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# Optimizing Operating Room Throughput

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# Optimizing Operating Room Throughput

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# Abstract

**Practice Problem**

Throughput is an instrumental aspect for hospitals to maximize patient capacity; therefore, methods to improve patient flow should be consistently implemented. Surgical areas are a major contributor to inpatient admissions and the subsequent revenue; however, without the appropriate oversight, patient throughput can be negatively impacted.

**PICOT**

The PICOT question that guided this project was: In operating room patients who require inpatient admission (P), how does the implementation of a standardized bed flow process (I), compared to the current methods for care transitions (C), reduce perioperative delays and improve hospital financial metrics (O), over a three-month period (T)?

**Evidence**

A review of the evidence revealed that streamlining operating room throughput was essential to the quality of clinical care and patient safety as well as to improve efficiencies associated with patient volumes, lengths of stay and hospital census.

**Intervention**

A dedicated bed flow manager was implemented in the project setting with the overall goal to enhance throughput measures within the operating room.

**Outcome**

While the intervention did not achieve statistical significance as determined by the data analysis, the results did demonstrate clinical significance as the organization was able to maximize capacity and throughput during the Covid-19 pandemic.

**Conclusion**

The addition of a dedicated surgical bed flow manager was beneficial to the optimization, standardization and systemization of the perioperative throughput process.

## Optimizing Operating Room Throughput

Leaders and healthcare professionals across the world must continually navigate the challenges associated with improving efficiencies within operating rooms (ORs) and recovery areas. Highly coordinated workflows are integral to achieve positive patient outcomes and to maintain the financial sustainability of healthcare organizations. Increasing operating room utilization and functionality requires implementation of a process that accurately tracks patients through each phase of the operative process and that facilitates interdepartmental collaboration.

## Significance of the Practice Problem

ORs are essential for most healthcare organizations because surgical staff offer a variety of services to meet the needs of diverse patient populations. Maintaining availability and capacity within these surgical areas drives increased patient volumes as well as hospital profitability. Rothstein and Raval (2018) described operating rooms as the financial hub of hospitals. ORs are significant financial drivers for hospital systems, as surgical care represents approximately one third of healthcare spending (Lee et al., 2019).

Successful identification of operational challenges can serve as a catalyst to improve OR throughput. Both barriers and opportunities exist in scheduling and in patient care transitions. Cox Bauer et al. (2016) found: (1) delays in patient arrivals and departures, (2) first cases of the day not starting on time, and (3) tardy providers. They noted that each of these could increase the cost of healthcare and therefore decrease profit margins for healthcare systems. Cox Bauer et al. (2016) estimated a 500k annual loss caused by these inefficiencies, not including individual physician fees. Somlo et al. (2018) described how maximizing efficiencies improved healthcare quality, reduced organizational costs and increased the overall capacity for additional procedures.

Comprehensive recognition of and planning to overcome each of these obstacles can facilitate higher utilization of OR services, which will improve patient outcomes and overall institutional profitability. High quality clinical care and patient safety should be the top priorities for healthcare providers, especially those who manage surgical suites, as decreased throughput has been shown to detrimentally impact patients as well as to increase their hospital length of stay (Nelson et al., 2020). Pascual et al. (2014) revealed that improper or delayed admission placement of acute surgical patients increased their safety risks during their hospital stay. Similarly, Bing-Hua (2014) indicated that “prolonged waiting” in post anesthesia care units (PACU), which he defined as greater than six hours, was associated with higher mortality in postoperative patients.

Healthcare professionals must seek innovative ideas to adapt to the continual changes of the healthcare landscape in order to achieve departmental and organizational success. Morris et al. (2018), described how surgical leaders must prioritize the optimization of access, safety, efficiency, and throughput. The surgical admission volume is rapidly expanding and currently accounts for 22% of the 36 million US hospitalizations each year (Amir et al., 2017). Robust plans should be reviewed and enacted to meet the growing needs of the surgical patient population. The creation of a process that manages the complex throughput challenges of each stage in the perioperative period could facilitate patient progression and access to care, which would improve patient outcomes and increased patient satisfaction.

## PICOT Question

The processes for procedure scheduling and care transitions for operating room patients should be maximized to improve hospital throughput, especially for patients who require inpatient admission as they commonly experience avoidable delays. Decreasing these inefficiencies and addressing pertinent barriers may translate to positive patient outcomes and greater financial gains for healthcare institutions. Therefore, the following PICOT question guided this evidence-based project. In operating room patients who require inpatient admission (P), how does the implementation of a standardized bed flow process (I), compared to the current methods for care transitions (C), reduce perioperative delays and improve hospital financial metrics (O), over a three-month period (T)?

## Evidence-Based Practice Framework and Change Theory

The inclusion of a quality improvement framework and a proven change theory can assist in outlining the key steps in a process change. Therefore, the continuous quality improvement strategy of the Plan, Do, Study, Act (PDSA) approach and the well-known model of Lewin's change theory were utilized as guiding principles. Continuous quality improvement (CQI) efforts are necessary to improve clinical quality and patient safety. They are also instrumental in increasing system efficiencies, workflows and operational capacity within healthcare organizations (McFadden et al., 2015). Similarly, the utilization of theoretical frameworks can drive effective change and assist in the identification of the best approaches or tools for research (Grol, et al., 2007).

The PDSA model is a cyclic process based on scientific methodology that guides quality improvement and change management strategies (Leis & Shojania, 2017). Donnelly and Kirk (2015) defined the four unique phases within the cycle: (1) plan by setting objectives, (2) do or implement the initiative, (3) study and evaluate the data, and (4) act to ensure that improvements are achieved. This model was applicable in an effort to build a process that standardized OR throughput, as the PDSA model is commonly used for projects that must be implemented in real-time work settings (Health and Human Services, 2011). The initial phase of planning was to set clear objectives surrounding improvement of perioperative throughput. Next, the “Do” phase encompassed the implementation of strategies, such as a standardized bed flow process, to meet the outlined objectives. Third, the “Study” phase included collecting and analyzing perioperative data. Examples included quantifying procedure delays, admission boarding times, and discharge rates within PACU. Finally, the “Act” stage was used to verify that the goals and objectives were achieved.

Kurt Lewin’s change theory consists of three distinct phases; each providing the change management structure required for the alterations that occurred as a result of realigning OR operations. Lewin's model of unfreezing, changing and refreezing is widely accepted as a change management strategy and has proven successful in a variety of industries, including healthcare (Cummings et al., 2016). The unfreezing phase occurred at the beginning of the project. This phase consisted of the actions or behaviors that had to be unlearned in order to embrace the next phase of change (Burns, 2004). The next phase, changing, occurred when the project was implemented and the new process began: such as the standardized bed flow management program. The last phase, refreezing, occurred following the transition and was signified by the stabilization of groups when new behaviors were relatively safe from regression (Sarayreh et al., 2013).

## Evidence Search Strategy

A search of relevant literature was conducted to thoroughly address the PICOT question and project plan. First, electronic databases were searched including Cumulative Index to Nursing and Allied Health Literature (CINHL) Complete, Education Resources Information Center (ERIC) and Medline. The following keywords and phrases were incorporated: (1) operating room capacity; (2) patient flow or throughput; and (3) patient outcomes OR quality of care OR health outcomes. Results of the search yielded greater than 100 articles. Therefore, several filters, inclusion criteria and exclusion criteria were then applied via the advanced search option to narrow the results. These included articles that were peer reviewed, from academic journals, written in the English language, and published between the years 2010-2020. Major headings consisted of “operating rooms,” “quality improvement,” “academic medical centers,” and “efficiency and organization”. Articles were not limited to full text only as an attempt to reduce bias in the results. Also, each subcategory such as geographical area, ages, gender and page length was selected to include all pertinent documents. Lastly, filters were placed to apply related terms as well as to search within the full text of the article in order to capture applicable literature.

## Evidence Search Results

The electronic search of three major databases using related key words resulted in 23 articles. After articles were excluded to remove duplicates, they were reviewed for applicability to the PICOT question. Eleven articles remained. These were subsequently graded for level as well as quality. Visual details summarizing the search are also displayed within Figure 1 (a PRISMA diagram). The literature search yielded both qualitative and quantitative articles that addressed the PICOT question.

The final evaluation resulted in 11 applicable articles surrounding the premise of the PICOT as well as the project plan of optimizing OR throughput through the establishment of a standardized bed flow process. The literature review and grading process was shown in Appendix A, an evidence table, utilizing the Strength of Recommendation Taxonomy (SORT) tool. The SORT tool “addresses the quality, quantity, and consistency of evidence” (Ebell et al., 2004, p.550). It was highly beneficial in categorizing not only the level and strength of the evidence, but also in determining which articles best reinforced the intended change.

The strength and level of evidence was determined through a patient centered framework (Ebell et al., 2004). The strength of the evidence was defined through grades: A, B, or C. Strength A is optimal; providing consistent and good-quality patient-oriented evidence (Ebell et al., 2004). Strength B has limited quality and C is often based on consensus or opinion (Ebell et al., 2004). During the review process, articles receiving an A or B were prioritized as substantial evidence because they provided the greatest amount of specific information to answer the overall project question and therefore support development of an effective solution. The quality of each individual study was also measured in levels one through three. Level one studies demonstrated good quality and were patient centered; Level two had limited quality, and Level three was the lowest level of evidence (Ebell et al., 2004).

Synthesized themes were established upon completion of the evidence search, review, and grading process and were subsequently illustrated in the evidence table (Appendix A). Furthermore, the literature utilized to gather themes was founded upon patient centered evidence: 10 out of the 11 selected articles received a Level two rating and one study by Schwarz et al., (2011) received a Level one. Additionally, greater than half of the articles (eight out of 11) scored strength grades of B, while the other three articles, Abir, et al., (2013), Knarr & MacArthur (2012) as well as Madni et al. (2019) received a C.

## Themes from the Evidence

Drawing themes from suitable literature was instrumental in substantiating a solid body of evidence to guide the underpinnings of the proposed project and to serve as a catalyst for successful implementation. In each of the 11 articles, improvement of OR throughput was the primary goal which was further demonstrated through research-based evidence and best practice recommendations. However, the individual focus, method and outlook of the many articles varied slightly. They all supported the efforts to identify a comprehensive process, or portions of a process, to optimize throughput within operative areas.

Choosing an environment that is similar to the implementation setting was often important to gauge general feasibility. Articles that surrounded large academic medical centers with similar capacity challenges held particular merit due to their commonality with the project setting. All of the articles within the evidence table fell into this category because they were trying to improve flow, throughput, or access to care for their patients in a setting where OR resources were at a premium. Also, in all of these healthcare facilities, a process was implemented to overcome the associated barriers applicable to their defined locations and populations.

The majority of these studies utilized a pre and post study design approach to accurately measure their applied process and findings. While a few articles (Abir et al., 2013; McKetta et al., 2016; and Ozcan et al., 2017) spoke to their engagement in simulation strategies prior to the initiative, the others applied a traditional implementation design. Every study reported benefit and perceived success, despite their election to pilot with simulation prior.

Each article also discussed the benefits of improving OR throughput, although the researchers concentrated on slightly different outcome measures. Kane et al. (2019) and McKetta et al., (2016) focused on quality healthcare and patient satisfaction, while Jweinat et al., (2013) examined how delays in the OR impacted length of stay and bed capacity for admitted patients. O’Donnell et al., (2017), spoke to the causes for operative delays such as not adhering to first case start times, OR and PACU hold durations, and lack of bed coordination. Costa Jr. et al.

(2015) and Madni et al. (2019) linked these efforts to the financial implications for healthcare organizations as well as costs to individual patients.

On the other hand, Martinez et al. (2018), Ozcan, et al. (2017), Schwarz et al. (2001) proposed solutions to streamline the associated delays through a systematic bed flow process. Similarly, Jweinat et al. (2013), Kane et al. (2019) and Martinez et al. (2018) all supported the use of a centralized process that embraces flow through interventions such as dedicated staff, technology and visual aids to maximize the available OR resources. Lastly, Knarr and MacArthur (2012), discussed the implications of combining each of these topics in their article, which described the overall impact of optimizing throughput via a multifaceted approach based upon an overarching process to proactively manage patient flow.

## Practice Recommendations

Evidence supported the substantial benefits of improving perioperative throughput, including those positively impacting the patients, the staff and the organization (Kane et al., 2019; Madni et al., 2019; Schwarz et al., 2011). However, identifying the foundational practices that would be most helpful to the individual health system was integral to operational success. The themes identified within the literature supported the implementation of a systematic process for perioperative bed management, especially within large medical centers containing substantial surgery programs. The literature also supported the development of a standardized workflow to ensure consistency and accountability among each of the teams.

Patient flow, bed allocation, and surgical schedule coordination were each instrumental aspects of throughput that were carefully considered in order to streamline efficiencies (Jweinat, et al., 2013). Therefore, a dedicated bed flow manager, also called a bed, nursing, or patient flow coordinator, was integral to ensure a balance between each of these elements and to enhance previous surgical flow processes (Hollis & Adame, 2013). Traditionally, these bed flow managers have a background in nursing and often have experience in the specialty that they are orchestrating. Perioperative bed flow managers are primarily responsible for optimizing the OR schedule through the utilization of technology, such as interactive dashboards and visual aids displaying real time data, as well as by the facilitation of open communication with operative and inpatient staff in order to progress patients accurately and timely through each phase of care (Kane et al., 2019; Martinez et al., 2018).

While, the addition of a perioperative bed flow manager was key in maximizing surgical throughput, they also had a significant impact on the entire healthcare facility. These managers, along with many others, were continually working to address hospital capacity challenges and to remove barriers associated with access to care. Therefore, perioperative bed managers were placed in environments, such as command centers or transfer centers, where they can collaborate with other specialty care coordinators in order to promote a systemic approach to bed allocation. Combination of these services offered a proactive approach in not only the oversight of perioperative throughput, but also in the reduction of emergency department inpatient boarding and in the prompt facilitation of transfers from outside hospitals or clinics (Kane et al., 2019).

## Project Setting

While the project primarily impacted the throughput in the operating room setting, it also had implications within the organization’s transfer and communication center. The hospital’s main campus contained a 25-bed preoperative area, 25 operating rooms and 18 post anesthesia recovery bays, which was considered undersized for a facility that performed greater than 1,200 procedures each month. However, the perioperative bed flow manager was physically stationed within the transfer and communications center, which served as the hub of bed placement for the entire health system.

The coordination of surgical patient flow was essential in meeting the mission and vision of the organization. An analysis of the project's strengths, weaknesses, opportunities and threats (SWOT) was completed (see Appendix B) to ensure full applicability. One strength was the organization's overall mission to improve the health of the communities they served, correlated with the project's mission to increase access to care for the surgical population. Initiation of timely surgical care contributed to increased healthcare quality and promoted positive patient outcomes. Similarly, the organization's vision to provide better patient care and better community health at a lower cost also related to the project in a variety of ways. Improving efficiencies within the perioperative areas supported this vision by reducing both patient delays and organizational financial expenditures.

The mission and vision of the project was also contingent on clear, open and concise communication between the entire healthcare team. Interprofessional collaboration was a crucial aspect to this project, especially due to the proximity and location of the key stakeholders. These stakeholders included the patients, clinical staff and leaders from multiple specialties such as surgical, inpatient nursing, human resources and technology services, as well as the perioperative bed flow manager, all of which resided in a variety of locations. Therefore, the utilization of tactics such as routine staff huddles, scheduled calls and visualization of real time dashboards were essential to ensure accurate communication between the teams. This communication was also important in sustaining and progressing the functionality of the bed flow manager following project implementation. Additionally, the bed flow manager had responsibilities related to communication and collaboration with representatives from other admitting areas such as the

Emergency Department and transferring facilities to ensure accuracy related to organizational capacity and bed management.

## Project Overview

### Objectives and Goals

In order to align with the mission, vision and values of the health system, the implementation of this project provided benefit to the surgical patient population as well as to the entire organization through a multifaceted approach. The bed flow manager overseeing the surgical areas followed the bell curve of procedure volumes, Monday-Thursday from 8am-6pm, and had the primary job responsibilities of standardizing and streamlining workflows through care coordination and interprofessional communication. The main project objectives were to increase patient throughput and capacity within the operative areas while also monitoring possible revenue increases related to the improved surgical flow. Project success was determined through pre and post implementation measures inclusive of PACU hold times, the number of patients boarding in PACU, and the total number of cases per day.

These measures were reviewed weekly by the project leader and were collected through the utilization of the electronic patient tracking software (EPTS), a computerized tool utilized to manage organizational capacity and the processes of patient admission, progression and dispositions. Trending of occupied timers was a key function of software, offering real time data streams through dashboard views, which were routinely monitored by the bed flow manager. The EPTS had the ability to generate high level data as well as patient level data due to the patient attribute functionality, this function ensured that the appropriate patients were captured during the various processes of data collection, sorting and analysis. Similarly, accuracy of this data collection process was increasingly achieved through the direct integration between the EPTS and the electronic medical record (EMR). Each of these programs were computerized, timestamped and offered autogenerated reporting capabilities; requiring zero manual entries or calculations upon extrapolation, thereby decreasing the risk of human errors. Next, applicable data was extracted from the EPTS and later converted into an Excel file, which also offered visual indicators in the form of bar graphs for the dissemination presentation. Furthermore, the data within the graphs were displayed by month so that a true comparison to the previous time period could be established.

The short-term goals of the project included efficient implementation, staff buy-in and achievement of desired results. For this to occur, the bed flow manager was successfully hired and oriented to the new role. Next, operative staff were educated on their responsibilities and updated workflows. Third, the bed flow manager was integrated into the transfer center through open communication and familiarity with technology resources. Lastly, the bed flow manager began to direct and monitor operative patient flow within the surgical suite as well as into their inpatient bed assignment through the utilization of the EPTS and the EMR. On the other hand, the long-term goals consisted of the continuation of the bed flow manager position, possibly with extension of coverage and expansion of employees, as well as the sustainability of the throughput gains achieved upon the early implementation period.

**Risks and Unintended Consequences**

There were very few risks and unintended consequences in this project as resources are added to the impacted areas rather than removed or reallocated. However, there was a possibility that even with the addition of a bed flow manager, that the throughput would not improve due to circumstances outside of the scope of the project, thereby increasing the organizational spend rather than improving revenue through the creation of access for surgical patients. Also, there could have been minor issues surrounding alterations in provider workflows and perioperative scheduling preferences as well as discontent among the inpatient units due to surgical patients arriving to their floor earlier in the day than previous postoperative admissions. Therefore, key stakeholders from respective areas were identified and included prior to project initiation in order to promote engagement and advocacy.

## Implementation Plan with Timeline and Budget

It is important to account for each of the specific stages of a substantial project, including the change management elements; therefore, the timeline and budget as well as the change management overview were thoroughly evaluated. As mentioned previously, Kurt Lewin’s change theory was utilized to comprehensively guide the change management strategy for project implementation. Lewin’s time-tested theory described three unique phases of change management inclusive of unfreezing, changing as well as refreezing and is highly effective in the navigation of change for individuals, small groups, or entire organizations (Kaminski, 2011). While Lewin’s theory can be applied in a variety of settings, it was significantly beneficial in the healthcare setting due to aspects such as continual changes within daily operations, evolving clinical practice standards and varying group sizes.

### Unfreeze

Unfreezing is the first phase of Lewin’s theory. During this phase, the impacted individuals, specifically the perioperative employees in this project, had to understand why the change was necessary. Perioperative employees needed to have a comprehensive understanding of why the new position was required as well as how delays and uncoordinated efforts lead to poor outcomes. Understanding of these crucial elements was achieved through staff education and leader rounding, both for employees working in the operative areas as well as those residing in the transfer center. Burns (2004) described how this phase was where previous behaviors and actions were unlearned in order to move forward. Similarly, Kaminski (2011) discussed how leader and stakeholder transparency of the desired change via efforts such as education, team building and brain storming sessions were key elements in progressing the target group through the unfreezing stage.

**Change**

Project implementation occurred within the change phase of Lewin's theory. The bed flow manager began to track, trend and coordinate surgical patient flow through each area in the perioperative process. The full list of the perioperative bed flow manager is outlined in Appendix E; however, the primary objectives were to undertake the assignment of inpatient beds for postoperative patients and subsequently monitor transition times as well as any associated delays. Additionally, patient flow and throughput efforts were continuously monitored via the PDSA model. According to Kaminski (2011), this phase is often considered the most time consuming and costly phase for project leaders; however, it was the most productive stage within the change management process.

**Refreeze**

Refreezing was the final stage in Lewin's theory and ensured that the new process was being upheld correctly. In this stage the new behaviors, processes, and responsibilities became standard and the change was stabilized. The operative staff as well as the transfer center staff, now routinely defer to the surgical bed flow manager for issues surrounding care transitions and patient throughput. In this stage, staff members were held accountable for policy adherence, avoidable delays or lack of pertinent communication; all of which were closely monitored through the measurement of data and the associated outcomes. Similarly, Kaminski (2011), described how this stage was essential in maintaining the desired change, as it was easy for individuals to revert to previous practices; therefore, continued leadership and guidance was required. As an example, weekly meetings to review the workflow and initiate minor adjustments were necessary, such as aligning daily huddles and routine communications with perioperative case volumes.

**Timeline and Budget**

The project timeline spanned over several months, beginning early fiscal year 2021 with an evaluation approximately 90 days post implementation. The detailed project schedule is depicted in Appendix C; however, the prolonged duration was largely contributed to literature and evidence review, identification of stakeholders, approvals, education, process implementation and data analysis. Similarly, the associated budget and specific expenditures are listed within Table 1; however, the primary expense was associated with the salary and benefits of a new position.

**Project Leadership**

Project success was primarily dependent on leadership involvement and their overall accountability. This included components like playing an active role in facilitating interprofessional communication, collaborating with other leaders from a variety of disciplines such as human resources, inpatient nursing, finance and technology services as well as writing staff expectation policies, education plans and workflow guidelines. As the responsible party for this initiative, the project leader not only thoroughly accounted for each element within the timeline and budget plan, but also ensured accurate and timely implementation at all stages of the project. Lastly, proactive sustainability planning was essential to ensure that the project would continue after the project manager departed. Therefore, prior to the official completion of the project, a handoff inclusive of key points, data trends and potential issues was presented to applicable leaders.

## Results

Although they are interrelated, evaluation of the project was determined in two distinct areas, (1) operational impact which was the primary goal and (2) financial impact which was a downstream implication. The operational impact surrounded the ability to reduce delays and increase accountability through the utilization of a bed flow manager. Overall, this measure was primarily determined through a value known to the organization as an occupied timer, or the duration of time that a postsurgical patient is unnecessarily held within the PACU in the presence of clean and ready inpatient bed assignment. A second measure related to the number of patients who boarded in the PACU for greater than the organizationally established threshold of 90 minutes was also incorporated for relevance. In order to extensively establish project results, several aspects were considered including the patient population, data collection strategy, data analysis and the protection of human rights, which are each further described in the sections below.

### Description of Participants

Participants of this study included the dedicated bed flow manager, a variety of indirect clinical and non-clinical staff members who may have been working in the surgical areas or within the transfer and communications center. Additionally, the recipients and target patient population for this project were adult patients, greater than or equal to 18 years of age, who were admitted through the hospital’s surgical services. Pediatric patients as well as same day surgery patients were excluded due their procedures occurring outside of this bed flow. Specific recruitment activities were not required as this patient population was already intact and subsequently scheduled based on medical necessity as well as physician availability. During the three-month implementation period, greater than 1,700 patients were managed through the dedicated position. These patients ranged in their surgical need, acuity level, past medical history, duration of procedure and overall medical complexity; however, they all required inpatient admission post procedure.

**Protection of Human Rights**

Human rights and the privacy of each of the patient's protected health information were top priorities of this project. Therefore, data was collected on an organizationally owned device and encrypted outside of the project manager. Additionally, presentations and visualizations surrounding project results do not contain patient specific information, only monthly trends of high-level operational data. Also, this project obtained approval from the practice setting's Institutional Review Board (IRB) as well as was reviewed by University of St. Augustine for Health Sciences Doctor of Nursing Practice Evidence-Based Practice Review Council (EPRC) and determined to not meet the requirements for research as defined in the Federal Register.

**Data Collection Strategy**

The data collected, both preintervention and postintervention, in this study was performed by the project leader. The project leader was responsible for ensuring that data was accurate, complete and was properly secured. Missing data may have impacted the validity of the project; consequently, any missing data due to system downtime or software updates was reviewed and removed. Historical data ranging from October 1, 2019 to December 31, 2019, due to operative case load seasonality, was collected and reviewed to determine preintervention performance; therefore, postintervention data points (Appendix D) were collected over the same 12-week time period within 2020.

**Data Evaluation**

A pre and post analysis was used to assess the impact of the intervention. In order to compare pre intervention with post implementation data, a retrospective analysis was performed using the average PACU hold times by minute as well as the average number of patients per day, categorized by month, via the EPTS. Prior to project initiation, primary data was gathered from the previous fiscal year period of October 1 through December 31 to determine baseline performance of each measure.

Descriptive statistics containing quantitative data was utilized to communicate mean times surrounding unnecessary PACU holds in minutes, the average number of patient cases per day and the average number of patients boarding greater than 90 minutes within the PACU. Each of these measures were utilized to evaluate the effectiveness of the bed flow manager in the reduction of delays and increased patient flow. Additionally, the comparison of two independent test groups was required to accurately determine success. Specifically, the pre-implementation period without a bed flow manager versus the post intervention implementation period were compared; therefore, an independent *t*-test was utilized via the Intellectus Statistics Software (2021).

## Data Analysis

**Surgical Patients Requiring Admission**

The normality was met through the use of the Shapiro-Wilk test, whereas the assumption of homogeneity of variance was met by a Levene's test. The result of the two-tailed independent samples *t*-test was not significant based on an alpha value of 0.05, $t(4) = 2.24$, $p = .089$, indicating the null hypothesis cannot be rejected (Table 1). Despite no statistical significance, 144 less patients required admission during the same time frame, demonstrating that the project goal was trending in a positive direction.

**Table 1**

*Two-Tailed Independent Samples t-Test for Number of Surgical Patients Requiring Admission Each Month by Intervention Status*

| | Pre-Intervention | | Post Intervention | | | | |
|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *t* | *p* | *d* |
| Surgical Patients Requiring Admission_ | 717.33 | 97.57 | 575.33 | 50.56 | 2.24 | .089 | 1.83 |

*Note.* N = 6. Degrees of Freedom for the *t*-statistic = 4. *d* represents Cohen's *d.*

**PACU Occupied Timer**

The Shapiro-Wilk test indicated that the normality assumption was violated; therefore, a Mann-Whitney two-sample rank-sum test was performed and was subsequently found not to demonstrate statistical significance. However, in the review of pertinent data, the fact that there was not a substantial time difference between the pre intervention (52.67 minutes) and post intervention data (55.17 minutes), actually indicated that normal patient throughput was achieved in PACU during the presence of the pandemic

**Table 2**

*Two-Tailed Independent Samples t-Test for PACU Occupied Timer in Minutes by Intervention Status*

| | Pre-intervention | | Post Intervention | | | | |
|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *t* | *p* | *d* |
| PACU Occupied Timer in Minutes | 52.67 | 1.15 | 55.17 | 2.02 | -1.86 | .136 | 1.52 |

*Note.* N = 6. Degrees of Freedom for the *t*-statistic = 4. *d* represents Cohen's *d.*

**PACU Patient Boarding**

Normality was met via the Shapiro-Wilk test and the assumption of homogeneity of variance was met by a Levene's test. The result of the two-tailed independent samples *t*-test was not significant based on an alpha value of 0.05, $t(4) = 0.19$ and $p = .856$, indicating the null hypothesis cannot be rejected.

**Table 3**

*Two-Tailed Independent Samples t-Test for Patients Boarding Greater Than 90 Minutes in PACU by Intervention Status*

| | Pre-intervention | | Post Intervention | | | | |
|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *t* | *p* | *d* |
| Boarding Greater Than 90 minutes in PACU | 295.33 | 70.51 | 287.00 | 24.25 | 0.19 | .856 | 0.16 |

*Note.* N = 6. Degrees of Freedom for the *t*-statistic = 4. *d* represents Cohen's *d.*

In summary, the comparison of both pre and post data points, determined that there was not a statistical significance as it relates to the number of surgical patients requiring admission, unnecessary PACU hold times, or PACU patient boarding with the addition of the bed flow manager; however, clinical significance was achieved as it related to continuity of clinical operations during a global pandemic.

## Impact

As mentioned above, this project was implemented during the COVID-19 pandemic, which not only influenced the project outcomes, but also significantly impacted the majority of basic healthcare operations, including the ability to maintain surgical procedures. While many facilities were forced to close their surgical suites to elective cases, creating a pronounced decrease in the financial margins, the project setting was able to maintain the scheduling of surgical cases, both emergent and elective, once restrictions were lifted, with the assistance of the bed flow manager. Although the project results did not demonstrate favorable trends of the predetermined data points nor meet the anticipated outcomes, it played a vital role in maintaining surgical patient throughput and creating inpatient bed capacity for post-surgical patients. The project demonstrated clinical significance by contributing to organizational financial viability and most importantly, upholding their mission and values. Additionally, while the statistical significance was not achieved as planned, the ongoing clinical significance of the dedicated role was noted by key stakeholders; aligning with the themes of current evidence. These results further assisted in the development of a sustainability and ongoing evaluation plan as well as the formulation of future recommendations and a comprehensive study conclusion.

**Sustainability and Ongoing Evaluation**

In order for the project to have continued support, a robust plan for sustainability and ongoing evaluation was essential. For sustainability purposes, general employee management has transitioned to the organization's transfer and communication center, which currently employs similar positions. Also, specific job responsibilities, which were created by the project leader, have been complied and listed within Appendix E as well as provided to the direct supervisor, for future leadership reference. Additionally, for consistency among employees, daily oversight and accountability is now assigned to the center's charge nurse. Ongoing evaluation and alterations will also be conducted by the management team within the transfer and communications center, while continually seeking input and constructive feedback from the surgical leadership team.

**Future Recommendations and Limitations**

Insight gained from ongoing evaluations will be utilized to make future recommendations for the project. Recommendations such as the expansion of coverage hours for the current surgical department as well as the replication of services into other specialty areas or surgical suites within the healthcare organization should each be considered with the further progression of positive results. There are very few limitations to this project; however, the pandemic implication is likely the most noteworthy. The COVID-19 pandemic placed severe constraints on patient throughput due to hospital capacity and restricted resources, contributing to prolonged lengths of stay and deviation from historical operational functionality. Also, there should be a consideration for the financial burden of the project, although it was minimal. While there no costs associated with many aspects of the project, there are ongoing expenses that should be routinely appraised. Labor costs as well as fees surrounding the upkeep and maintenance of the technology requirements are each a reoccurring expense that could be viewed as limitations and subsequently restrict the ongoing success and sustainability of the project.

## Plans for Dissemination

Upon project completion, dissemination of results was communicated to the practicum preceptor as well as other target audiences. First, the preceptor received an electronic presentation, that outlined key elements of the intervention as well as historical data compared to postimplementation data. This presentation also included the results of the project as well as discussion surrounding sustainability measures and future recommendations. Next, the presentation was provided to many of the key stakeholders as well as escalated through organizational leadership. A brief version of the presentation was presented at the monthly leadership meeting for the transfer and communication center, as this department is responsible for system wide direction pertaining to patient throughput policies as well as is the reviewing body for all large-scale operational process changes. Additionally, project results were shared with system regional leaders to deem applicability for replication within their facilities.

This paper may be submitted to several different journals in hopes to assist other professionals who are seeking improvements to hospital throughput and patient flow. Journals considered for submission include the Association of periOperative Registered Nurses (AORN) and the Journal of PeriAnesthesia Nursing, both of which are specific to surgical care. However, the Journal of Nursing Administration (JONA), which is appealing to healthcare leaders, the target audience of this study, would take priority for submission. Also, to assist in the peer review process prior to submission, the project preceptor as well as a representative from the facilities' research council will be given a copy for intensive edits.

## Conclusion

Hospital throughput and capacity management are key aspects in improving patient safety as well as the overall quality of healthcare. Surgical admissions are a substantial contributor to the hospital census; therefore, perioperative throughput initiatives should be methodically considered, researched and implemented. The addition of a dedicated surgical bed flow manager, who was embedded within the organizational transfer center, standardized and streamlined the perioperative bed flow process as well as improved interdepartmental communication. While effective project implementation was not demonstrated by a decrease in the PACU hold times nor by an increase in operative procedures per day, it did demonstrate clinical significance during the COVID-19 pandemic.

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Table 1

*Budget*

| **EXPENSES** | | **REVENUE** | |
|---|---|---|---|
| Direct | | Expense reduction: Decrease in nursing salary dollars associated overnight PACU holds | 0.00 |
| Salary and benefits | $85,000.00 | Profit: Reduction of delays and subsequent increased cases per day. | 0.00 |
| Supplies | $3,500.00 | Institutional budget support | 0.00 |
| Services | 0.00 | Grants | 0.00 |
| | | | |
| | | | |
| | | | |
| Indirect | | | |
| Overhead | 0.00 | | |
| | | | |
| Total Expenses | $88,500.00 | Total Revenue | 0.00 |
| Net Balance | | | |

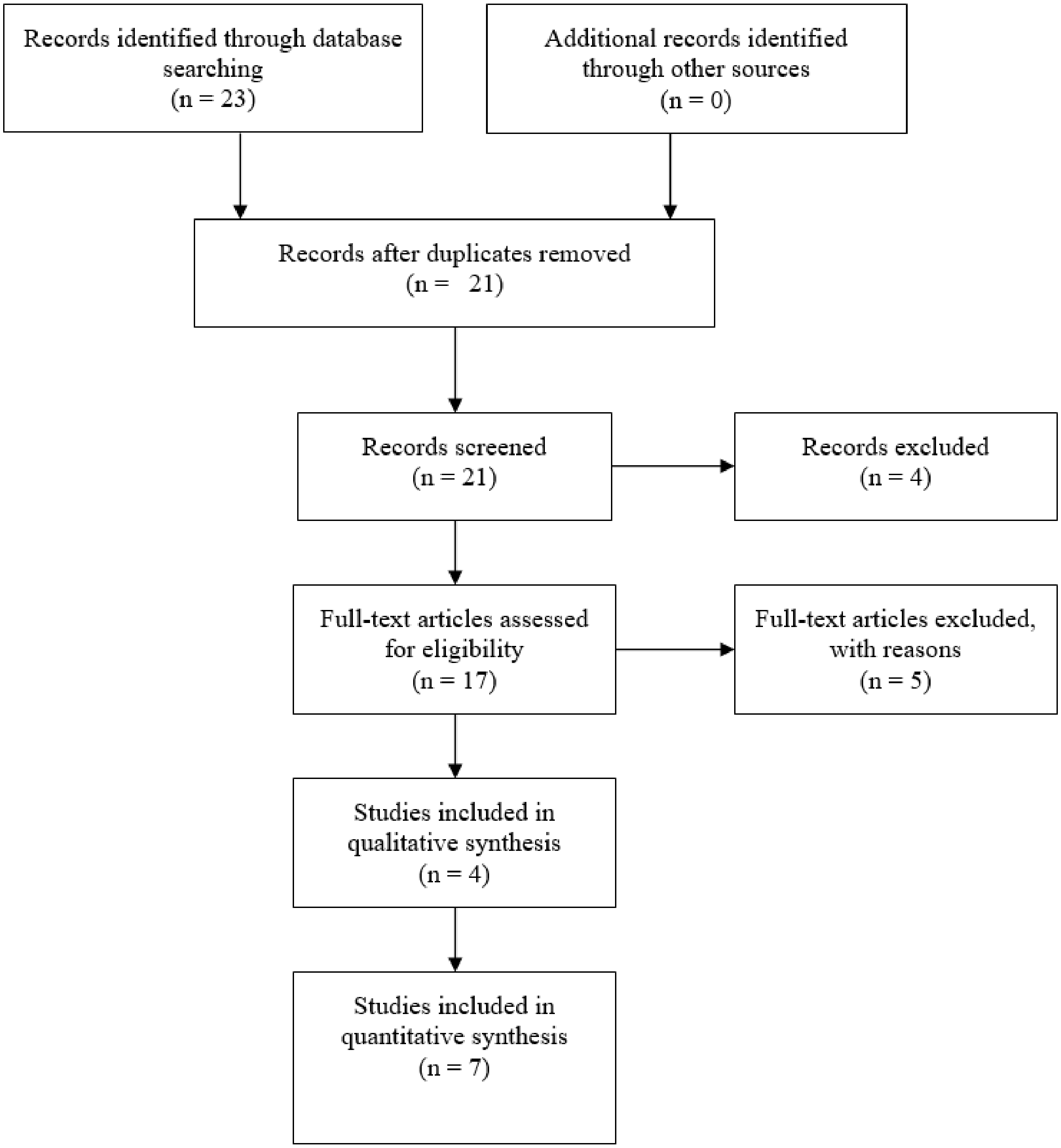


*Figure 1*

PRISMA Diagram

Appendix A

Summary of Primary Research Evidence

| **Citation** | **Design, Level**<br><br>**Quality Grade** | **Sample**<br><br>**Sample size** | **Intervention**<br><br>**Comparison** | **Outcome Definition** | **Usefulness Results Key Findings** |
|---|---|---|---|---|---|
| Abir, M., Davis, M. M., Sankar, P., Wong, A. C., & Wang, S. C. (2013). Design of a model to predict surge capacity bottlenecks for burn mass casualties at a large academic medical center. *Prehospital and Disaster Medicine*, *28*(1), 23-32. https://doi.org/10.1017/S1049023X12001513 | Cross-sectional study 2 C | Simulation containing 100 patients | This study is pertinent to large academic medical centers who have significant capacity constraints on a consistent basis. Therefore, the researchers were able to predict how they would handle significant patient surges through the utilization of a simulation software called Pro Model. This model serves as a proactive approach via predictive analysis methodology to determine patient flow as well as the anticipated healthcare resource use as compared to the current reactive approach of daily data collection. | This study analyzes the influence of institutional resources, space, and staffing capacity to coordinate care for a large volume of patients as well as subsequently provides identification of processes that should be created to manage areas of greatest opportunities. | Simulation was utilized to measure and manage potential capacity constrains due to large influxes of patient requirement medical as well as surgical intervention. Delays were studied and attributions for delays were identified through the simulation model. The key drivers of delays were recognized as physical beds, certain medications and blood products; not operating rooms capacity or staffing as first ideated. |

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|---|---|---|---|---|---|
| Costa Jr, A. D. S., Leao, L. E. V., Novais, M. A. P. D., & Zucchi, P. (2015). An assessment of the quality indicators of operative and non-operative times in a public university hospital. *Health Economics and Management. 13*(4), 594-599. https://dx.doi.org/10.1590/S1679-45082015GS3289 | A descriptive cross-sectional study 2 B | 8,420 operations occurring from January 2011 to January 2012. The operations performed in the same operating room, between 7:00 am and 5:00 pm Monday – Friday, excluding holidays. | Data collection and research surrounds OR phases of care and durations of procedures as well as idle times compared to literature and standard of other like medical centers. | Delays frequently occurred in the operating room and had a significant impact on patient flow and resource utilization.<br><br>Determination of the time indicators of the operating room is essential in improving efficiency. | Idle operating rooms come at a high cost due to the waste of available resources. In the United States, the average cost for a surgical procedure is estimated at $900.00 to $1,200.00 per hour. Additionally, the idle time of an empty OR has substantial financial impact; each minute wasted can vary from $60.00 to $100.00.<br><br>The logistics of the perioperative and admission periods as well as the coordination of care among the interdisciplinary teams are needed to support a high functioning OR. |
| Jweinat, J., Damore, P., Morris, V., D'Aquila, R., Bacon, S., & Balcezak, T. J. (2013). The safe patient flow initiative: A collaborative quality improvement journey at Yale-New Haven Hospital. *The Joint Commission Journal on Quality and Patient Safety, 39*(10), 447-459. https://doi.org/10.1016/S1553-7250(13)39058-8 | Pre/post study design 2 B | Organizational wide throughput and quality process implemented from October 2008 to September 2009 (one fiscal year) | The implementation of the utilization of a bed management process combined with an organizational wide method to standardizing the discharge process, use status boards for visual control, and to improving accuracy and timeliness of data entry compared to the absence of a defined process to measure patient flow and efficiency. | Improvements were noted in clinical, operational, and financial outcomes by embracing five key components of demand capacity management: real-time communication, inter/intradepartmental and interdisciplinary collaboration, staff empowerment, standardization of best practices, and institutional memory. | Between FY 2008 and FY 2011, the site experienced an 84% improvement in discharges by 11:00 am, average length of stay decreased from 5.23 to 5.05 days, thereby accommodating an additional 45 inpatients on a daily basis which contributed to a positive operating margin. |
| Kane, E. M., Scheulen, J. J., Püttgen, A., Martinez, D., Levin, S., Bush, B. A., ... & | Pre/post study | 1,131 bed tertiary care | The creation and implementation of a | The command center and bed process | OR exit holds, in which patients are unable to move |

| | | | | | |
|---|---|---|---|---|---|
| Efron, D. T. (2019). Use of systems engineering to design a hospital command center. *The Joint Commission Journal on Quality and Patient Safety, 45*(5), 370-379. https://doi.org/10.1016/j.jcjq.2018.11.006 | design using a systems engineeri ng approach 2 B | center in Baltimore, MD with greater than 65k annual ED visits and 48k annual inpatient admissions. | Capacity Command Center which provides global oversight as opposed to the prior practice of a singular bed flow process. | focuses on three primary goals: (1) reducing emergency department boarding, (2) eliminating operating room holds, and (3) facilitating transfers in from outside facilities, which were all successfully achieved post implementation as demonstrated through a capacity increase of 13-15 additional beds daily. | from the OR to the PACU or the ICU due to capacity constraints, are associated with worse patient outcomes, increased mortality and avoidable expenses. |
| Knarr, L. L., & MacArthur, B. G. (2012). An admission unit: A vital link to patient flow. *Nurse Leader*, *10*(3), 45-48. https://doi.org/10.1016/j.mnl.2012.03.003 | Pre/post study design 2 C | A 770-bed, nonprofit, acute care facility. | The implementation of a new admissions unit as well as a technology solution to expedite the flow of patients within the healthcare facility as compared to the previous system of patient placement. | The hospital's addition of an automated patient tracking tool that allows for house-wide visualization of the patient admits, transfers, and discharges within all nursing units has shown benefit to allocate resources as well as to place the necessary patients in the new admission unit. | Systematically improving patient flow can include increased access to care, shorter wait times, lower costs, and improved outcomes<br><br>Proactively managing the flow of patients is essential to prevent overcrowding, which enhances timeliness of care and patient safety. |
| Madni, T. D., Nakonezny, P. A., Imran, J. B., Barrios, E., Rizk, P., Clark, A. T., ... & Phelan, H. A. (2019). Prospective analysis of operating room and discharge delays in a burn center. *Journal of Burn Care & Research, 40*(3), 281-286. http://dx.doi.org/10.1093/jbcr/irz015 | A prospecti ve cross-sectional study 2 C | 1633 patients who were admitted as an inpatient following an operative procedure | Identification and quantification of perioperative delays in order to justify resources as well as to accurately measure the financial implications | The approximate costs for operating room delays ranged between $1,000,000 and $5,000,000 over the study period. | Delays in the operating room lead to longer lengths of stay for operative patients and increased healthcare costs. |

| | | | | | |
|---|---|---|---|---|---|
| | | over a two-year period (2014-2016). | associated with inefficient patient throughput | | |
| Martinez, D. A., Kane, E. M., Jalalpour, M., Scheulen, J., Rupani, H., Toteja, R., ... & Levin, S. R. (2018). An electronic dashboard to monitor patient flow at the Johns Hopkins Hospital: Communication of key performance indicators using the Donabedian model. *Journal of Medical Systems, 42*(8), 133. https://doi.org/10.1007/s10916-018-0988-4 | Pre/post study design 2 B | Johns Hopkins Hospital, a tertiary care center. Organizational wide implementation - 2017 study period | Operating room exit delays are linked with worse patient outcomes and avoidable expenses. Therefore, by implementing a dashboard to assist with the identification of patient flow delays and throughput key performance indicators, additional hospital bed capacity could be achieved. | Implementation of the dashboard initiative resulted in reducing delays for patients leaving the operating room by 20%. | Dashboards leverage on visual information to support decision-making in multiple clinical contexts, and they have been found helpful to increase adherence to clinical guidelines and thus improved outcomes |
| McKetta, D., Day, T. E., Jones, V., Perri, A., & Nicolson, S. C. (2016). Managing disruptions to patient flow capacity: Rapid-cycle improvement in a pediatric cardiac procedure complex. *The Joint Commission Journal on Quality and Patient Safety*, *42*(7), 321-324. https://doi.org/10.1016/S1553-7250(16)42044-1 | Pre/post study design 2 B | Cardiac Operative and Imaging Complex Hybrid Suite, which can function as an operating room, catheterization laboratory, or both, for a single patient encounter. The center is operational five days per week. | Following the simulation surrounding patient flow, interventions to improve throughout and bed capacity were implemented based on the simulation feedback. Additionally, data was collected to accurately identify how they would maintain continuity of care if significant disruptions occurred (room closures, surge of patients, etc..). Pre simulation OR data was compared to the | Utilization of a simulation program to determine barriers to OR throughput and maximum functionality. Optimal patient throughput was achieved without increasing staff or using increased overtime. The organization was able to meet all patient demand, despite reduced throughput capacity (planned disruptions through simulation). | Beginning the first OR case 45 minutes earlier and reducing turnaround time between cases is important to achieve full efficiency.<br><br>Performing procedures when they are scheduled is a safety and quality issue for patients. Delays in performing procedures on time has been identified as a significant driver of patient dissatisfaction. |

| | | | | | |
|---|---|---|---|---|---|
| | | | post simulation feedback period. | | |
| O'Donnell, B., Walsh, K., Murphy, A., McElroy, B., Iohom, G., & Shorten, G. D. (2017). An evaluation of operating room throughput in a stand-alone soft-tissue trauma operating theatre. *Romanian Journal of Anesthesia and Intensive Care*, *24*(1), 13. https://doi.org/10.21454/rjaic.7518.241.wal | Prospective pre/post study design 2 B | 800 bed tertiary referral academic medical center. 58-day study period | Data was collected to determine causes of non-operative time and miscellaneous delays within the OR. Processes determined by the data collection would then be implemented to increase OR throughput and minimize delays. | The primary objective of this study was to increase the operating room throughput by one additional surgical case per standard working day (9 hours). Additional attending anesthesiologist coverage did not impact non-operative time and to achieve improvement in the primary outcome measure additional nursing/physician support staff is required. However, improvements were seen in secondary outcome measures such as the duration of recovery room stay and the ability to bypass the recovery room. To achieve improvement in the primary outcome measure additional nursing/physician support staff is required. | On average two hours of operating room time were lost per day due to avoidable delays, mostly case cancellations. |
| Ozcan, Y. A., Tanfani, E., & Testi, A. (2017). Improving the performance of surgery-based clinical pathways: A simulation-optimization approach. *Health* | Retrospective Case Study | Data was retrospectively for 1 year (January 1 | Utilization of simulation to determine true OR capability by | Simulation analysis indicated that the current system performance was not | Simulation found that increasing both the number of surgical patients and the bed utilization rate by adding |

| | | | | | |
|---|---|---|---|---|---|
| *Care Management Science, 20*(1), 1-15. https://doi.org/10.1007/s10729-016-9371-5 | 2 B | to December 31, 2010) in the Department of Surgery of a public hospital located in Genoa, Italy. | answering the following questions: How many resources (beds and operating room blocks) should be assigned to different groups of patients to create optimal value? What is the optimal mix of such resources?<br><br>Implementation of a decision support tool based on the simulation results as compared to previous operative performance. | satisfactory and had to be improved from both a patient and provider perspective. Two main issues were identified as areas for opportunity: the low rate of bed utilization and procedures not starting on time or taking greater than their allotted operative time. | three additional OR blocks and one additional inpatient bed should optimize capability. |
| Schwarz, P., Pannes, K. D., Nathan, M., Reimer, H. J., Kleespies, A., Kuhn, N., ... & Zugel, N. P. (2011). Lean processes for optimizing OR capacity utilization: prospective analysis before and after implementation of value stream mapping (VSM). Langenbeck's Archives of Surgery, 396(7), 1047. https://doi.org/10.1007/s00423-011-0833-4 | Prospective pre/post study design<br>1 B | Centre Hospitalier Emil Mayrisch Clinic – 618 bed facility in Luxembourg | Development of a concept for a flexible and patient-orientated OR capacity utilization process. | Efficient OR capacity utilization and the optimized use of human resources allowed an additional 1,820 procedures to be carried out per year without any increase in human resources.<br><br>Using a team-orientated specialized OR throughput/bed flow process increased the quality and operational organization and led to an improvement in patient safety | Increased capacity can be used to optimize patient monitoring, improving safety and quality, and additional operations as well as contributes to patient satisfaction.<br><br>In order to increase staff motivation in the hospital and increase the efficiency of the OR teams, all relevant staff members were involved in the development of the process.<br><br>Making the first incision on time, sequence stability, reduction of change times and transfer times increase the utilization of available |

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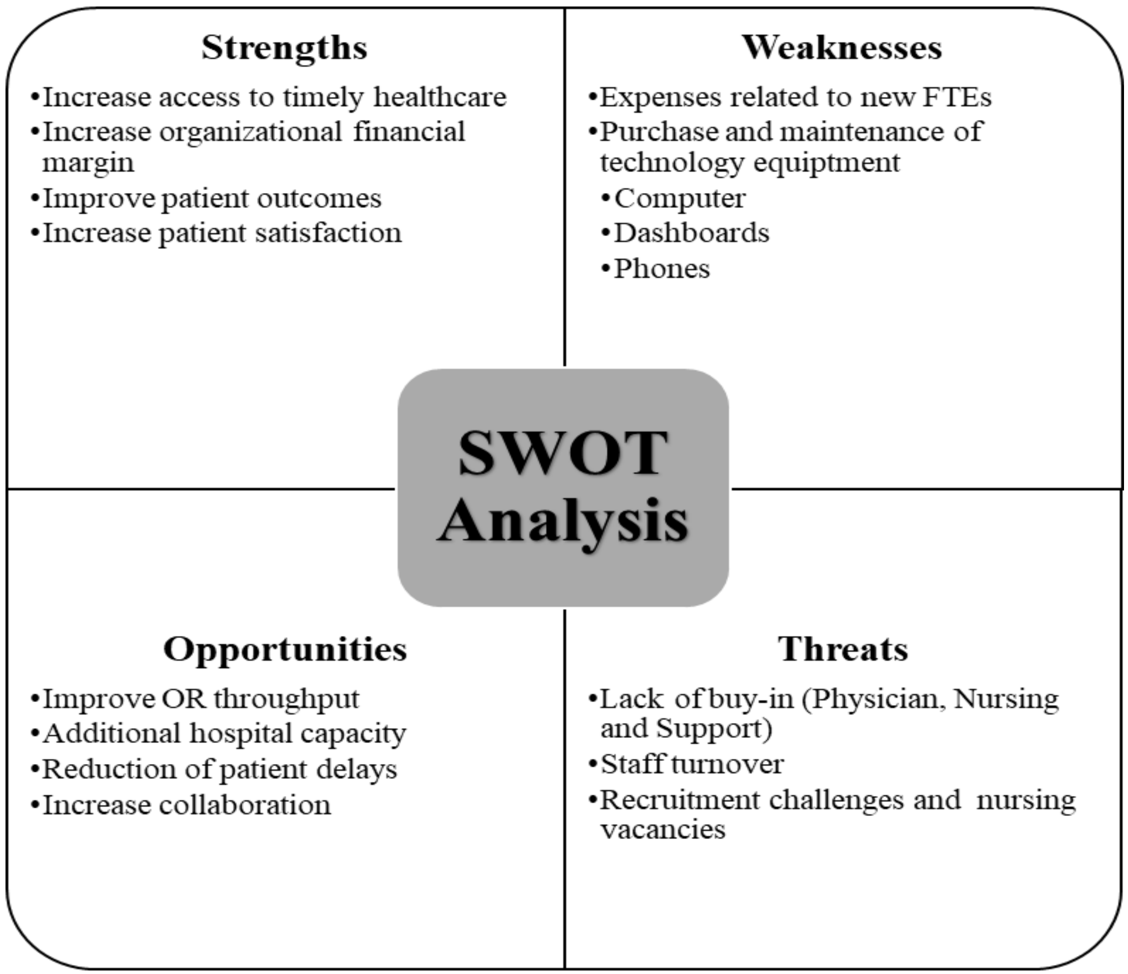
| | | | | | OR capacity. This requires close synchronization between all staff. |

Appendix B

SWOT Analysis



# Appendix C

## Project Schedule

| | NUR7801 | | | | | | | | NUR7802 | | | | | | | | NUR7803 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Activity | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 |
| Meet with preceptor | x | | | | | | | | | | | | | | | | | | | | | | | |
| Prepare project proposal | x | | | | | | | | | | | | | | | | | | | | | | | |
| Construct PICOT question | | x | | | | | | | | | | | | | | | | | | | | | | |
| Conduct literature search | | x | | | | | | | | | | | | | | | | | | | | | | |
| Evaluate literature | | | x | | | | | | | | | | | | | | | | | | | | | |
| Grade evidence | | | x | | | | | | | | | | | | | | | | | | | | | |
| Propose a practice recommendation | | | | x | | | | | | | | | | | | | | | | | | | | |
| Identify key stakeholders | | | | | x | | | | | | | | | | | | | | | | | | | |
| Construct budget | | | | | | x | | | | | | | | | | | | | | | | | | |
| Present project to preceptor | | | | | | | x | | | | | | | | | | | | | | | | | |
| Make edits post preceptor evaluation | | | | | | | x | | | | | | | | | | | | | | | | | |
| Review edits with preceptor | | | | | | | | x | | | | | | | | | | | | | | | | |
| Seek budgetary approval | | | | | | | | | x | | | | | | | | | | | | | | | |
| IRB approval and Submission | | | | | | | | | x | x | | | | | | | | | | | | | | |
| Obtain technology resources (computer, phone, dashboard access) for new position | | | | | | | | | | x | | | | | | | | | | | | | | |
| Workflow education for the perioperative staff and transfer center staff | | | | | | | | | | x | | | | | | | | | | | | | | |
| Project go live | | | | | | | | | | | x | | | | | | | | | | | | | |

| | NUR7801 | | | | | | | | NUR7802 | | | | | | | | NUR7803 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Activity | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 | Week 1 | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 | Week 13 | Week 15 |
| Monitoring workflows through PDSA utilization | | | | | | | | | | | x | x | x | x | x | x | x | | | | | | | |
| Data collection | | | | | | | | | | | x | x | x | x | x | x | x | x | | | | | | |
| Data analysis | | | | | | | | | | | | x | x | x | x | x | x | x | | | | | | |
| Evaluation, documentation and dissemination of Results | | | | | | | | | | | | | | | | | | | x | x | x | | | |
| Preceptor evaluation | | | | | | | | | | | | | | | | | | | | | | x | | |
| Project handoff | | | | | | | | | | | | | | | | | | | | | | | x | |
| Project conclusion | | | | | | | | | | | | | | | | | | | | | | | | x |

Appendix D

Data Collection

| **Pre Intervention Data**<br><br>*October 1- November 30, 2019* | **Post Intervention Data**<br><br>*October 1- November 30, 2020* | **Statistical Test** |
|---|---|---|
| PACU Hold Times in Minutes | PACU Hold Times in Minutes | *t*-test |
| Number of PACU Boarding Patients | Number of PACU Boarding Patients | *t*-test |
| Number of Surgical Patients Requiring Admission Each Month | Number of Surgical Patients Requiring Admission Each Month | *t*-test |

Appendix E

Duty List

| List of Duties and Responsibilities for the Perioperative Bed Flow Manager |
| --- |
| 1. Daily (Monday – Thursday) review of surgical schedule |
| 2. Attend morning surgical bed huddle with operative charge nurses |
| 3. Utilize EPTS software and interactive dashboards to facilitate patient tracking and flow within perioperative areas |
| 4. Queue patients for admission to surgical floors in order of post-operative need |
| 5. Timely patient assignment to inpatient beds |
| 6. Prompt follow up with PACU charge nurse and/or inpatient charge nurse to improve unnecessary delays surrounding patient transitions. |