper was to utilize simulation to improve the hospital metrics related to patient satisfaction and hospital performance. The model was designed to apply an “optimal weight of simple rules in a combined scheduling policy in the model” (p. 3). The variables included in the simulation model included the number and types of ORs, the hours of operation, the case mix, and the total capacity of the operating rooms. Database information included the master surgical schedule and the model used for surgical scheduling to include full block, modified block, and open block time. The researchers described real-time sequencing of the surgical schedule as the operational goal. The authors reviewed current scheduling rules, which consisted of over 100 criteria. These rules were divided into three categories: priority scheduling rules (simple rules, weighted priority index); heuristic (trial and error, practical, individual decisions); and other (Liang et al., 2015).

These researchers concluded that when applying the designed simulation model to elective surgical procedures only, “three simple rules with a weighted index were most effective” (p. 10).

In a 2012 experimental study in one acute care health facility in Taiwan, the researchers created optimization software in an attempt “to model the scheduling problem in the form of a mathematical program...to minimize the deviation between the total operation time and the total available time in the operating rooms” (Jeang & Chiang, 2012, p. 1207). The authors theorized that by utilizing a highly sophisticated mathematical process, OR management could be optimized. The authors described their hypothesis as resulting in: “Length of stay can be reduced, staff morale can be enhanced, reduction of cost, and increased revenue for the hospital” (p. 1220). Computerized simulation has failed to demonstrate adaptability to real-time additions and deletions of surgical cases to the surgical schedule (Azari-Rad et al., 2013; Jeang & Chiang, 2012; Liang et al., 2015; Soh et al., 2017; Wong, Khu, Kaderali, & Bernstein, 2010; Wu, Brovman, Whang, Ehrenfeld, & Urman, 2016). Until these simulation models are refined, institutional methodologies for high reliability outcomes are required (Soh et al., 2017).

In another reviewed case study, the implementation of a simulation model for OR scheduling was presented. The aim of this study was to reduce elective general surgery cancellations at Toronto General Hospital (Toronto, Canada) by introducing a discrete event simulation model to simulate perioperative processes over a 1-year period. The Toronto General Hospital (TGH) is a large teaching hospital with 19 operating rooms (ORs) and 406 patient beds. General surgery utilizes two to three ORs with 30 in-patient beds. Hospital volumes include 9,000 surgical cases annually (Azari-Rad et al., 2013).

The described simulation model was tested on three scenarios:

1. Case cancellations compared to ranking of surgeon according to Length of Stay (LOS) of their patients.
2. Sequence of surgical procedures based upon average time to complete.
3. Addition of 2 surgical beds in the post-operative surgical ward (Azari-Rad et al., 2013).

Data entered in the simulation model included the daily surgical schedule and surgeon-specific historical data. The authors described their results as reducing the number of elective cancellations. The published results indicated 17.6 fewer surgical cancellations noted with a 95% Confidence Interval (29.0 to 6.1), but no significance was noted in LOS (Azari-Rad et al., 2013). This reduction was accomplished by:

1. Scheduling surgeons whose patients had shorter average lengths of stay in the hospital earlier in the week.
2. Sequencing shorter surgeries and those with less variance in duration earlier in the day, adding up to two additional beds in the post-surgical ward (Azari-Rad et al., 2013).

A published control study conducted between 2008 and 2014 examined the variable of surgical control times across multiple services. Surgical Control Times (SCT) were defined as the time duration of a surgical procedure that the organization's scheduling software estimated. This Institutional Review Board (IRB) approved a study conducted at Brigham and Woman's Hospital (793-bed tertiary referral center in Boston, MA) and was approved with a waiver of informed consent. An analysis of 116,599 scheduled surgeries was performed. The findings revealed that surgeons underestimated their surgical times by 12.9 minutes, and neurosurgery in particular was overestimated by 29.7 minutes. This demonstrated that the surgeons were not able

to accurately estimate their surgical times. In another lower evidence prospective observational study, a data base were replicated from the senior authors' previous study (over a 9-year period) related to surgical case delays (Wong et al., 2010). This study was included in the literature search due to the analysis data on perioperative system delays in a neurosurgery practice. The variables studied were prevalence, causes, and impact of perioperative system delays from May 2000 to February 2009. Data collection included the type of procedure: cranial or spinal, the order of the surgery (first, second, or third case of the day), type of anesthesia administered (awake or general anesthesia), and the admission status (inpatient or outpatient).

Wong et al.'s study (2010) analyzed 1,531 elective surgical cases. The published top three delay reason included human delay, technical delay, and contamination comprised 87% of the delays, while nursing, anesthesia, management, communication and other comprised 16% (some delays were noted in multiple categories).

Benchmarking

In consideration of the review of the literature under the theme of Benchmarking, the value of non-research, class V literature cannot be underestimated in today's era of rapid change in healthcare. Anand and Kodali (2008) identified various benchmarking models available to collect current and relevant best practice data and processes. This review allowed for a relevant and current compilation of organizational surgical scheduling criteria from four renowned facilities to suggest a model for change in the proposed quality improvement project. For the purposes of benchmarking best practices for this proposed project, Orange Park Medical Center in Jacksonville, FL, Abington Hospital in Philadelphia, PA, The University of Colorado, Denver, CO, Penn State Health in Hershey, PA, and Vanderbilt University in Nashville, TN were sources for current and real-time professional collaboration. These organizations provided institutional

policies, procedures, and tools utilized in their organization's operational management of POS. From the information received, the scheduling guidelines with definitions and principles of daily operational surgical practices could be determined. These benchmark facilities all suggested defining add-on cases to include three to four levels of emergency cases. These cases were extrapolated into a chart for comparison (Appendix D).

The literature review included clinical practice guidelines, consensus opinions, or position statements. In a 2018 consensus statement, the Association of periOperating Room Nurses (AORN) published the *AORN Nursing Research Topics, AORN Research Priorities in Perioperative Nursing 2018-2023* (AORN, 2018). AORN is the professional organization for operating room nurses that publishes clinical practice guidelines that have been accepted into the National Guideline Clearinghouse. Perioperative professionals consult the AORN topics for evidence-based practice and clinical scholarship when considering nursing research. These topics include nursing priorities for patient safety, team function, system and care delivery, perioperative education and administration, gap analysis, and outcomes related to guidelines. AORN recommended:

Priority I: Build the science of perioperative nursing practice through the discovery and translation of evidence-based strategies in the clinical setting.

1. Team function/human factors
2. Perioperative nursing leadership: systems of care delivery, technology for decision support

Priority II: Produce valid evidence to inform ongoing development and revision of the AORN Guidelines for Perioperative Practice.

1. Patient and worker safety

2. Patient care

Priority III: Examine and link sentinel perioperative indicators to promote positive patient outcomes through evidence-based practices.

1. Patient safety culture
2. Location of delivery of care
3. Vulnerable populations (AORN, 2018).

Framework

Quality improvement methodology, including Lean Six Sigma business principles of creating value and minimizing waste, and computer simulation models, has been reported to successfully influence change in healthcare (Aij et al., 2015; Ferreira et al., 2011; Heng & Wright, 2013; Robertson et.al, 2015). Lean methodology improves standard workflow, efficiencies, and creates a highly reliable product (Woiciechowski, E., Pearsall, T., Murphy, P. & French, E. 2016). This workflow included the safe scheduling of surgical procedures. According to Woiciechowski et al., (2016), utilizing Lean methodology value is added by eliminating excess waste such as inventory, over and under-production of surgical procedure time, surgical team member redundant activities and motion, and operating room productive time, all providing for a safe surgical environment. This process begins with surgical scheduling. According to Liang et al., (2015), by applying quality improvement methodology a process defect in surgical scheduling was addressed. These process improvements led to improved production in POS by optimizing the surgical schedule and evidenced in performance measures and enhanced patient safety.

Mixed methodology began in the social science field by combining the findings of both qualitative, quantitative and case study data (Gallo, 2017). Using a mixed methodological

approach, the research reviewed demonstrated improvements in efficiency, productivity, and outcomes including safety in healthcare by utilizing change theory, and Lean methodology (Aij, 2015; Ferreira, 2011; Heng & Wright, 2013; Robertson, 2015). In a case review the authors implemented a Continuous Quality Improvement (CQI) process that integrated Lewin's Model for Change and a Lean System approach during a six-month period in 2015 (Wojciechowski, et.al 2016). This case study acknowledged that the complexity of healthcare requires not only interdisciplinary but inter-professional collaboration. Two common frameworks were utilized in this project to improve communication critical to the transition of patient care much like that needed when scheduling a surgical procedure. Lewin's Three Step Model of Change was found to work very well with the quality methods of Lean. The authors presented a very concise and clear demonstration of how these two theories and methods work together in change management related to interdisciplinary communication between healthcare team members (Wojciechowski et al., 2016).

Project Purpose and Objectives

The primary purpose of this quality improvement (QI) project was to improve patient safety in the perioperative neurosurgery department by decreasing daily schedule changes and improving communication in the neurosurgery perioperative OR. A secondary objective was to improve operating room utilization and financial metrics. To that end, the objective of this QI project was to create clear definitions and guidelines for the scheduling of neuro surgical and neuroradiology patients for operative procedures. The elective surgical scheduling process for the neuro surgical and neuroradiology patients did not change. The existing Cerner Surginet ® scheduling system has three choices in case classification: elective, add-on, and emergency

without a policy or definition. The surgeon's office personnel continue to schedule through the surgical scheduling office.

The build of this EMR screen and manual documentation forms are available for the project. By implementing clear scheduling definitions and guidelines, this project is expected to improve patient safety, improve neurosurgery and neuroradiology OR utilization, and improve cost expenditures, which will allow for a safer, more predictable, and more cost-effective workflow

For the purpose of this project, Level I emergent/emergency cases were defined as those surgical procedures requiring immediate operative intervention for a life-threatening emergency (20 minutes to the OR/IR) with the case beginning within 30 minutes of patient arrival to the suite. Level II emergent/emergency cases are defined as those surgical procedures that require surgical intervention within 2-4 hours of scheduling. Level III emergent/urgent cases are defined as those surgical procedures that require surgical intervention within 4-24 hours of scheduling, and from which significant morbidity may result from delay of surgery greater than 24 hours. This is a medical determination. As previously defined in this paper, elective surgeries are those planned surgeries scheduled into a surgeon's reserved operating time, based on the day of the week. Add-on surgeries are scheduled after the official close of the scheduling office, which in this organization is 1600.

The Surgical Services Committee consists of the medical staff departmental chiefs, surgical services leadership, the vice-president of patient care, the president of the hospital, and ancillary leadership such as health information systems and other invited guests. This committee meets quarterly to discuss critical information and current initiatives within surgical services. At the project facility this committee reviewed the proposed classification definitions of

neurosurgical cases and voted to adopt them on a trial basis. Other levels of multidisciplinary support were approved by the organizations medical board (system chiefs of the medical staff), medical departmental business meetings (neurosurgery, general surgery, obstetrics and gynecology, anesthesia), nurse executive council (system chief nursing officers), the facility clinical council (nurse managers and directors of the study facility), system surgical council (system directors of surgical services), and staff meeting for all affected units. A stakeholder analysis was performed for this project that confirmed its need. The stakeholders identified potential patient safety issues and reduced capacity through Neuro OR, believed to be caused by the numerous schedule changes and communication challenges.

Project Description / Design

Objective and Outcomes

The objective of the project was to collect three months of data pre and post implementation of the structured scheduling guidelines related to elective, urgent and emergency neurosurgery cases. The add-on and emergency surgical scheduling process for the neuro surgical and neuroradiology patients changed with a trial of the proposed intervention by requiring a surgical classification based upon the intervention definitions. Historically these cases were scheduled by the surgeon or their delegated advanced practice nurse by calling the neurosurgery department, and scheduling the case with the neuro surgery Health Unit Coordinator (HUC) or the Assistant Nurse Manager (ANM) for the neurosurgery unit. Under the trial intervention definitions cases were required to be classified as elective, urgent, emergency level I, emergency level II or emergency level III. For the purposes of the initial data collection elective, add-on and emergency cases were tracked and quantified based upon this classification. The definitions of classification are as follows:

- Elective Cases: Schedule at least two business days prior to surgery date. Pre-certification required.
- Add-on Cases: Added elective case added to the published schedule
- Cancelled cases: cases cancelled after being posted (i.e., entered into the Cerner Surginet ® surgical schedule).
- Level I Emergency Cases: require immediate surgical intervention for a life-threatening emergency (20 minutes to the OR / IR)
- Level II Emergency Cases: require surgical intervention within 2-4 hours of scheduling
- Level III Emergency Cases: require surgical intervention within 4-24 hours of scheduling, and where significant morbidity may result from delay of surgery greater than 24 hours
- Elective Cases: planned surgeries scheduled into a surgeon's reserved operating time, which changes based on the day of the week.
- Add-on surgeries are scheduled after the official close of the scheduling office, which in this organization is 1600 and can be categorized by the definitions mentioned above.

The focus of this quality assurance project was to decrease the volatility of the neurosurgery elective schedule, i.e. the consistent cancelation of cases, the addition of unscheduled cases, and the high number of declared urgent cases which occurred daily. The constant rearranging of the neurosurgery surgical schedule is a patient safety issue impacting safe surgical care. The expected outcome of the project was to create a more reliable and accurate elective, urgent and emergent surgical schedule by implementing the surgical case scheduling description/definitions reflected in the measurement of OR utilization.

Intervention

The intervention was applied to the neurosurgery patient population of a large tertiary acute care community hospital. The creation of a structured scheduling process of classification and definition of elective neurosurgical patients and urgent and emergency (emergent) surgery cases were included in the Cerner Surginet® electronic health information system. The build of this EMR screen and manual documentation forms reflects the definitions and levels of emergencies proposed in this project. All surgical cases were scheduled by the physician and/or surrogate and required the classification level of the surgical case. The emergency surgery cases were categorized into three levels. Level I Emergency Cases are those cases that require immediate surgical intervention for a life-threatening emergency (20 minutes to the OR / IR). Level II Emergency Cases: require surgical intervention within 2-4 hours of scheduling. Level III Emergency Cases: require surgical intervention within 4-24 hours of scheduling, and where significant morbidity may result from delay of surgery greater than 24 hours

This information was collected by the project author in the developed data collection tool (Appendix E) for validation pre and post-intervention implementation. These validated data were then statistically analyzed against the outcome measures described.

Setting

This quality improvement project location is a large tertiary care referral center in northeast Florida. This facility is a member of a four hospital health system in northeast Florida. This facility is licensed for 1,100 beds and contains a total of 34 operating rooms (ORs) for adult surgery. Of this total, there are five dedicated to the neurosurgery service and two dedicated to performing neuro endovascular interventional radiology procedures. Together these neurosurgery/neuroradiology suites performed 3,544 cases in fiscal year 2018 (October 1, 2017

to September 30, 2018). Perioperative services for the neurosurgery department include six preoperative patient preparation and discharge bays and eight post anesthesia care unit (PACU) bays.

The neurosurgery department of the study organization performs 78 different surgical procedures, each requiring different equipment, instruments, supplies, positioning devices, implants, and medications. The top 10 by volume procedures performed in the neurosurgery department from October 1, 2018 through January 30, 2019 included micro-endoscopic discectomy (neurosurgery operating room), cerebral angiogram (neuroradiology suite), multiple level anterior cervical fusions (neurosurgery operating room), cerebral angiogram with intervention (neuroradiology suite), robotic lumbar fusion transforaminal lumbar interbody fusion (TLIF) with Mazor® computer navigation (neurosurgery operating room), lumbar laminectomy with minimally endoscopic decompression (neurosurgery operating room), craniotomy for tumor (neurosurgery operating room), robotic lumbar fusion extreme lateral interbody fusion and transforaminal-interbody fusion (XLIF/TLIF) with Mazor® computer navigation (neurosurgery operating room), cerebral angiogram with carotid stent placement (neuroradiology suite), and lumbar fusion with TLIF minimally invasive surgery (MIS), (neurosurgery operating room).

Privacy and Confidentiality

Data were collected and reported in accordance with information security policy and practices. The study facility has a secure server which is designed to block unauthorized access to the system while allowing for outgoing transfer of information. The study facility employs encrypted password protected devices, and robust internal monitoring for privacy and security compliance. All systems and software programs are protected under the requirements of the

Health Insurance Portability and Accountability Act (1996). The project site includes a Health Information Security Officer.

A personal computer (PC) was utilized through a secure website connection to the project hospital to secure the electronic data. All paper data were stored in a locked cabinet in a locked office within a locked suite. Additionally, this project is focused on surgical case descriptions and classification, not individual patients. Data specific to individual patient identifiers was not recorded.

Implementation Plan

To implement the intervention the following steps were taken:

1. Pre-implementation data was collected by the author utilizing the developed data collection tool (Appendix E).
2. Create an Electronic Service Request (ESR) for the information technology clinical informatics team to add the definitions and classification to the existing drop-down elections for surgical scheduling priority.
3. Engage the same stakeholders in the same manner that approved the project with updated information, implementation date, study period, presentation of findings intent, and answer questions.
4. Share educational material in PowerPoint as to the classification definitions with images to demonstrate where this can be found in the surgical scheduling element of Cerner Surginet® with the neurosurgery departmental team members and providers
5. Determination and implementation of “go live” date.
6. Monitor daily/ weekly data collection during three-month post-implementation time period

7. Analyze data

Instruments

To quantify the safety issues, data were obtained from the perioperative surgical services dashboard. Elements of the internal organizational dashboard report the number of surgical cases within any designated period and the utilization of the neurosurgery Operating Rooms (ORs) during defined hours of operation. The number of cases performed and the percent of OR utilization during staffed hours of operation provide safe staffing and support services such as materials management, sterilization teams, etc. for scheduled and unscheduled procedures. Additionally, when the OR is utilized during defined hours of operation the labor costs are less.

The purpose of the STAR system within the study organization is to collect and analyze information to improve safety and quality. Additionally, the Florida Statute Title XXIX requires an organization to report all adverse events that result in injury defined by the statute (Public Health § 395.0197; Internal risk management program, FL Statute 395.0197). The STAR system provides this reporting structure for the study organization.

Facility Permission

On May 25, 2019, at 2:00 p.m., the proposed project was presented at the Magnet System Research Council meeting. This council reviews and approves all evidence-based performance improvement activities as well as nursing research proposals. This project was approved and ready for submission to the project facility Institutional Review Board (IRB) after IRB approval from JU.

The project concept was then shared with members of the research team at the facility. The individuals included a statistician and two nurse researchers who reviewed the proposed

project and found it to be consistent with the organization's mission. Additionally, the statistician agreed to assist with data analysis.

Instrument Measures

The data collected for quantification include the block time utilization report internal to the study facility within the Cerner Surginet® software system. The data collected post implementation will be compared for validity to the internal study facility data within the Cerner Surginet® software system

Timeline

1. September 28, 2018: Complete a draft manual data collection tool for this project (see Appendix E for this tool).
2. October 01, 2018: Begin trialing the developed manual data collection tool that will be validated by comparing the electronic medical record (Cerner) to the actual finalized and published surgical schedule each day.
3. January 30, 2019: Analyze the pre-implementation trial 3-month period of data collected manually compared to the published neurosurgery surgical schedule for baseline validation and quantification of the classification of scheduled surgical procedures data.
4. January 16, 2019: Present the data analysis to the OR Steering Committee. Present the benchmark scheduling guidelines from the four described organizations for stakeholder feedback. Once approved, present to all medical staff business and quality meetings for input and approval.
5. March 11, 2019: Present formal request for approval and adoption of the definitions and classification to the organization's Medical Board.

6. March 13, 2019: Draft a clinical policy related to the scheduling of surgical procedures including classifications according to facility protocol and submit for facility approval (Appendix F).
7. Fall 2019: Present to the IRB of Jacksonville University for exemption.
8. Fall 2019: Present to the IRB of the study organization (BMCJ) for exemption.
9. Winter 2019-2020: Implement definitions and categorization of surgical case posting according to Medical Staff leadership and clinical leaders' approved definitions.
10. Winter 2019-2020: Collect post-implementation data
11. Spring 2020: Interpret findings
12. Fall 2020: Disseminate findings

Stakeholder assessment

An analysis of stakeholders was performed noting the stakeholder's name, contact information, and role within the study organization. The ability for this stakeholder was evaluated for the impact and influence they could contribute to the project. This was ranked from low, medium or high. Other considerations included:

1. What is important to the stakeholder?
2. How could the stakeholder contribute to the project?
3. How could the stakeholder block the project?
4. What strategy for engaging the stakeholder can be utilized?

Financial costs

Funding stability was established for this project (Appendix G). The total estimated cost was \$56,000.00. This was calculated for the purposes of this project proposal and included the full time equivalent salary dollars spent on data collection, clinical informatics build of the

intervention in the EMR, and data analysis. The expenses for this project were included in the operational budgets for the neurosurgery and information technology departments of the neurosurgery and information technology. No additional resources were required to complete the project. Therefore there was no additional cost to the organization for this project and/or the implementation of the intervention.

Sustainability

Sustainability is attainable in the proposed quality improvement project. Political support is established in all stakeholder areas. Partnerships are well established across the multidisciplinary units of neurosurgery including the senior leadership supported quality lean Rapid Improvement Event. These lean events occur with a small team of stakeholders that devote 100% of their work hours to target concerns and processes that can be improved upon to improve quality. Organization capacity is determined by the number of operating /procedure rooms available that can be fully staffed during normal work hours. This capacity is then measured by the amount of time these rooms contain a patient versus the amount of time there is no patient in the operating /procedure room calculated at percent utilization. The organization defines the utilization as a key performance indicator with a threshold of 75%. The neurosurgery operating room had an existing utilization recorded at less than 45%. Vacancies in the nursing and technical staffing for the study unit were a noted vulnerability in the project. Hours of operation and the number of available operating rooms were dependent on available staffing to the expected (budgeted) volumes. Competing priorities of the organization and key stakeholders was another point of vulnerability in the sustainability of the project. The QI project evaluation is an established ongoing metrics report, and thus a sustainable measurement of the project success.

Communication structures existed to meet the QI project goals. Strategic planning at the QI project site included the measures of success identified in the project.

IRB

The Jacksonville University Internal Review Board (IRB) and Baptist Medical Center (BMC) IRB approved an expedited request for exemption. This project occurred over two 3-month time periods, one to collect pre-implementation data, and the second after implementation of the classified scheduling of surgical cases in the neuro OR.

Evaluation Plan

Data Analysis Plan

The project tool data were analyzed and summarized in table and graph format demonstrating distribution of data, outliers, and time series plots as indicated. Utilizing Microsoft Excel® statistical software the data were analyzed. Standard deviation regression analyses were performed. The analysis techniques used to determine relationships was percentage. Parametric data were analyzed utilizing the Two-Sample T-Test and CI sampling of the pre and post intervention implementation. The outcome variables (independent and dependent) are included the research study variables (See Table 1).

Post-implementation data collected specified the newly implemented classification of cases as either elective, urgent, emergency level I, emergency level II, or emergency level III, performed or cancelled during planned hours of operation. These data were then compared to the internally published daily Cerner Surginet® surgical schedule and analyzed for variances in number of each classification of surgical cases scheduled. The manual data collection tool (Appendix E) was completed by the assistant nurse manager (ANM) of the neuro OR who manages the daily operations of the unit. This tool was completed weekly, sorted by day of the

week and tabulated number of cases performed based upon the classification definitions and validated through the internal daily Cerner Surginet® report of performed surgical cases.

Physician, clinical team, scheduling office staff, and team members were educated about the intervention at established meetings and forums for information dissemination and learning. A power point presentation was created to share with the stakeholders to reinforce their education. The process is as follows. The clinical team member receiving the surgical posting information (Scheduling team member, Health Unit Coordinator, or RN) is required to ask the physician or designee (RN, Nurse Practitioner (NP), Physician Assistant (PA) or Resident) posting the case to submit a classification when neurosurgical procedures are scheduled. By comparing the volume of each category of cases before and after implementation of the patient classification system, safety and efficiency will be analyzed for correlation and significance. It is expected that with clear scheduling guidelines the variability of the surgical schedule will decrease while utilization of the neuro ORs will increase with less safety events reported.

Data Collection

For this QI project, data collected were all elective, add-on, emergency, and cancelled cases during the pre-implementation and post implementation period using the newly defined surgical posting policy for the Neurosurgery operating rooms of Baptist Medical Center Jacksonville utilizing stakeholder-accepted definitions for elective and added surgical cases. The data consisted of the daily (Monday through Friday) surgical cases performed in the neurosurgery operating rooms in each of the proposed classification of surgical case descriptions for surgical scheduling. Data collected on each neuro surgical case included the date, time, scheduled surgical procedure, surgical classification, actual surgical procedure performed, estimated duration of the surgical procedure, actual duration of the surgical procedure, surgeon

of record, admission status, and proposed discharge from the OR status such as in-patient, observation, or outpatient.

Table 1 summarizes the independent and dependent variables. The variation between the scheduled operations and actual operations is primarily reflected in the daily count of Add-On surgeries. Data collected were transferred to an Excel spreadsheet for comparison to the published elective surgical schedule within the health information system “Cerner Scheduling®” module. These data were collected weekly over a 3-month period prior to implementation of the new scheduling policy and compared to data collected during a comparable 3-month period post implementation of the new scheduling policy.

The data collection plan included the utilization of the internal health information system of Cerner® and the sub product Surginet® for the purposes of scheduling surgical procedures, OR utilization and other standardized reports. Another internal software system in the study facility is the STAR® event reporting system internal to the study organization.

Data Analysis

The baseline data were collected pre-implementation of the surgical classifications and descriptions from October 8, 2018 through December 28, 2019. A total of 958 surgical cases were performed during this time. The post-implementation data were collected from November 1, 2019 through January 31, 2020. A total of 847 surgical cases were performed during this time. Holidays (Thanksgiving Thursday and Friday, Christmas Day, and New Year’s Day) were eliminated from the analysis. The last week of the post-implementation period (beginning Jan 27, 2020) was eliminated as most of its data was missing. This means that the number of observations by day varies slightly, as shown in Table 2.

The data on the individual procedures was summarized as daily counts of Elective, Add-on, Cancelled, Emergent-I, -II, and -III procedures. The de-identified data was transferred both to Minitab 18® and the SAS system for statistical analysis. Descriptive statistics were used to summarize the project variables and reported. The results of the statistical analysis were reported in graph and table format.

For each type of procedure, the mean daily counts and percentages were compared for the pre- and post-implementation period using independent sample *t* tests. In a two sample (n=30) T-Test the baseline mean of 2.87 add on cases were reduced to 1.60 with a p-value of 0.016. Since sample variances frequently differed substantially for the two periods, the unequal variance version (Welch's *t* test) was used throughout. For this version of the *t* test, the degrees of freedom depend partially on the difference in the two sample variances, so may differ even for comparisons based on the same sample sizes. Because counts and proportions near zero have very non-normal distributions, *t* tests are not reported for counts by day-of-week for the Emergent-I, -II, and -III cases.

Counts and proportions for a single period and type of surgery were compared across days-of-week using the one-way ANOVA with day-of-week as the factor. The data showed normal distribution. A series of independent samples t-tests will be used instead of a two-way ANOVA because each surgical type is on a very different scale both for location and for dispersion. A statistical package will compute the ANOVA if requested, treating type as a factor, but the equal variance assumption would fail. An ANOVA would have its estimated Mean Squared Error dominated by the Elective surgeries. By contrast, independent samples t-tests will scale each standard deviation separately for each surgical type and therefore be more sensitive to the pre versus post differences within each surgical type. The data on counts and percentages in

Tables 3 and 4 had large sample sizes. The *t*-tests and ANOVA were valid based upon normal distribution. The data for Tables 5 and 6 the counts and proportions for elective and add on cases were noted to have normal distribution for *t*-test and ANOVA analysis. The data for emergent and cancelled cases were not normally distributed and therefore were not analyzed for ANOVA.

Findings

The primary aim of this QI project was to decrease the daily schedule changes and improve communication challenges that cause patient safety concerns in the Neurosurgery Operating Rooms (OR) as well as the financial implications associated with unused staffed operating room resources. This project focused on the creation of evidence-based classification of surgical case descriptions that would be utilized in the scheduling of surgical cases which would decrease the number of surgical schedule changes to improve safe daily operations.

The data consisted of the daily (Monday through Friday) surgical cases performed in the neurosurgery operating rooms in each of the proposed classification of surgical case descriptions for surgical scheduling. Baseline data were collected pre-implementation of the surgical classifications and descriptions from October 8, 2018 through December 28, 2019. A total of 958 surgical cases were performed during this time. The post-implementation data were collected from November 1, 2019 through January 31, 2020. A total of 847 surgical cases were performed during this time. Holidays (Thanksgiving Thursday and Friday, Christmas Day, and New Year's Day) were eliminated from the analysis. This means that the number of observations by day varies slightly, as shown in Table 2. The last week of the post-implementation period (beginning Jan 27, 2020) was eliminated as most of its data was missing. The baseline data

demonstrated the extreme variability in number of changes made to the daily OR schedule pre-implementation to that of the post-implementation data.

The total number of operations per day was much higher in the post-implementation period than in the pre-implementation period, as shown in Table 2, in the column titled 'All'. This largely appears to be due to a substantial increase in the number of elective surgeries. Elective surgeries increased significantly both in number and as a percentage of the daily total number of operations (Table 3). These data support the suspected physician preference in the scheduling of surgical case.

By contrast, the number of Add-On surgeries decreased significantly, both in terms of number (Table 2) and percentage (Table 3). Add-On surgeries were consistently smaller numbers than the Elective surgeries. The decrease in their numbers does not offset the large increase in the number of Elective surgeries with regard to the overall change in the number of surgeries. Cancellation of posted surgical cases showed a small, but significant, increase in the numbers per day. However, as a percentage of the overall number of surgeries, the change was not significant.

Quantify Prevalence of Add-ons during the Pre-Implementation Period

As shown in Tables 3 and 4, Add-On surgeries were a substantial part of the actual schedule during the pre-implementation period. These surgeries, which document the variation between the published and actual schedule, averaged about 3 per day (Mean = 2.96, S.D. = 2.04). As a percentage of the daily schedule, they averaged about 15% per day (Mean = 15.25, S.D. = 9.04).

Examining the data by day-of-week during the pre-implementation period, as shown in Tables 5 and 6, we see that the number and percentage of Add-Ons was apparently greater on

Mondays. However, the one-way ANOVA for a difference in the mean counts by day-of-week was not significant ($F(4,52) = 1.64$, p value = 0.178). Similarly, there was no significant difference in the mean percentage of Add-Ons by day-of-week ($F(4,52) = 1.71$, p value = 0.161).

Documentation of overall increase in usage during the Post-Implementation Period

The number of Emergent-1 cases stayed about the same in the two time periods, though as a percentage of the total they showed a decrease. However Emergent-2 and 3 cases declined both in number and as a percentage.

The total number of operations per day was much greater in number in the post-implementation period than in the pre-implementation period, as shown in Table 3, in the column titled 'All'. On average, the daily number of surgeries increased from about 19 to about 31. This was a statistically significant change. The increase in number of operations largely appears to be due to a substantial increase in the number of elective surgeries. Elective surgeries increased significantly both in number and as a percentage of the daily total number of operations (Table 3 and 4).

Test for a lessening of Add-ons during the Post-Implementation Period

As shown in Table 3, there was a significant reduction in the number of daily Add-On surgeries, from a mean of about 3 per day, to a mean of about 1.5 per day. This happened despite the large increase in the overall number of surgeries, so that the change is even more marked if one compares the percentage of Add-On surgeries. This variable showed a decrease from about 15% to about 5%. Both changes showed strong statistical significance.

While the pre-implementation period data suggested an increased tendency to Add-On surgeries on Mondays, that tendency has disappeared in the post-implementation data. There

were no significant differences either in the mean counts of Add-Ons by day-of-week ($F(4,56) = 1.42, p \text{ value} = 0.239$) or in the mean percentage by day-of-week ($F(4,56) = 1.71, p \text{ value} = 0.160$).

Tables 4 and 5 show that the same patterns occur throughout all days of the week. For each day, there is a large increase in the number of Elective surgeries both in counts (Table 4) and as a percentage (Table 5). Add-on surgeries show a decrease. The smaller sample sizes cause some of the changes in Add-on surgeries to fail to reach statistical significance, but the pattern of change is consistent across all days.

Comments on Cancelled cases

As shown in Table 3, there was a small but significant increase in the mean daily number of cancelled cases (from an average of about 1.1 to an average of about 1.6). However, when viewed as a percentage of the total number of daily cases, as in Table 4, cancelled cases actually decreased slightly, though the change was not statistically significant.

Comments on Emergent cases

The mean daily number of emergent-I cases was similar in both the pre- and post-implementation periods (about 0.8 and 0.7 respectively). While the percentage of emergent-I cases, as a percentage of the total number of daily cases did decrease significantly (Table 4), this is because the total number of all cases increased post-implementation rather than a change in the number of Emergent-I cases. Unexpectedly, there was a significant decrease in both the number (Table 3) and percentage of Emergent-II cases (Table 4).

Project Amendment

This QI project received approval immediately prior to the recent COVID19 pandemic. Because of the March 20, 2020 State of Florida Office of the Governor Executive order Number 20-723 C.F.R. (pursuant to section 252.36(7) of the Florida Statute), all hospitals were asked to cease performing any elective surgery that was not urgent, emergent, or medically necessary. This Agency for Health Care Administration order had no established end date. It is for these reasons that an amendment to the Jacksonville University IRB approved project was submitted and approved to request the use of retrospective data which existed within the organizations electronic medical record, Cerner® Surginet for this project.

The primary purpose of this quality improvement (QI) project was to improve patient safety in the perioperative neurosurgery department. The expected outcome related to improved safety was expected by implementing classification of surgical case descriptions and structured surgical scheduling process.

In the project process of gaining approval and stakeholder support the proposed classification of surgical case descriptions for surgical scheduling was shared with the Operational Performance Improvement offices for Baptist Medical Center, the System Surgical Services Directors Committee, and the Cerner® Surginet informatics team.

Completely separate from this project Baptist Medical Center South began a trial of surgical scheduling analytics software, LeanTass®. In the design phase it was suggested by the vendor that utilizing surgical classifications is best practice. The leveling definitions proposed in this QI project were so well received while gaining stakeholder approval prior to the project implementation, the LeanTass® team chose to adopt the proposed classifications and definitions. In doing so, this classification was added to the Cerner® Surginet scheduling process in October

2019. Because the health system operates under one Cerner® license, the addition of the proposed classifications and definitions was implemented in all surgical scheduling locations (Appendix H).

As a result of the unexpected implementation of the acuity leveling, there was now data in SurgiNet from November of 2019 forward. A revised amendment request was submitted to the Jacksonville University IRB and met with approval March 31, 2020. This approval accepted the use of retrospective data that was available and unaffected by the COVID-19 environment, and the moratorium on elective surgery.

Because of this amendment some of the proposed data reporting is not included. Going forward, post COVID-19, and once the surgical schedule normalizes additional data will be evaluated for implementation impact of the new leveling definitions but unrelated to this formal study.

From the original proposal the following data were collected and analyzed in this study revision:

- Number of surgical cases posted in the neuro OR per day of the week, month, and three-month retrospective study period
- Classification of surgical cases in the neuro OR per day of the week, month, and three-month retrospective study period
- Neuro OR utilization percentage per day of the week , month, and three-month retrospective study period

From the original proposal the following **was not** collected in this project:

- Number of surgical cases posted in the neuro OR per day of the week, month, and three-month prospective study period

- Classification of surgical cases in the neuro OR per day of the week, month, and three-month prospective study period
- Neuro OR utilization percentage per day of the week , month, and three-month retrospective study period

Recommendations/Implications

The results of this QI project support the objective to decrease daily schedule changes by implementing classifications and definitions for surgical scheduling in neurosurgery. By utilizing the principles of Lewin's Theory of Change and Lean principals this project was successfully implemented in the study organization. In spite of an unpredictable emerging pandemic the study was able to be completed with sustained results and retrospective data. These clear definitions and classifications, along with the supportive policy to sustain the change, improved communication of the priority for the day of surgery added surgical cases.

Due to the unprecedented global pandemic in 2020, an amendment of this project was submitted and approved to limit the aim of the project to those stated above. Therefore, recommendations for further study include the analysis of the relationship between the data presented and the study organization's safety reporting data. An aim outside of this project is to decreased safety events by decrease in schedule changes and improved communication. Additionally, further study of this project is recommended to evaluate the correlation of improved operating room utilization to enhance financial organizational return.

This study showed an apparent increased usage as shown by increased daily operations, while demonstrating a decrease in number and percentage of add-on surgical case volume in the study neurosurgery unit with the implementation of the surgical case classification. It is recommended that with the addition of surgical scheduling software at the study facility later in

2020 that the continued use of these classification and case descriptions be supported by the results of this QI project. This proposed software will apply to all specialties in the four hospital system. Lastly, a recommendation of key stakeholder physicians was to develop processes to analyze surgical cases posted as emergent I and II through the medical staff peer review committee of the study organization.

Dissemination

After completion of the QI project, findings and conclusions will be submitted for publication in the professional journal for The Association of periOperative Registered Nurses (AORN). Potential dissemination and presentation will be offered at the next Magnet® recertification survey of the study facility. Additional dissemination may include presentation at a conference of perioperative nurses.

Findings will first be presented to the Chief Nursing Officer. Within the project facility, the intended dissemination plan is to utilize the structured forums already established. Presentation and participation of the project stakeholders will be included in the OR Steering Committee, System Surgical Council, System Quality Improvement Committee, Success Briefing leadership meetings, and Department Meetings. Future dissemination may include presentation of the findings across the healthcare system through the Nurse Executive Committee to show relatability across all of POS. A full adoption of the intervention throughout the health system is a future goal.

The proposed QI project suggests that leaders must develop the structure and processes for change, anticipate and respond to barriers, note when the transformation becomes an actual change, and support the new behaviors and practices (Aij et al., 2015). The leaders must be able

to measure the changes and the impact as they create a multidisciplinary culture to sustain the change. This is a true test of evidence-based leadership and professional modeling.

Through completion of this QI project leaders were reminded to look at key processes with critical analysis. Then through recent and relevant evidence propose and lead change that is systemized and sustainable. As for this project, the emerging COVID-19 pandemic may alter the way we deliver care in surgical services. One such proposed change is to adopt a scoring system for medical necessity. Leaders in surgical services must remain current in their knowledge and practices to remain relevant in their role managing constant change.

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Table 1*Variables and Benchmarks for Success*

Independent Variables
1. Published elective schedule Monday through Friday in the Neuro OR (Nominal)
2. Actual schedule Monday through Friday (Nominal)
3. Number of cancelled cases after the surgical schedule is posted (Ratio / Discrete Scale)
4. Variance between the published and actual schedule for the neuro OR Monday through Friday in the form of Counts of Add-on Surgeries, Ratio / Discrete Scale
5. Percent of elective, add-on, and emergent level 1, 2, and 3 performed daily, weekly, monthly and quarterly in the Neuro OR, Ratio / Continuous Scale)
6. Published elective schedule Monday through Friday in the Neuro OR (Nominal)
7. Actual schedule Monday through Friday (Nominal)
8. Number of cancelled cases after the surgical schedule is posted (Ratio / Discrete Scale)
9. Variance between the published and actual schedule for the neuro OR Monday through Friday in the form of Counts of Add-on Surgeries, Ratio / Discrete Scale
10. Percent of elective, add-on, and emergent level 1, 2, and 3 performed daily, weekly, monthly and quarterly in the Neuro OR, Ratio / Continuous Scale)
Dependent Variables (Measurable Outcomes Pre- versus Post- Intervention)
1. Number of surgical cases in the neuro OR classified as Elective, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
2. Number of surgical cases in the neuro OR classified as Add-On, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
3. Number of surgical cases in the neuro OR classified as Cancelled, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
4. Number of surgical cases in the neuro OR classified as Emergent-I, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
5. Number of surgical cases in the neuro OR classified as Emergent-II by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
6. Number of surgical cases in the neuro OR classified as Emergent-III by day of the week, for each day in the pre- and post-implementation period. (Ratio / Discrete)
7. Proportion of the day's surgical cases in the neuro OR classified as Elective, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Continuous)
8. Proportion of the day's surgical cases in the neuro OR classified as Add-On, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Continuous)
9. Proportion of the day's surgical cases in the neuro OR classified as Cancelled, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Continuous)
10. Proportion of the day's surgical cases in the neuro OR classified as Emergent-I, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Continuous)
11. Proportion of the day's surgical cases in the neuro OR classified as Emergent-II, by day of the week, for each day in the pre- and post-implementation period. (Ratio / Continuous)

Note. This table demonstrates the independent variables of this project and the dependent variables expected to be influenced by the intervention

Table 2*Average Number of Cases per Day of the Week Pre and Post-Implementation*

	Monday	Tuesday	Wednesday	Thursday	Friday	All Days
Pre	12	11	12	11	11	57
Post	13	13	11	12	12	61

Table 3

Daily Number of Cases by Classification (Elective, Add-On, Emergent I, II, and III) excluding

Holidays (Mean / Standard Deviation)

	Classification Type M (SD)						
	All	Elective	Add-On	Cancelled	Em-1	Em-2	Em-3
Pre (n = 57)	18.75 (5.40)	11.88 (3.77)	2.96 (2.04)	1.07 (1.15)	0.84 (0.90)	0.84 (1.07)	1.16 (1.35)
Post (n = 61)	30.89 (11.16)	26.23 (9.46)	1.54 (1.49)	1.61 (1.32)	0.74 (0.83)	0.10 (0.40)	0.67 (0.94)
t-test	7.59***	10.96***	-4.3***	2.36*	-0.65	-4.96***	-2.25*

Note. ***p < .001, **p < .01 *p < .05.

Table 4

Daily Percent of Cases by Classification (Elective, Add-On, Emergent I, II, and III) excluding Holidays (Mean / Standard Deviation)

	Classification Type <i>M (SD)</i>					
	Elective	Add-On	Cancelled	Em-1	Em-2	Em-3
Pre (<i>n</i> = 57)	64.74 (17.20)	15.25 (9.04)	5.35 (5.43)	4.36 (4.84)	4.29 (5.20)	6.01 (7.54)
Post (<i>n</i> = 61)	84.51 (10.49)	5.17 (5.48)	5.24 (4.50)	2.24 (2.61)	0.29 (1.36)	2.57 (4.82)
t-test	7.47***	-7.27***	-0.13	-2.93**	-5.64***	-2.94**

Note. ****p* < .001, ***p* < .01 **p* < .05.

Table 5*Average Number of Cases by Classification and Day of the Week*

		Day of the Week				
		Total Number of Daily Operations <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	19.50 / 6.26	20.73 / 7.31	17.25 / 4.37	18.09 / 4.06	18.27 / 4.56	
Post	27.38 / 9.73	34.62 / 14.46	28.73 / 11.04	32.25 / 9.69	31.25 / 10.27	
t-test	t(21)=2.43*	t(18)=3.03**	t(13)=3.22**	t(15)=4.64***	t(15)=3.97***	
		Number of Daily Operations that are Elective <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	10.08 / 3.18	13.82 / 4.53	11.75 / 3.57	11.82 / 3.87	12.09 / 3.30	
Post	23.46 / 8.95	29.08 / 13.19	24.00 / 7.21	28.17 / 8.83	26.25 / 7.59	
t-test	t(15)=5.06***	t(15)=3.91***	t(14)=5.09***	t(15)=5.83***	t(15)=5.88***	
		Number of Daily Operations that are Add-Ons <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	4.17 / 2.79	3.00 / 2.05	2.17 / 1.53	2.73 / 1.49	2.73 / 1.79	
Post	1.23 / 1.09	2.00 / 1.53	1.45 / 1.75	0.92 / 0.51	2.08 / 2.02	
t-test	t(14)=3.41**	t(18)=-1.33	t(20)=-1.03	t(12)=-3.83**	t(21)=-0.81	
		Number of Daily Operations that are Cancelled <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	1.58 / 1.31	0.91 / 0.70	1.25 / 0.87	0.82 / 0.87	0.73 / 1.68	
Post	1.46 / 0.97	1.62 / 1.33	1.64 / 1.50	2.25 / 1.60	1.08 / 1.08	
		Number of Daily Operations that are Emergent-1 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	0.67 / 0.78	0.91 / 1.04	0.75 / 0.87	0.73 / 0.79	1.18 / 1.08	
Post	0.23 / 0.44	1.00 / 0.71	0.82 / 1.08	0.67 / 0.65	1.00 / 1.04	
		Number of Daily Operations that are Emergent-2 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	0.92 / 1.08	1.45 / 1.13	0.25 / 0.62	0.82 / 1.25	0.82 / 0.98	
Post	0.00 / 0.00	0.31 / 0.63	0.00 / 0.00	0.00 / 0.00	0.17 / 0.58	
		Number of Daily Operations that are Emergent-3 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	2.08 / 1.73	0.64 / 1.03	1.08 / 1.08	1.18 / 1.54	0.73 / 0.79	
Post	1.00 / 0.91	0.62 / 0.77	0.82 / 1.40	0.25 / 0.45	0.67 / 0.98	

Note. *** $p < .001$, ** $p < .01$ * $p < .05$. The *t*-Test was not performed on Number of Daily

Operations that are Cancelled *M (SD)*, Number of Daily Operations that are Emergent-1 *M (SD)*,

Number of Daily Operations that are Emergent-2 M (SD), Number of Daily Operations that are Emergent-3 M (SD) because sample size was small, and the distributions so non-normal, that the p-values on the t- tests were only approximate. This is noted in the body of the methods section.

Table 6*Percent of Daily Cases, by Classification and Day of the Week*

		Day of the Week				
		Percentage of Daily Operations that are Elective <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	53.12 / 18.92	63.38 / 12.10	69.81 / 18.08	65.31 / 16.98	67.66 / 15.89	
Post	84.85 / 6.44	79.59 / 17.56	85.45 / 8.46	87.10 / 5.48	86.00 / 9.18	
t-test	T(13)=5.52***	T(21)=1.84	T(16)=2.69*	T(12)=4.07**	T(16)=3.35**	
		Percentage of Daily Operations that are Add-Ons <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	20.76 / 11.44	13.65 / 6.29	11.87 / 8.19	15.10 / 8.11	14.68 / 9.00	
Post	4.25 / 3.65	8.21 / 9.11	4.31 / 3.62	3.07 / 1.82	5.74 / 5.05	
t-test	T(13)=-4.78***	T(21)=-1.72	T(15)=-2.91**	T(11)=-4.81***	T(15)=-2.90**	
		Percentage of Daily Operations that are Cancelled <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	7.80 / 5.75	4.32 / 4.10	6.82 / 4.34	4.49 / 5.01	2.98 / 6.93	
Post	6.65 / 6.65	4.20 / 2.63	5.37 / 4.47	6.76 / 3.98	3.18 / 3.16	
		Percentage of Daily Operations that are Emergent-1 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	3.17 / 4.18	3.95 / 4.94	4.27 / 4.94	3.91 / 3.96	6.60 / 6.13	
Post	0.83 / 1.63	2.91 / 2.64	2.74 / 3.45	2.04 / 2.06	2.76 / 2.84	
		Percentage of Daily Operations that are Emergent-2 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	4.07 / 4.75	7.40 / 5.21	1.37 / 3.34	4.81 / 6.67	4.11 / 4.64	
Post	0 / 0	1.00 / 2.64	0 / 0	0 / 0	0.37 / 1.28	
		Percentage of Daily Operations that are Emergent-3 <i>M (SD)</i>				
	Monday	Tuesday	Wednesday	Thursday	Friday	
Pre	11.10 / 11.34	2.30 / 3.76	5.86 / 5.92	6.39 / 7.48	3.86 / 4.13	
Post	3.42 / 2.92	4.07 / 9.03	2.13 / 3.35	1.03 / 1.89	1.94 / 2.79	

Note. *** $p < .001$, ** $p < .01$ * $p < .05$. The *t*-Test was not performed on Number of Daily

Operations that are Cancelled *M (SD)*, Number of Daily Operations that are Emergent-1 *M (SD)*,

Number of Daily Operations that are Emergent-2 *M (SD)*, Number of Daily Operations that are

Emergent-3 *M (SD)* because sample size was small, and the distributions so non-normal, that the

p-values on the *t*-tests were only approximate. This is noted in the body of the methods section.

Appendix A

Neuro OR Process Improvement Project Charter

Project Name: Neurosurgery Service Line RIE	Date:8/23/2018
Process Owner: Debbie Hickman	Executive Champion: Matt Zuino/Tammy Daniel

Project Overview

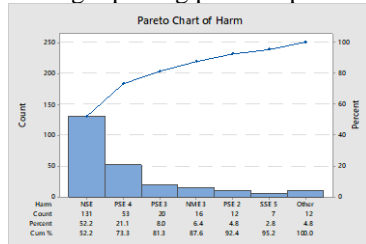
(Explain the project’s purpose and strategic alignment.)

- The purpose of this project is to increase patient safety and process flow to improve capacity while increasing patient and staff satisfaction.

Problem Statement

The numerous schedule changes and communication challenges are believed to cause potential patient safety issues and reduced capacity through Neuro OR. Data analyzed from the surgical services (SS) dashboard and Safety Trending and Action Reporting (STAR) information from April-August 2018 show several process issues. According to the July SS dashboard report, 47% of the endovascular cases were added-on after 4:00 PM for surgery the following day. In addition, multiple changes to the sequence of cases are made on the day of surgery.

- Due to the frequent schedule changes and poor communication, issues are occurring in Neuro recovery and on inpatient floors (Weaver 7, 8, 9 and ICU) and impacting morale and teamwork across the service line. From Oct. 1 2017-Aug. 30, 2018, the turnover rate was as follows: Neuro Intra-Op: 19.28%, Lyrerly: 23.29%, Weaver 9: 29.17%, Weaver 10: 28.15%.
- During reporting period April-August 2018



Project Goals and Objectives

(Describe the project goals using SMART – Specific, Measurable, Attainable, Realistic, and Time Bound. These goals should be used to determine the project’s success at its conclusion.)

- Evaluate emergent and non-elective cases and the demand that design processes be robust enough to facilitate patient safety and efficient throughput of the OR.
- Outline and provide visual management of Key Performance Indicators measures for continued process improvement, accountability, and sustainability (e.g., number of changes in schedule that are non-emergent, delays in starts, etc.).
- Increase OR capacity from 43% to 65% by October 31, 2019.
- Improve patient safety (near misses, etc.) from reports by 25 % October 31, 2019.
- Implement and/or develop plan for implementation in event week, which includes standard work, process maps, and visual management.
- Increase staff engagement/morale related to process and communication barriers that are resulting in high turnover.

Scope

(What activities will be included in the project? Consider timeline, resources, training, and costs. Scope may be updated after additional project planning activities have been completed.)

- **Inclusions:** Lysterly, Baptist OR Scheduling, PACE, Neuro Pre-op, Neuro PACU, Neuro Post-Op phase II, inpatient surgeries, elective surgeries, and emergency surgeries. Process start: Initiation of posting process at Lysterly through surgery start time and patient enters recovery through discharge or inpatient admission.
- **Exclusions:** *Neuro Intra-Op, Prep & Sterile, other surgery centers at Jacksonville and other campuses.*

Anticipated Key Decisions

(What key decisions do you anticipate will need to be made during the project? Examples: equipment or software selection, significant changes to staffing or operations)

Live visual management and daily reviews by Senior Leadership with team accountability (includes purchasing materials). Can you please add to the OR cLean sweeps “fluid in warmers are dated for expiration according to policy/recommendations and stock is rotated”. Thankyou.

-
- Role of leadership in addressing team morale and issues.
- May impact change of process sequence (e.g., patient scheduling).

Project Timeline

Start Date: Aug. 1st End Date: *October 31, 2019

(List constraints and drivers of timing.)

*May extend 6 months to a year

- Follow-up reporting to occur at 30, 60, and 90 days after completion of RIE on the following dates: Oct. 26, Nov. 27, Dec. 27th.

Financial Impact

(Anticipate the financial effects, using attachments if needed.)

- If we reduce the number of schedule changes, we will improve the capacity of Neuro throughput and thus, financial revenue (To be determined by Amanda G./Jeff Stevens).

Project Risks

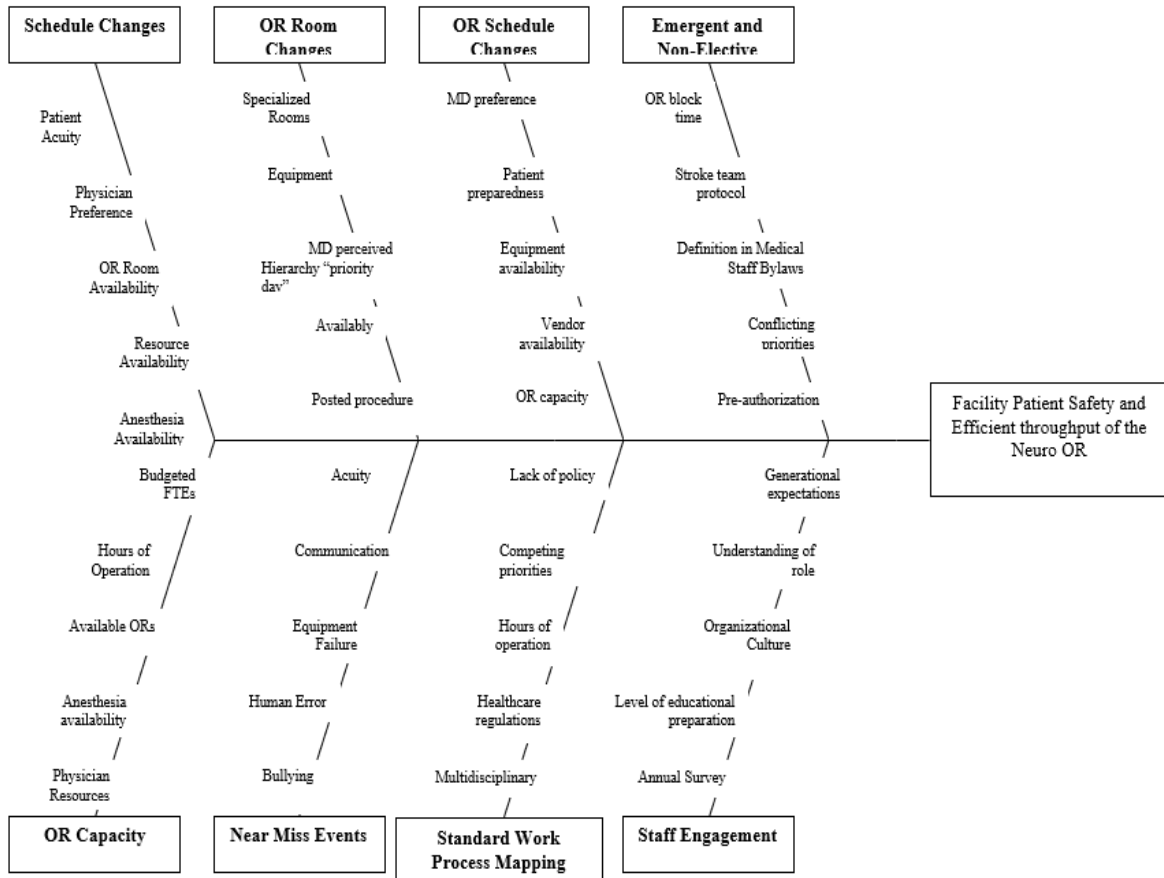
- Change in culture and endovascular surgeons’ and staff behaviors.
 - Daily live information and accountability that is communicated to and supported by Senior Leadership
- Attendance and support of physicians.

Risk if issues not addressed:

- Risks to patient safety.
- Morale and team issues, including turnover.
- Loss of revenue.

Appendix B

Neurosurgery OR Process Improvement Fishbone Diagram; Potential Defects



Appendix C

Neuro Surgical Scheduling Tool

**BAPTIST HEALTH SYSTEM
POSTING REQUEST FORM**

Neuro OR posting: 904-202-4455



Surgery: Appt Location: Date/Time Submitted: _____

Pt Name: _____

SSN: _____ DOB: _____ PT contact #1: _____ PT contact #2: _____

Interpreter needed? What Language? _____

Personal/Family Hx of Malignant Hyperthermia? Latex Allergy?

Hospital Stay: Requested Duration: _____ MIN DOS: _____

Primary Surgeon: Dr. _____ Co-Surgeon: _____

Pre-Op Dx: _____ ICD10: _____

CPT Code(s): _____

Name of Procedure(s):

Preference Card(s):

Special Comments/Equipment Needed:

INSURANCE/Plan: _____ Subscriber/Member#: _____

Auth# _____ Expiration/Range: _____

Same Day Add-On? Office Contact: _____ Phone#: _____

To be completed by Hospital Posting ONLY: OR Poster: _____

Date/Time Received: _____ Procedure Date: _____ Procedure Time: _____

Pace Date: _____ Pace Time _____ Surginet Conf#: _____

Disclaimer: At the time of the schedule request, the physician's office is responsible for providing sufficient insurance details for coverage verification, securing notifications, facility referral and/or pre-authorizations from insurance providers. If the physician's office is unsuccessful in returning the required information by 3:00pm the working day prior to the scheduled surgery day. The service will be canceled and can be rescheduled once the information is received.

Appendix D

Benchmarking/Facility Comparison

In consideration of the review of the literature under the theme of Benchmarking, the value of non-research, class V literature cannot be underestimated in today’s era of rapid change in healthcare. This review allowed for a relevant and current compilation of the organizational criteria below from four renowned facilities to suggest a model for change in the proposed DNP project. Note: Emergent and Emergency are used interchangeably.

Abington Hospital Jefferson Health	University of Colorado Northern Region	Milton S. Hershey Medical Center	Vanderbilt University Medical Center	Baptist Medical Center Jacksonville
<p><u>Category I:</u> Patients requiring immediate surgical intervention for life or limb threatening conditions; Loss of life or limb.</p>	<p><u>Priority Class A Emergencies:</u> Life, limb, airway or organ threatening conditions requiring immediate attention, taking precedence over any other case to be performed in the first available operating room (will bump prescheduled cases during regular hours) and requires the on-call team during off hours.</p>	<p><u>Emergent I:</u> Life threatening emergencies requiring immediate operative interventions.</p>	<p><u>Level 1 Emergency (Emergent):</u> Critical condition, which is an immediate threat to life. To be placed immediately in any unoccupied room. Examples include: hemodynamic instability, shock/active bleeding, airway obstruction, intracranial injury, C-Section. The case is expected to arrive imminently and will go directly to the</p>	<p><u>Level I:</u> Emergent/emergency cases are defined as those surgical procedures requiring immediate operative intervention for a life- threatening emergency (20 minutes to the OR/IR; puncture or cut within 30 minutes of patient arrival to the suite).</p>

			designated room upon arrival. Must be in the OR in 20 minutes or less from the time of boarding the procedure.	
<u>Category II:</u> Patients requiring surgery within 30 minutes to 2 hours of identification and notification; Must be performed within 2 hours.			<u>Level 2 Emergency (Urgent):</u> The attending surgeon believes that the patient’s condition will deteriorate significantly if the procedure is not done urgently. The case should start as soon as possible and, in any event, no later than 2 hours from posted time. The patient will be sent for immediately. The case will be placed preferentially in the room of same surgeon or service.	<u>Level II:</u> Emergent/emergency cases are defined as those surgical procedures that require surgical intervention within 2-4 hours of scheduling.
<u>Category III:</u> Patients requiring surgery within 2-6 hours of identification; Must be	<u>Urgent Class B Emergencies:</u> Emergencies that are not life threatening but may lead to severe complications if	<u>Emergent II – Surgical</u> intervention required within 6 hours of scheduling.	<u>Level 3 Emergency (Urgent):</u> The nature of condition is time sensitive but not emergent and	<u>Level III:</u> Emergent/urgent cases are defined as those surgical procedures that require surgical intervention within 4-24 hours of

<p>performed within 6 hours.</p>	<p>surgery is not performed within 8 hours of classification, where the posted time will be noted on the schedule board, and all Class B emergencies that have waited 8 hours will be reclassified as Class A emergencies.</p>		<p>permits delay of surgery of up to 4 hours. Examples include acute appendicitis, acute cholecystitis, and drainage of abscess. The patient will be sent for well in advance of 4 hours and may be sent for immediately if an open room is available at the time the case is boarded. Case to go preferentially in room of same surgeon/service.</p>	<p>scheduling, and where significant morbidity may result from delay of surgery greater than 24 hours.</p>
<p><u>Category IV:</u> Patients requiring surgery over 6 hours from notification; Must be performed >6 hours and < 24 hours.</p>	<p><u>Expedited Class C Emergencies:</u> Cases that are not life threatening, but which may lead to complications if surgery is not performed within 24 hours, to be worked into the existing urgent/emergent schedule or performed during evening hours, will be queued based on the time posted.</p>	<p><u>Emergent III:</u> Surgical intervention required within 24 hours of scheduling, where significant morbidity may result from delay of surgery greater than 24 hours. An exception is made for inpatients for which completion of the procedure will allow an</p>	<p><u>Administrative Leveled Case:</u> Cases that are time sensitive, independent of surgical urgency, will be prioritized by a member of the Perioperative Executive Leadership Team at the request of the attending surgeon.</p>	

		earlier discharge.		
<u>Category V:</u> Elective Cases; Elective Add-On	<u>Elective Cases:</u> Cases that can be electively scheduled in the future. All cases block and non-block, will have case times assigned at the time the case is scheduled based upon historical time.	<u>Elective Surgery:</u> Scheduled for greater than 48 hours. <u>Add-on:</u> An urgent or emergent case that is being placed on the current day's schedule (all cases scheduled after 1200 on the day prior to surgery will be considered an add-on). Only Ortho Trauma, Emergency General Surgery, Neurosurgery, and Cardiac Surgery will have access to place add-on cases in their assigned block rooms until 0600 the day of surgery.	<u>Level Upgrades:</u> A change in the level of a previously scheduled case.	<u>Level IV (add-on):</u> Where no significant morbidity or mortality will result from delay of surgery at least 24 hours, but no more than 48 hours.
		<u>Stand-by:</u> An elective case waiting to be placed in an available scheduled slot once block times are released.		

		<p><u>Urgent:</u> No significant morbidity or mortality will result from delay of surgery of at least 24 hours but no more than 48 hours.</p>		
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Appendix E

Manual Data Collection Tool

VISUAL MANAGEMENT					
Week / Date:					
	Monday	Tuesday	Wednesday	Thursday	Friday
<i>ELECTIVE</i>					
1. Elective Cases Preferred scheduling at least two business days prior to the surgery date and in accordance with block release time and availability. Preauthorization is required. Elective cases are booked through the surgeon's office or clinic. It is the responsibility of the surgeon to provide the scheduling information and to ensure it is complete and accurate. All elective surgical cases are scheduled into the hospital HIS Cerner/Surginet no later than 1600 the working day prior to the date of surgery.					
<i>ADD-ON</i>					
2. Add-on Case Scheduling The OR Schedule is officially closed at 1600 on the last working day before surgery. Cases booked after the schedule is closed/published will be considered "add-on cases" and are to be called into the Main Desk. Add-on cases are classified <u>urgent or emergent/emergency cases</u> . These cases may be included in the next day's O.R. schedule at the discretion of and in an order determined by the Anesthesia of the Day (ADD) and OR charge nurse. Disagreement regarding the urgency of an "add-on" <u>will be resolved between the surgeon(s) involved and the ADD, with referral to the Chief of that Service and Perioperative Director, if required.</u>					
Level IV - No significant morbidity or mortality will result from delay of surgery of at least 24 hours but no more than 48 hours.					
Emergent/Emergency					
Level I (emergency) - Life threatening emergencies requiring immediate operative intervention; 20 minutes to the OR / IR; puncture or cut within 30 minutes Level II (emergent) - Surgical intervention required within 2-4 hours of scheduling Level III (urgent) - Surgical intervention required within 4-24 hours of scheduling where significant morbidity may result from delay of surgery greater than 24 hours					

Appendix F

Proposed Policy Neurosurgical Services

POLICY

To ensure adequate allocation and governance of available operating room block time within Perioperative Services.

II. PURPOSE

To define and govern standard surgical block scheduling practices, block time, and open time allocation, and manage OR utilization to ensure a fair, flexible, and efficient system for increasing and maintaining capacity for surgical practices.

III. DEFINITIONS

- A. **Add-On Case** - A case that is scheduled after the close of Operating Room (OR) Scheduling Office business hours on the business day prior to the day of surgery. This case is added to the published schedule. Priority will be to add the case to the service's available block when available.
- B. **Allocated Time** - Hours of OR time allocated services and exclusively reserved for them to schedule patients. This is based on the requesting service's historical case volume and total utilization of elective surgery time with a minimum of 3 months' data preceding the request.
- C. **Block Time** - A scheduling tool allocating a time period on a specific day of the week in a designated OR for a clinical service.
- D. **Cancelled Case** – A case that is cancelled from the published surgical schedule. The reason for cancellation must be furnished and documented in Cerner/Surginet.
- E. **Elective Cases** - Preferred scheduling at least 2 business days prior to the surgery date and in accordance with block release time and availability. Preauthorization is required. Elective cases are booked through the surgeon's office or clinic. It is the responsibility of the surgeon to provide the scheduling information and to ensure that it is complete and accurate. All elective surgical cases are scheduled into the hospital HIS Cerner/SurgiNet. The CPT codes are required by Inpatient Access in order to perform precertification.
- F. **Leveled Emergent, Urgent, Add-on Cases**
 1. **Level I (emergency)**
Life-threatening emergencies requiring immediate operative intervention 20 minutes to the OR/IR; cut within 30 minutes.
 2. **Level II (emergent)**
Surgical intervention required within 2-4 hours of scheduling.

Level III (urgent)

Surgical intervention required within 4-24 hours of scheduling where significant morbidity may result from delay of surgery greater than 24 hours.

3. Level IV (add-on)

Where no significant morbidity or mortality will result from delay of surgery at least 24 hours, but no more than 48 hours.

- G. **Open Time** - Hours of OR time not reserved for any particular service, into which any service or surgeon may be posted.
- H. **Priority Access** - Hours of OR time unfilled or released. If unfilled by those designated services at 0600 on the morning of surgery, the hours are released and become available for assignment by the nursing leader and AOD.
- I. **Release Time** - The predetermined number of hours prior to the posted operative day when allocated time ceases to be exclusively reserved for a particular service or surgeon. This occurs if nothing has been posted into a block. As a result, the time is “released” and becomes available for assignment by the nursing leader and AOD to meet the operative needs of other surgical services. Release times are set for each service based on the nature of the patient population served and on historical utilization patterns.
- J. **Target Block Utilization** - Utilization percentage may impact the future allocation of block needs.

IV. PROCEDURES**K. Block Utilization Management:**

Block utilization is monitored monthly and adjusted quarterly, and/or as the Block Time OR Steering Subcommittee deems necessary.

1. To maintain its assigned block time, a service is expected to maintain an average utilization of 65% for the preceding quarter unless otherwise considered by the Block Time OR Steering Subcommittee for extenuating circumstances.
2. Monthly reports to monitor OR Utilization by block time allocation and outside of block time are reviewed by the OR Steering Committee and Block Time OR Steering Subcommittee. These reports are made available to each surgeon and service with block time.

Note: Block changes must be requested in writing by the surgeon and/or surgeon group to the Block Time OR Steering Subcommittee through the Director of Adult Surgical Services.

a. Daily Management of Block Utilization

Access to Open Time: Any Clinical Service with allocated block time should have already posted at least 80% of its assigned block on the day of surgery before being permitted to schedule cases in the open time on that day.

b. Daily Placement of Add-on Elective Cases

- The nursing leader for the unit (Manager, Assistant Nurse Manager, or Clinical Coordinator) and the Anesthesiologist of the Day (AOD) place add-on elective cases in available open, released, and unused block time based on patient need, surgeon availability, and the order in which the cases were posted in accordance with the level assigned to the case by the surgeon.
- When the surgeon is unavailable for the offered space and time, it is offered to the next add-on case.
- If a service that did not fill its block posts additional cases after its release time, those cases are treated as add-on cases. The nursing leader and the AOD accept those cases in chronological order. Every effort will be made to place those cases in the service's own Blocked rooms at the first available time.

c. Open Room Allocation

- An OR each day will be open to all services for Surgicalist and add-on cases. These are determined by the OR Steering Committee and Block Time OR Steering Subcommittee and built within the block schedule.

d. Release of Blocks – determined by specialty and at the discretion of the OR Steering Committee.

L. When a **“leveled” case** (including those starting prior to 7:00 am) causes another case to be bumped, the order in which bumping occurs is:

1. Same Surgeon;
2. Same Service;
3. Overlapped Surgeons with open rooms, between cases; and
4. Any open room, between cases, during turnover.

Note – The surgeon involved in a case that bumps any other case is expected to contact that surgeon directly to minimize the impact and inconvenience on the patients and surgeons who were delayed.

- M. Documentation regarding Leveled case placement and bumped cases is kept in the Main OR Control Desk on paper and maintained in the HIS Cerner/Surginet.

Case Level	Level Definition	Posting Procedure
<p>Level 1 Emergency (Emergent)</p>	<ul style="list-style-type: none"> • Critical condition, which is an immediate threat to life • To be placed immediately in any unoccupied room • Examples include hemodynamic instability, shock/active bleeding, airway obstruction, intracranial injury, C-Section • The case is expected to arrive imminently and will go directly to the designated room <u>upon arrival.</u> • Must be <u>in the OR in 20 minutes</u> or less from the time of posting the procedure with the <u>goal of incision within 30 minutes.</u> 	<ul style="list-style-type: none"> • The attending surgeon is expected to arrive in the OR with the patient and actively participate in the procedure from the start until the clinical situation has been stabilized. • The attending surgeon is expected to notify the NURSING LEADER/AOD personally of any Level 1 case and confirm the operation to be done, with an exception for any situation where the attending surgeon is unable to do so because he is actively involved in resuscitating the patient. • The surgeon notifies the surgeon whose case is being bumped by a Leveled case unless the surgeon is actively resuscitating the patient, at which time the AOD will assume the communication responsibility. • The NURSING LEADER/AOD

<p>Level 2 Emergency (Urgent)</p>	<ul style="list-style-type: none"> • The attending surgeon believes that the patient's condition will deteriorate significantly if the procedure is not done urgently. • The case should start as soon as possible within <u>2-4 hours</u> from posted time. • <i>The patient will be sent for immediately.</i> • The case will be placed preferentially in the room of same surgeon or service. 	<ul style="list-style-type: none"> • The attending surgeon is expected to notify the NURSING LEADER/AOD personally of any Level 2 case and confirm the operation to be done. • The Attending Surgeon must speak with the AOD directly to assure communication about the patient's needs and the surgical plan. • The surgeon posting Level 2 emergencies is also expected to inform the affected surgeon(s) of any cases being bumped. • When there is multiple case change emergency case, the NURSING LEADER/AOD and AOD should help facilitate communication to the various attending surgeons whose cases have been changed.
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	<ul style="list-style-type: none"> • The nature of condition is time sensitive but not emergent and permits delay of surgery <u>4 up to 24 hours.</u> • Examples include acute appendicitis, acute cholecystitis, and drainage of abscess. • The patient will be sent for well in advance of 4 hours and may be sent for immediately if an open room is available at the time the case is posted. • Case to go preferentially in room of same surgeon/service. 	<ul style="list-style-type: none"> • The attending surgeon of the Service posting the Level 3 emergency must inform the surgeon of any case being bumped.
Administrative Leveled Case	<ul style="list-style-type: none"> • Cases that are time sensitive, independent of surgical urgency will be prioritized by a member of the Block Time OR Steering Subcommittee at the request of the attending surgeon. 	<ul style="list-style-type: none"> • The case will be posted based on the Level designated by a representative of the Block Time OR Steering Subcommittee. • The Level assignment will be communicated to the AOD and the NURSING LEADER/AOD by the representative from the Block Time OR Steering Subcommittee.
Level Upgrades	<ul style="list-style-type: none"> • A change in the level of a previously posted case. 	<ul style="list-style-type: none"> • The attending surgeon from the service initiating the level upgrade must inform the surgeon being bumped of the change in patient status. • Upgrades to Level 2 or Level 1 require a call from the attending surgeon to the NURSING LEADER/AOD and the

This policy/procedure is only intended to serve as a general guideline to assist staff in the delivery of patient care; it does not create standard(s) of care or standard(s) of practice. The final

decision(s) as to patient management shall be based on the professional judgment of the health care provider(s) involved with the patient, taking into account the circumstances at that time.

Any references are to sources, some parts of which were reviewed in connection with formulation of the policy/procedure. The references are not adopted in whole or in part by the hospital(s).

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Appendix G

Project Budget

Classification of Surgical Case Descriptions **Project Budget**
for Surgical Scheduling Improvement in Neurosurgery

INCOME		Budget	Actual	Difference
Internal Funding				
Department Budget		\$174,000,000	\$230,000,000	56,000,000
Other		-	-	-
Total Internal Income		174,000,000	230,000,000	56,000,000
External Funding/Other				
Other		-	-	-
Total External Income		-	-	-
Total INCOME		174,000,000	230,000,000	56,000,000
EXPENSES		Budget	Actual	Difference
Cost of Software		-	-	-
Cost of Software modification		-	-	-
Salary of Informatics RN to modify		200	200	-
Presentations by project owner		4,200	4,200	-
Operational Performance Improvement team		3,500	3,500	-
Training of scheduling staff internal and external		960	960	-
Statistical Analysis		850	850	-
Subtotal		9,710	9,710	-
Total EXPENSES		9,710	9,710	-
NET (Income - Expenses)		173,990,290	229,990,290	(56,000,000)

Appendix H

Cerner® Surginet Intervention Implementation

*Classification:

OR-Elective
Add-On
ASAP/NOW
Early AM
OR-Elective
OR-Emergency Level 1 (20-30 mins)
OR-Emergent Level 2 (2-4 hrs)
OR-Urgent Level 3 (4-24 hrs)
OR-AddOn Level 4 (next day/routine)
Pre-op
Routine
Soon
Stat
Timed Study