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Implementation of a Multipronged Approach to Improve Pre-Operative Efficiency and First Case on Time Start Performance

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Implementation of a Multipronged Approach to Improve Pre-Operative Efficiency and Elective First Case on Time Start Performance

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Abstract

Background: Surgical services are an important source of revenue and important economic driver of hospital systems. Surgical services account for approximately 42% of a hospital's annual revenue, however, it also constitutes 40% of facility operating costs (Gupta, et al., 2022 & Morel & Gomez, 2021). Despite the high costs associated with surgical services delays remain a significant issue across the nation. On-time starts for the first surgical cases of the day is a key performance metric tracked by surgical facilities to determine efficiency. Currently, 50 – 90% of first surgical cases are delayed throughout the United States and the most common cause of delay include surgeon and patient tardiness, workflow inefficiencies, equipment malfunctions, and medication administration issues (Gupta, et al., 2022).

Local Problem: Throughout the 2022 calendar year, only 36.75% of first surgical cases of the day made it into the operating room at their scheduled time. This is well below the facility goal of 75% of first cases and below the corporation average of 56%. The most commonly identified delays included surgeon tardiness, patient toileting needs, and delays in medication orders or administration.

Methods: Using the define, measure, analyze, improve, control (DMAIC) model, a multipronged quality improvement initiative was developed to address and improve the frequency and length of delays in start times for the first surgical cases of the day.

Intervention: This quality improvement initiative aimed to address pre-operative delays and improve first surgical case on time start performance through means of a multifaceted approach. Signs were hung in patient areas to improve patient navigation to the surgical waiting room and simplify the patient check-in process. In addition, an infographic outlining the costliness of delays were hung in the staff breakroom.

Results: Prior to the intervention implementation 68.57% of all first surgical cases started late and the average length of delay was 16.88 minutes. Following the interventions 75% of all first surgical cases started late with an average delay of 19 minutes. Prior to the interventions 51% of patients arrived after their scheduled arrival time by an average of 6.79 minutes. In addition, 20% of patients voiced difficulties either finding the waiting room or using the phone to call the nursing desk to alert staff to their arrival. Following intervention implementation only 41.67% of patients arrived late and the length of delay when patients did arrive late was reduced to six minutes. In addition, no patients expressed difficulty finding the waiting room or using the phone to call the nursing desk on arrival.

Conclusion: Surgical delays were more frequent, and the average length of delays was longer following intervention implementation, however, since surgical delays are unique to each facility it does not mean these interventions would not be effective in a different setting. It is important that a thorough root cause analysis is conducted prior to addressing surgical delays in order to identify the interventions that are more likely to be effective.

Keywords: Delays, first case, first case on time start (FCOTS), multipronged approach, improvement

Introduction

Problem Description

The ambulatory care unit (ACU) at a community hospital in southern New Hampshire is a same day surgery center that performs surgeries Monday through Friday. Occasionally, emergent surgeries are performed outside of regular operating hours. A number of surgical specialties operate at this facility on a regular basis. Specialties include spinal, orthopedics, breast, podiatry, and otolaryngology. There are seven pre-operative admission bays, four operating rooms, and six post-operative bays in the post-anesthesia care unit (PACU) (Medicare.gov, 2023).

Delays in the surgical process and surgical start times are a common issue worldwide and this facility was no exception. Throughout the 2022 calendar year, only 36.75% of first surgical cases of the day made it into the operating room at their scheduled time. This was well below the facility goal of 75% of first cases and below the corporation average of 56% (L. Crispo, personal communication, March 3, 2023). These delays were due to a number of issues including surgeon tardiness, patient toileting needs, and delays in medication orders or administration (L. Crispo, personal communication, March 3, 2023).

Surgeon tardiness was one of the most common causes of surgical delays at this facility. There are several providers who arrive late on a regular basis and those that do arrive on time make patient contact within ten minutes of the scheduled surgery start time When surgeons do meet with the patients prior to the scheduled start time, it was not uncommon for patient and family questions, reviewing consent, or bedside discussions to extend past the scheduled start time causing delays despite on time surgeon arrival.

Patient tardiness is another common cause of delays. Patient navigation to the waiting room was identified as a contributing factor. Patients are given directions at check-in but there was no additional signage to aid patients should they become lost. Once in the waiting room, patients are expected to call the nurse's station inside the unit to alert staff of their arrival. Some patients noted confusion with this task as well as a lack of clear direction and signage. Additional causes for patient arrival delays include delays in registration and late arrival times.

Available Knowledge

Surgical services are an important source of revenue and important economic driver of hospital systems. In 2014 the Agency for Healthcare Research and Quality (AHRQ) estimated 17.2 million surgeries were performed in the United States (Morel & Gomez, 2021). Emergency and elective surgeries are an important patient service and represent a significant source of revenue for hospitals. Surgical services account for approximately 42% of a hospital's annual revenue, however, it also constitutes 40% of facility operating costs (Gupta, et al., 2022 & Morel & Gomez, 2021). In the United States the cost of operating room (OR) time varies between facilities but is estimated at $30 to $150 per minute (Gupta, et al., 2022). Due to these high operating costs it is imperative that operating rooms are run efficiently to reduce unnecessary spending and loss of revenue.

Despite the obvious benefits of surgical efficiency, operating room delays remain a significant issue across the nation. On-time starts for the first surgical cases of the day is a key performance metric tracked by surgical facilities to determine efficiency. Currently, 50 – 90% of first surgical cases are delayed throughout the United States (Gupta, et al., 2022). If a facility's operating cost is $105 per minute, a delay of only 5 minutes for 4 surgical cases each day is equal to an annual loss of revenue of $546,000 (Morel & Gomez, 2021). In addition to the

monetary cost of delays, inefficiencies throughout the surgical day remain an issue. On average, only 50% of OR time is used for procedures. The rest is used for cleaning, preparation and room turnover (Gupta, et al., 2022). In addition to the astronomical financial costs of inefficiency, delays also contribute to low staff morale, decreased patient satisfaction and an increase in case cancellations later in the day (Coffey, et al., 2018). Conversely, the benefits of OR efficiency and on time starts includes improved staff and patient satisfaction, decreased overtime needs, increased last case on time ends, and improved physician and hospital revenue (Gupta, et al., 2022).

Operating room delays are often multifaceted and unique to each facility. Some of the most common causes of delays include surgeon or patient tardiness, incomplete surgical consents, redundant or inefficient workflow, equipment malfunction, and nursing, surgical team, or anesthesia delays (Gupta, et al. 2022). Surgeon tardiness is often cited as the most common cause of first case delays. Oftentimes several delays are present simultaneously making addressing delays a challenge. Due to the significant costs of operating room inefficiency, it is imperative for hospitals to address surgical delays in order to maximize revenue, productivity and improve staff and patient satisfaction.

A literature review was conducted using the preferred reporting items for systematic review and meta-analyses (PRISMA) flow chart and checklist method. A comprehensive search of available publications was completed using the Medline and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases. Search results were restricted to publications between the years 2016 and 2023. The primary search terms included “surgery,” “first case delay,” and “improvement.” Boolean phrases used to improve article retrieval included “PACU,” “surg*,” “delay,” “first case,” and “FCOTS.”

Using the above search criteria 46 articles were retrieved from the CINAHL database and 62 articles were retrieved from the Medline database for a total of 113 publications to be screened. Eighteen duplicate publications were identified and leaving 95 articles to be screened. Seventy-one articles were excluded after screening of publication titles because they did not address surgical delays, were not conducted in the United States, or were specific to pediatrics only. After these initial exclusions 24 articles were sought for retrieval. Of the 24 publications sought for retrieval, the full text publication could not be accessed for eight articles. This left 16 articles to be assessed for inclusion eligibility.

Five articles that were overlooked during the initial screening were excluded because they were not conducted in the United States. Two studies were excluded because they defined delays but did not address ways of improving delays. An additional 2 articles were excluded because they were specific to pediatric populations only. One study was excluded because it only examined in-patient surgeries. This excluded out-patient surgeries which represents a significant number of surgical cases in the United States. Lastly, one publication was excluded because it was specific to labor and delivery surgeries. Eleven articles in total were excluded of the 16 assessed for eligibility leaving five articles for inclusion in this review.

Two projects focused on addressing surgeon tardiness. One project conducted by Han, et al., (2016) implemented a policy requiring surgeons to complete site marking and procedure consents at least 30 minutes prior to the scheduled surgery start time (Han, et al., 2016). Financial incentives were used to try and improve surgeon buy-in and compliance. Prior to the policy change the average first case delay was 9.67 minutes. The average delay after the policy change was 7.17 minutes. This was a 26% reduction in delay times and was a statistically significant result (Han, et al., 2016). For the year that this study was conducted this resulted in a

total decrease in delays of 52 hours and 57 minutes and an estimated savings of $168,000 (Han, et al., 2016). Site marking and surgical consents were completed at least 30 minutes prior to surgery in 97% of cases during the incentive program (Han, et al., 2016).

The second quality improvement initiative conducted by Morel & Gomez (2021) was a proposed evidence-based initiative developed following a literature review. The proposed plan consisted of three phases: surgeon education regarding the cost and negative outcomes associated with surgical delays, visual cues, and e-mail reminders for habitually late surgeons. This was only a proposed study, however, the interventions suggested were supported by evidence identified from the literature review that informed this project proposal.

One quality improvement project conducted by Lee, et al., (2020) addressed patient arrival delays by improving patient navigation. Signage was placed at key areas of confusion to aid patients and reduce patient arrival delays. The addition of signage significantly improved the time it took for patients to arrive from registration to the surgical waiting from 34 minutes to 20 minutes allowing more time for pre-procedure tasks.

The last two improvement projects assessed focused on pre-procedural process delays. One project conducted by Gupta et al., (2022) the lean process improvement method to address pre-operative inefficiencies. Missing pre-operative orders were identified as an addressable contributor to surgical delays (Gupta, et al., 2022). An automatic electronic medical record (EMR) alert was developed that alerted providers of missing orders so they could be entered in a more timely manner (Gupta, et al., 2022).

After this EMR alert was implemented the average surgical delay time was decreased from 19 minutes to 11 minutes. Additionally, pre-operative orders were placed only 51% of the time prior to the intervention. Following the intervention orders were placed for 100% of cases.

Despite these improvements in delays and order entry, there was actually a decrease in first case on time starts from 57% to 53% (Gupta, et al., 2022). Despite the decrease in on time performance by case, the average length of delays was reduced which still resulted in reduced financial loss (Gupta, et al., 2022).

The last improvement project conducted by Coffey, et al., (2018) used the lean process improvement method to redesign the pre-operative workflow and improve efficiency. Changes that were implemented as part of this lean process improvement bundle included staggered patient arrival times, improved signage, greeters, operating room team huddles at the bedside, a huddle board where staff could track delays, and daily debriefs on performance. All these changes combined resulted in a statistically significant improvement in first case on time starts from 23.5% to 73.0% (Coffey, et al., 2018). The use of lean project management and a multipronged approach to delays was the most effective at reducing the length of delays and improving overall first case on time starts.

Rationale

The define, measure, analyze, improve and control (DMAIC) process was used to address the issue of first case on time starts. In the define stage, the cause of start time delays was defined through assessment, measurement and analysis prior to identifying and implementing changes to improve start times. The current admission process was analyzed in detail to identify areas for improvement. In the measure phase data collection focused on patient arrival times, surgeon arrival times, when the surgeon saw the patient prior to surgery and the frequency and length of delays in first case surgical start times.

In the analyze phase the data collected was examined to determine which aspects of admission take the greatest amount of time and are most responsible for delays in surgical start

times. The aspects of admission that take the greatest amount of time were further assessed to determine areas for improving efficiency. Surgeon and patient tardiness were identified as areas with an opportunity to improve efficiency, but other aspects were considered based on the data collected.

In the improve phase, changes were identified that are expected to improve pre-operative efficiency and subsequently first case on time starts. These changes were focused on addressing patient and surgeon tardiness. In the control phase, the identified interventions were implemented. Data was collected before and after the interventions were implemented and descriptive statistical analysis was performed. Inferential statistical analysis was then be used to compare outcomes before and after the interventions were implemented to assess for improvement.

Global Aim

The global aim of this improvement project was to improve pre-operative workflow efficiency and first case on time start performance.

Specific Aim

The specific aim was to improve first case on time performance to 56% by June 30, 2023. This specific goal of 56% was the current first case on time start percentage across all HCA facilities.

Methods

Context

Emergent and elective surgeries are an important patient service that is offered at hospitals around the world. Not only is it an important service for patients but it is an extremely lucrative service for hospitals. Surgical services account for 42% of a facility's annual revenue

but also represents 40% of its annual operating costs (Gupta, et al., 2022 & Morel & Gomez, 2021). The cost of running an operating room varies between facilities but is estimated at $30 to $150 per minute (Gupta, et al., 2022). This means a delay of just a few minutes per case can potentially cost a hospital millions in unnecessary spending. Studies have shown that even a reduction in the length of delays without improving on-time start performance can still lead to a marked reduction in unnecessary financial loss (Gupta, et al., 2022). Despite high operating costs, a significant loss in revenue and the obvious benefits associated with on-time surgical performance, delays in surgical start times are a significant issue across the nation.

The average first case on-time start for all surgical cases during the year of 2022 was 36.8% (L. Crispo, personal communication, March 3, 2023). Only 45.5% of first cases started within five minutes of their scheduled start times and 60.9% of first cases started within ten minutes of their scheduled start time (L. Crispo, personal communication, March 3, 2023). This facility performs approximately 2,500 surgeries annually which means that nearly 1,500 surgeries did not start on time during the 2022 calendar year.

Financial losses are not the only negative impact associated with surgical delays. Surgical delays can also negatively impact patient satisfaction and this facility currently only has a three out of five-star Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient rating (Gupta, et al., 2022 & Medicare.gov, 2023). This potential impact on patient satisfaction as well as overall patient outcomes is not in line with the mission, vision or values. The vision is “to provide the perfect patient care experience,” (HCA, 2023). The values are presented under the mnemonic “ICARE.” Each letter of this acronym represents a different value of the hospital including integrity, compassion, accountability, respect, and excellence (HCA,

2023). Delays in surgical start times are not in line with the vision of a perfect patient care experience not the values of integrity, accountability and excellence.

Surgical delays are a multifaceted issue but even a small improvement in these delays could yield a significant reduction in facility costs, as well as improved patient and staff satisfaction. Evidence has shown that low or no-cost solutions have proven effective in reducing surgical delays. The interventions that were implemented in this quality improvement initiative are largely education and improved signage. All of these interventions are low or no cost and if these interventions can improve surgical delays even if only by an average of a few minutes, it could result in thousands to hundreds of thousands of dollars saved in unnecessary spending. If more significant improvements can be achieved there may also be a subsequent improvement in patient satisfaction scores as well as staff morale and well-being.

Interventions

Due to the complex and multifaceted nature of surgical delays, a multidimensional approach was be taken to addressing this issue in this facility. Currently, the greatest causes of first case delays include surgeon and patient tardiness. The delays identified at this location are supported by current evidence regarding common surgical delays. These causes play a significant role in surgical delays, so interventions were implemented that address each of these major delays simultaneously.

To address surgeon delays, visual aids were be placed in the physician lounge and high traffic areas outlining the importance of on-time starts. Key statistics such as the annual cost of delays as well as its effect on reimbursements, available funds for new and better equipment and salary were outlined as a hopeful motivator for improving on-time arrival.

In the hopes of improving patient arrival times to the pre-operative area an assessment of patient way-finding delays was be conducted. By means of patient interview, areas where patients get lost on their way to the pre-operative area were identified and improved signage was be placed in these key locations. Patients are required to call the desk when they arrive in the waiting room, so an assessment was also be done of signage and instruction at this point to identify the need for improvement.

Study of the Interventions

To assess the effectiveness of signage outlining delays pre-intervention and post-intervention data was collected on frequency, length, and primary cause of delays. To determine the effectiveness of signage meant to improve the patient navigation experience patient arrival times were tracked prior to the implementation of improved signage and after implementation. Additionally, patients were asked about difficulties finding the waiting room before and after intervention implementation to. The expected outcome was that these interventions combined would result in either improved on time start performance, reductions in the overall length of delays or both.

Measures

The primary outcome measures for these interventions were on-time start performance rate and average length of surgical delay in minutes. The data collected and subsequent analysis was largely quantitative. Current state data was collected by means of direct observation and chart auditing. Data was collected on various aspects of the pre-procedural process to identify areas for improvement prior to implementation of any interventions. Patient specific data being collected included patient arrival time, surgery type, and each patient was queried regarding challenges finding their way from registration to the surgical waiting room.

Data on surgeon arrival times, the time the surgeon sees the patient prior to surgery, the time anesthesia sees the patient prior to surgery, the time the operating room nurse sees the patient, and the time the patient enters the operating room were also collected. All of this data was used to determine the current on time percentage, the average length of delays and which pre-procedure tasks took the longest or were completed latest.

The same data outlined above was collected following intervention implementation. Descriptive and inferential statistical analysis were done to compare pre and post-intervention data and determine whether the implemented interventions had an effect on surgical first case on-time start performance.

Analysis

First, descriptive statistical analysis wascompleted noting mean, standard deviation and range for delayed start times. Then inferential statistical analysis was performed using a paired sample t-test noting differences between pre and post-intervention data to determine if the interventions outlined above impacted either first case on-time start performance or the length of surgical delays. A cause-specific assessment of delays pre and post-intervention was also conducted comparing the specific causes for delays such as surgeon or patient tardiness to see if the implemented interventions had an impact on these cause specific delays.

Ethical Considerations

No patient specific data or interactions were expected for this intervention and there was a minimal expected risk for social, physical or psychological harm to patients or staff. This proposal was a quality improvement initiative that was reviewed by the University of New Hampshire Department of Nursing Quality Review Committee to attest that it is exempt from needing a full institutional review board review.

Results

Operating room delays are often multifaceted and unique to each facility. Some of the most common causes of delays include surgeon or patient tardiness, incomplete surgical consents, redundant or inefficient workflow, equipment malfunction, and nursing, surgical team, or anesthesia delays (Gupta, et al. 2022). A "5Ps" assessment of the clinical site was performed and after a pre-intervention analysis of the ambulatory care unit was conducted, the top causes of surgical delays were identified and found to be reflective of what was presented in the literature.

To address surgeon tardiness initial interventions were intended to include an infographic outlining the monetary costs of surgical delays as well as the negative impact on staff and patient satisfaction. Ideally a surgeon education would have been performed with a before and after survey determining improved knowledge of the costliness of delays and the numerous costs associated with surgical delays. The infographics were developed and displayed but no in person education was conducted. Infographics were not displayed in all the locations that would have been the most valuable due to concerns from the unit director.

To address patient tardiness the initial intervention was intended to be signs at key locations in the hallways between registration and the surgical waiting room to make finding the waiting room easier and prevent arrival delays. Due to facility restrictions, signs could only be placed directly outside of the waiting room and not at key hallway intersections as initially intended. Medication administration and order entry delays were also another commonly identified cause of surgical delays. To address this issue a procedural change was proposed that recommended entering medication orders for the first cases the night before the surgery so they could be approved and ready for administration first thing in the morning to improve efficiency.

This recommendation, however, was never formally proposed or implemented because the surgical director felt this was an inappropriate intervention for a student to implement.

Evidence supports a multifaceted approach to surgical delays, so several process measures were implemented in this quality improvement initiative. Firstly, to improve patient arrival times signs were hung up to more clearly identify the surgical waiting room as well as more clearly outline instructions for calling the nursing desk upon arrival (Appendix A). The last process measure was the development and display of an infographic outlining the financial costs of delays as well as their negative impact on staff morale and patient satisfaction (Appendix B). These infographics were hung in staff community areas so all staff would have the opportunity to see and read them. The primary outcome measure was delays in first case start times. The percentage of delayed cases as well as the length of delays were collected by direct observation and chart audits.

Surgeon delays are one of the most common causes of surgical delays throughout the United States (Gupta, et al., 2022). This demonstrates a significant cultural phenomenon that needs to be addressed. An attempt was made in this quality improvement initiative based on the evidence and suggestions made by Morel and Gomez (2021), however, not all suggested improvements could be implemented due to time constraints and facility restrictions. Due to previous experience on the unit prior to the development and implementation of this quality improvement initiative the nurses working on the unit were acutely aware of the project and the data being collected. This may have skewed findings and affected the data. No other providers or specialties were aware of the initiative that was being conducted as a way of minimizing bias.

There was no significant improvement in the percentage of cases that were delayed nor the length of these delays when comparing the pre-intervention and post-intervention data. Prior

to implementing the changes noted above 68.57% of cases were delayed and the average length of delay was 16 minutes. The percentage of delayed cases as well as the length of delays was worse following the interventions. After the interventions were implemented 75% of cases were delayed and the average length of these delays was 19 minutes. Despite these shortcomings there was improvement in patient arrival time and experience finding the waiting room. Prior to the interventions 51% of patients arrived late. After the interventions only 41% of patients arrived late. Additionally, prior to the improved signage 20% of patients had difficulty finding the waiting room or using the phone to call the nursing station. Following the interventions, no patients identified difficulty finding the waiting room or using the phone.

One of the most significant unintentional consequences of this initiative was the direct involvement of the person implementing the project in the pre-operative process. The person implementing the project was familiar with the unit procedures from previous clinical experience and therefore comfortable and at times expected to assist with the admission process. This may have impacted the results that were obtain as well as resulted in some bias. Additionally, the data that could not be collected by chart audit was collected through direct observation and trying to track several admission cases simultaneously may have led to some errors in observation and data collection. These factors coupled with the restrictions placed on the interventions that could be implemented may have impacted the success of this improvement project. No data was ever collected from other care provider's point of view aside from the nurses working in the perioperative area. This may have impaired the effectiveness of the interventions that were implemented. Additionally, it may have failed to identify other more significant areas that could have benefited from an improvement initiative.

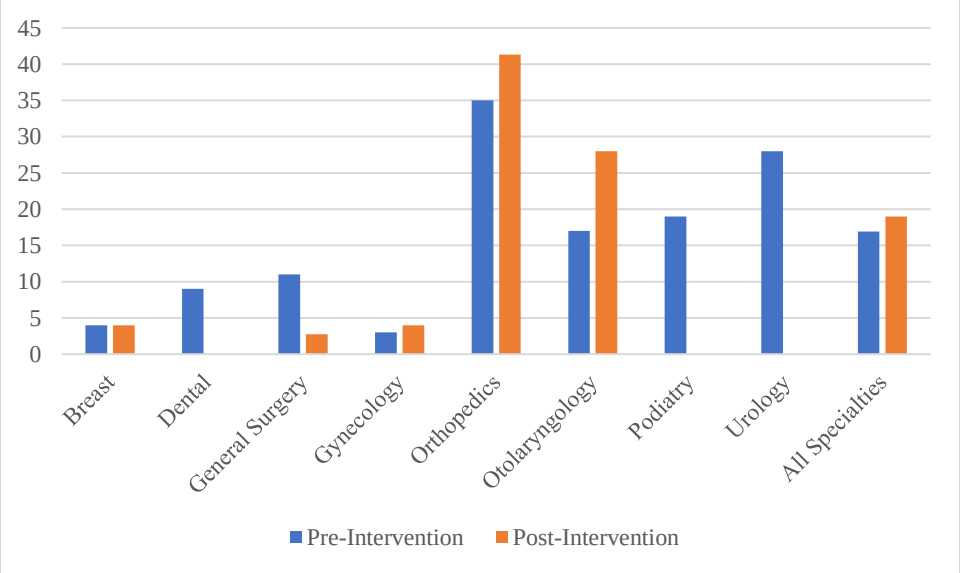
Discussion

Summary

Prior to the intervention implementation 68.57% of all first surgical cases started late and the average length of delay was 16.88 minutes. Following the interventions 75% of all first surgical cases started late with an average delay of 19 minutes. This represents an increase in the number of delayed cases as well as the length of delays experienced, however, these delays were not statistically significant (p=0.7340). The longest delays were seen for orthopedic cases both prior to and after the interventions. The most common cause of delay was surgeon tardiness prior to the interventions as well as after implementation. Other common delays included medication administration delays and delays attributed to anesthesia staff.

Figure 1

A Comparison of Pre-Intervention and Post-Intervention Delays by Specialty in Minutes



Note: No post-intervention data was collected for dental, podiatry and urology specialties.

Table 1

Summary of Most Common Causes of Delays

	Pre-intervention	**Post-intervention**

Delayed Cases	68.57%	75%
Average Length of Delays	16.9 minutes	19 minutes
On-Time Starts	31.43%	25%
Delay Due to Surgeon Tardiness	31.43%	25%
Delay Due to Medication Administration	11.43%	0%
Delay Due to Anesthesia	5.71%	0%

Table 2

Unpaired t-test Comparison of Pre-Intervention and Post-Intervention Surgical Delays

Pre-Intervention Delay Mean (in minutes)	**Post-Intervention Delay Mean (in minutes)**	**Difference**	**95% CI Lower**	**95% CI Upper**	**t**	**df**	**Two-tailed p-value**
16.88 (n=24)	19.00 (n=9)	-2.13	-14.77	10.52	0.3429	31	0.7340

Note: These results were obtained using an unpaired t-test comparing pre-intervention and post-intervention surgical start time delays in minutes.

Although no improvement was seen in the incidence of delays nor the length of delays for surgical start times, there was an improvement in patient arrival times and overall reported ease in the arrival process. Prior to the interventions 51% of patients arrived after their scheduled arrival time by an average of 6.79 minutes. In addition, 20% of patients voiced difficulties either finding the waiting room or using the phone to call the nursing desk to alert staff to their arrival. After hanging signage directing patients to the waiting room only 41.67% of patients arrived late and the length of delay when patients did arrive late was reduced to six minutes. In addition to this improvement in arrival times, no patients expressed difficulty finding the waiting room or using the phone to call the nursing desk on arrival. Despite this improvement in patient arrival times, there was no noted improvement in surgical delays which suggests that patient tardiness is not a significant factor influencing delays in surgical start times.

Table 3

Patient Arrival Delays and Challenges

	Pre-Intervention	Post-Intervention
Late Arrival to Waiting Room	51%	41.67%
Delay (in minutes)	6.79	6
Difficulty Finding Waiting Room	20%	0%

This quality improvement project was conducted using the define, measure, analyze, improve and control (DMAIC) model. This model was selected because of the multifaceted approach and the need to assess and develop interventions from several of perspectives. In addition, the overarching goal of this quality improvement project was to improve the efficiency and overall performance of surgeons and staff in pre-existing process which is more aligned with the DMAIC improvement model.

The global aim of this improvement initiative was to reduce pre-operative delays and improve first surgical case on time start performance. The specific aim was to improve first case on time performance from 36.8% to 56% by June 30, 2023, by means of staff and surgeon education and improved patient arrival experience. This specific goal of 56% was chosen as it reflects the the current first case on time start percentage across all facilities owned by the same corporation. These goals were not met, in fact, the length of delays as well as the number of delayed cases increased following the interventions. Although the incidence of surgical start time delays as well as the length of these delays was increased following intervention implementation there was an improvement in patient arrival times and experience. Fewer patients arrived late following intervention implementation, no patients expressed difficulty finding the waiting room and the average length of patient arrival delays was reduced by almost one minute.

One of the greatest strengths of this quality improvement initiative is the multifaceted approach. Although this prevents identification of a clear correlation between intervention and outcomes, it represents a holistic approach to a complex issue that cannot be solved with one intervention alone. This multifaceted approach is meant to address the areas in need of greatest improvement to address surgical start time delays. Identifying delays by specialty may highlight some patterns that could benefit from additional studies. Providers or specialties with significantly more or longer delays could be addressed by management and a root cause analysis could be conducted to develop more quality improvement initiatives moving forward. Additionally, many other interventions were suggested but ultimately not permitted to be implemented by hospital staff. Although these interventions could not be implemented, they were supported by evidence and could potentially be implemented in the future by hospital staff.

Interpretation

The most common causes of delays for surgical cases include surgeon tardiness, inefficiencies in pre-operative workflow, equipment issues, and patient tardiness (Gupta, et al., 2022). After an initial assessment, the most cited delays were identified as surgeon and patient tardiness. Other delays were also identified including equipment issues and medication administration delays; however, they were not as frequent as delays associated with patients and surgeons arriving late. Surgeon and patient delays were the most identified causes for delays and were the primary focus of this quality improvement initiative.

Prior to intervention implementation 68.57% of cases were delayed. Of these cases, 31.43% of delays were due to surgeon tardiness and patients arrived later than their scheduled arrival time 51% of the time. Of these late patients, 20% expressed difficulty finding the waiting room and completing the check in process. The average length of surgical delays prior to

intervention implementation was 16 minutes. After intervention implementation 75% of cases were delayed and the average length of delays was 19 minutes. Of these cases only 25% were due to surgeon tardiness. Despite the increase in delayed start times, only 41.67% of patients arrived late following intervention implementation and no patients expressed difficulty finding the waiting room or understanding the check in process.

Surgeon tardiness is a common yet challenging delay to address. One proposed quality improvement initiative outlined by Morel and Gomez (2021) conducted a literature review to identify ways to enact culture change and improve surgeon on-time performance. The proposed study outlined three phases: surgeon education regarding the costliness of delays, visual cues to remind staff of the costs associated with delays, and e-mail reminders for habitually late surgeons (Morel & Gomez, 2021). Due to time constraints and restrictions imposed by hospital staff the only aspect of this proposed project that could be implemented was the visual cues. Where the visual cues could be placed was also restricted due to facility policies. After implementation more cases were delayed and the average length of delays were longer than before intervention implementation, however, fewer cases were delayed due to surgeon tardiness. Initially cases were delayed due to surgeons 31.43% of the of the time. Following interventions, cases were delayed due to surgeon tardiness 25% of the time.

An improvement initiative conducted by Lee, et al., (2020) focused on improving patient arrival times and the efficiency of the patient check-in procedure. After observing areas of confusion between the reception desk and the surgical waiting room, signs were put up to aid patients. The addition of these signs was found to improve patient arrival times and reduce the time it took patients to arrive at the waiting room from 34 minutes to 20 minutes (Lee, et al., 2020). The findings of this quality improvement initiative were similar to those of Lee, et al.,

(2020). Signs were hung in the hospital to aid patients on their way to the waiting room and signs outlining the check-in process were re-imagined improving eye appeal and understanding.

Prior to the interventions 51% of patients arrived after their scheduled arrival time by an average of 6.79 minutes. In addition, 20% of patients voiced difficulties either finding the waiting room or using the phone to call the nursing desk to alert staff to their arrival. After hanging signage directing patients to the waiting room only 41.67% of patients arrived late and the length of delay when patients did arrive late was reduced to six minutes. In addition to this improvement in arrival times, no patients expressed difficulty finding the waiting room or using the phone to call the nursing desk on arrival.

Lastly, this improvement initiative was done as a bundled approach because a study conducted by Coffey, et all., (2018) as well as Gupta, et al., (2022). Demonstrated improvements in surgical delays from a multifaceted approach. Coffey, et al., (2018) used the lean process improvement method to address several common pre-operative delays. These efforts resulted in a statistically significant improvement in first case on time start performance from 23.5% to 73.0% of cases (Coffey, et al., 2018).

Gupta, et al., (2022) also implemented the lean process improvement method to address pre-operative delays. Unlike Coffey, et al., (2018), this improvement project resulted in a decrease in on time start performance from 57% to 53%, however, the average length of delays was reduced from 19 minutes to 11 minutes which still resulted in reduced financial loss (Gupta, et al., 2022). Despite the findings of these two improvement initiatives, the bundled approach was not successful in this project. Prior to intervention implementation the 68.57% of cases started late and the average length of delay in minutes was 16.88 minutes. Following the interventions 75% of cases started late with an average delay of 19 minutes.

The interventions implemented in this project were not effective at improving surgical delays, however, there was improvement in patient navigation and check-in experience. Patients identified fewer challenges with the check-in process, arrived on time more frequently, and generally were more at ease when brought back into the pre-operative area. Although the interventions as they were implemented were not successful, evidence suggests that alterations to these changes might results in improved surgical start times. Changing the locations of patient information signs, providing in-person education on the costliness of delays, implementing consequences or follow-ups with habitually late surgeons and re-evaluating the pre-operative process by means of lean process management could all improve pre-operative efficiency and on-time starts.

Based on the findings of Morel & Gomez (2021), it was expected that providing visuals outlining the costliness of delays may have a positive impact on surgeon tardiness. This, however, was not the case. Morel & Gomez also suggest in-person education and email reminders or consequences for habitually late providers. Perhaps if all these interventions were implemented simultaneously an improvement in on time start performance may have been seen. Additionally, a multifaceted approach using the lean process management approach conducted by Coffey, et al., (2018) resulted in statistically significant improvement in surgical delays, however, a multifaceted approach was not effective in this situation. Perhaps a second root cause analysis and define, measure, analyze, improve and control (DMAIC) cycle could be conducted that would identify unaddressed areas of delays and improve surgical on time start performance.

There were very few monetary costs associated with this improvement project. The cost of printing and laminating a few signs was approximately $20. These costs, although small, were not offset but the results of the study. The length and frequency of delays was increased which

ultimately resulted in further monetary loss for the facility. Despite this monetary loss associated with delays, there was noted improvement in patient arrival times, experience and overall satisfaction which could lead to better patient reviews, more patient referrals and an increased likelihood patients will return to the facility again in the future should they need medical care.

Limitations

One of the most important limitations to note is that operating room delays are often multifaceted and facility specific (Gupta, et al. 2022). Although many systems may experience similar causes of delays, the root cause of these delays may be different facility to facility. Although the interventions in this project were unsuccessful in the current setting it does not mean that they would be equally unsuccessful in other surgical settings. Additionally, the identified interventions that were expected to be most effective in this setting may not be as valuable in other settings. For this reason, it is important that any surgical unit looking to improve surgical start times should conduct a root cause analysis prior to implementation of interventions to ensure that the areas of greatest delays are being addressed.

Another significant limitation was project time constraints. Both pre-intervention and post-intervention data sets were small due to this time constraint and the fact that only three or four operating rooms are staffed and running daily. This increases the risk for type two error. Intervention signs could not be hung where they were initially intended to due to lack of stakeholder buy in and limitations set by hospital policies also put limitations on project interventions. Other proposed interventions such as recommending entering medication orders the day prior to surgery were not supported by stakeholders.

The nurses working in the post-anesthesia care unit were aware that a quality improvement initiative was being conducted and because of this it may have affected their

performance. Nearly all the other surgical staff were unaware of what data was being collected and why, so it is unlikely their actions or performance were influenced. In addition to staff awareness of the project, the study designer was also involved with patient care and pre-operative tasks which may have affected data as well as skewed the most identified delays. Not only could this have influenced the data and findings, but it may also have led to errors in data collection as some data was missed because patient care was being performed. Although no improvement was noted following the interventions of this project, it is important to note that the sample sizes both before intervention implementation (n = 35) and after implementation (n = 12) were small and therefore increase the likelihood that a type II error may have occurred. If this error occurred, an improvement may have been seen if more data had been collected and the determination that the implemented interventions were ineffective may have been made prematurely.

To address the limitation of staff awareness and confounding bias many staff were not made aware of the improvement initiative. The staff that were not informed of the project included operating room nurses, anesthesia, and surgeons. Nurses working in the perioperative area were aware of the improvement project, however, and this may have impacted perioperative data collection. Ideally, data would be collected for longer to develop a larger sample size that is more resistant to bias and error. This could unfortunately not be done during this project due to time constraints and due dates. It is important to note that many interventions could not be implemented as initially intended due to facility restrictions.

Conclusion

Sustainability

This project was quite sustainable as it required minimal monetary and material resources to implement. The signs that were developed can be used for a long time to come and may continue to improve patient experience as well as continue to raise awareness about delays for surgical team staff.

Potential for Spread to Other Contexts

The generalizability of this project is limited since surgical delays are often unique to a facility. In addition, if facilities have similar broad category causes of delays such as surgeon or patient tardiness, the underlying root cause of these delays may differ. Due to this, it is important that any facility looking to address surgical delays does a detailed root cause analysis prior to developing and implementing interventions to address delays. Although the interventions in this project were not effective at reducing surgical delays, these same interventions could be effective in another setting.

Implications for Practice and Further Study

Despite the need to consider each facility's unique challenges, some delays are common regardless of location. One of the most identified surgical delays is surgeon tardiness (Gupta, et al., 2022). Although the interventions in this project were unsuccessful at improving surgeon arrival times, it does not mean that these interventions would have been unsuccessful in other facilities facing their own unique challenges. It is important that future research is conducted to address surgeon culture and why surgeon late arrival is such a universal delay among surgical services.

Suggested Next Steps

For future quality improvement projects, it could be valuable to place signs for patients at other locations in the hospital to improve patient navigation. To further improve patient arrival

times adding ten minutes to patient arrival times to account for the check-in process should be considered. Additionally, further interventions focused on surgeon tardiness may be valuable such as in person education or repercussions for habitually late providers. To address delays associated with medication administration, orders should be placed the night before, so they are approved by pharmacy and available for administration when needed during the pre-operative process. Further evaluation of the current check-in and pre-operative process using the lean process management approach should be conducted to identify redundancies and inefficiencies that could be streamlined to further improve the process and ultimately surgical on time start performance.

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Appendices

Appendix A: Patient Instructions for Calling Nursing Desk Upon Admission

Appendix B: Infographic Outlining the Costs Associated with Surgical Delays