Improving First Case On-Time Starts at East Ann Arbor Surgery Center

Final Report

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Executive Summary

The East Ann Arbor Surgery Center (EAASC) is an outpatient ambulatory care surgery center that performs surgeries in General Surgery, Gynecology, Orthopedics, Oncology, Otolaryngology, Plastic Surgery, and Urology, as well as several other departments. Each patient admitted to the EAASC for surgery is referred to as a case. The EAASC has been experiencing a low rate of first case on-time starts (FCOTS). When a first case does not start on-time, the delay can propagate throughout the day and cause overtime costs and dissatisfaction for medical providers. The EAASC Nurse Manager wanted to know which factors cause delays in FCOTS, and she asked an Industrial and Operations Engineering (IOE) student team to determine significant factors that cause delays and provide recommendations that achieve 65% to 85% FCOTS. To determine effective recommendations, the team evaluated the current process at the EAASC, deduced potential reasons for delays, and developed recommendations that will achieve a higher FCOTS rate if implemented.

Background
The East Ann Arbor Surgery Center (EAASC) at the University of Michigan Health System (UMHS) has six operating rooms (OR) that operate Monday through Friday. On Thursday, first cases are scheduled to begin at 8:30 AM; all other day’s first cases are scheduled to begin at 7:30 AM. The morning pre-operative process requires considerable coordination amongst surgeons, anesthesiologists, residents, nurses, and medical staff in order to prepare the patient and ORs for surgery. While the patient is undergoing necessary steps for surgery in the pre-operative bays, the medical staff is setting up the OR with the correct tools and resources to perform a high-quality operation. Given the coordination of many individuals all working to complete different tasks in parallel and sequential order, there is a great deal of variation that can lead to first case delays.

Methodology
The team identified significant factors using a literature search, observations, time studies, Swim Lane Diagrams, Value Stream Mapping (VSM), historical data analysis, surveys, and sweep log.

- **Performed a literature search.** Using PubMed, the team obtained information from four studies that focused on FCOTS in various academic and tertiary medical centers. In addition, two past IOE 481 improvement projects guided the team in creating a VSM and analyzing time study data.
- **Observed pre-operative processes and conducted time studies.** The team observed 24 first cases on four mornings and identified tasks the nursing staff, surgeons, and anesthesiologists complete. These tasks were timed to gather data for the time study analysis.
- **Created a Swim Lane Diagram and developed a Value Stream Map.** After observing the pre-operative process and conducting time studies, the team developed a Swim Lane Diagram to determine sequential and parallel tasks. The team, then, developed a VSM to gain insight to the time spent on value added and non-value added tasks.
- **Analyzed historical MiChart data.** Using a calendar year of data with 1,196 first case records, the team determined the current state of FCOTS and stratified data by surgeon,
surgery department, OR number, day of week, and month. to find significant factors. The team also used per minute fixed and variable cost data provided by the EAASC Financial Manager to calculate the costs associated with delays in first cases such as overtime and over-appointment costs.

- Created sweep log for charge nurses. The team created a sweep log for charge nurses to track reasons for delays in first cases. The sweep log included 14 reason codes such as surgeon issue, nurse issue, planned delay, and a missing History & Physical (H&P) form that was used over 11 days.
- Distributed surveys to surgeons. The team distributed surveys to the three physicians with the lowest percentage of delayed first cases to identify trends in the surgeon pre-operative tasks that result in a high rate of FCOTS.

Findings
The literature search indicated that huddles, multidisciplinary problem solving, and visual cues are successful methods to increase FCOTS in various medical institutions. From observations and time studies, the team identified 14 tasks that describe the complete the pre-operative process, as conducted by the nursing staff, surgeons, and anesthesiologists. From the historical data analysis, the team found that the EAASC currently has 17.5% FCOTS. The team identified a significant variation in percent on-time between surgeons. This ranges from 0% on-time for several surgeons to 66% for the surgeon with the highest percentage of first cases that start on-time. The responses to the survey indicated that the surgeons with the lowest percentage of delayed first cases arrive between 6:50AM and 7:10AM. Additionally, the survey indicated that these surgeons’ cases frequently had their H&P completed prior to the day of surgery. The sweep log results indicated that an issue relating to the surgeon was the most common cause for delay.

Conclusions
1. *H&P completion has an effect on case start times.* Based on the findings from the methods, the team concluded that having H&P completed prior to the day of surgery for a surgeon’s cases has a positive effect on case start times and decreases pre-operative times.

2. *Surgeon pre-operative process effects case start times.* Based on the findings from the methods, the team concluded that having a surgeon arrive and visit their patient early has a positive effect on case start times, and increases the portion of cases that start on-time for a surgeon.

3. *Patient pre-operative tasks times vary.* Patients have different factors surrounding their personal case that can result in longer pre-operative times. Some of these factors can be prepared for, such as shaving and research. With controllable factors in mind, the EAASC can instruct patients who need extra attention to arrive at an earlier time than patients who don’t need extra attention.

4. *Delay reasons change over time.* Through observations and qualitative data provided by the Nurse Manager, the team found that reasons for delays change over time. The team concluded that the sweep log effectively provides a method to record delay reasons.
Recommendations
The team recommends requiring H&P to be completed prior to the day of surgery, standardizing surgeon pre-operative process and standardizing arrival time, adjusting patient arrival times based on predetermined factors, and including a Sweep Log in the Debrief Form.

- **Require H&P completed before day of surgery.** The team recommends that surgeons require all patients to receive their H&P before the day of surgery. Completed H&P forms will reduce the total time required to complete pre-operative processes to ensure the patient is ready to be wheeled in at the scheduled start time.

- **Standardize surgeon pre-operative process.** The team recommends the administrative staff implement a formal process to have all surgeons arrive at least 30 minutes before the scheduled start, change into scrubs, and then consult with the patient at least 20 minutes before the case starts.

- **Adjust patient arrival times based on predetermined factors.** The team recommends the patient arrive to the EAASC either 75 minutes or 90 minutes before the scheduled case start time, dependent on whether the patient is a research candidate or requires shaving of the surgery site.

- **Include Sweep Log in the Debrief Form.** The team recommends a post-surgery huddle of the surgeon, anesthesiologist, and circulating nurse in the OR during the debrief process. The team recommends a new section in the online Debrief Form to include standardized reason codes from the manual Sweep Log. Data from the Debrief Form will be captured in the EAASC internal report system for future analysis as a continuous improvement initiative.
Introduction

The East Ann Arbor Surgical Center (EAASC) at the University of Michigan Health System performs outpatient ambulatory surgical procedures in General Surgery, Gynecology, Orthopedics, Oncology, Otolaryngology, Plastic Surgery, and Urology, as well as several other surgical departments. The EAASC has six Operating Rooms (ORs) that operate from 7:00 AM to 5:00 PM, Monday through Friday. On Thursday, first cases are scheduled to begin at 8:30 AM; all other day’s first cases are scheduled to begin at 7:30 AM.

The EAASC Nurse Manager is concerned with delays for FCOTS. Delays propagate throughout the day, where last cases may be significantly delayed. In addition, the providers have expressed dissatisfaction with the delayed starts because staff may be required to work after their scheduled shift end time. Additionally, the EAASC has been paying overtime and over-appointment costs due to late starts. The Nurse Manager wants to know what factors causes delays in FCOTS and requested an Industrial and Operations Engineering (IOE) 481 student team from the University of Michigan to determine the current state of FCOTS, identify the main drivers that cause delays, and provide recommendations to achieve 65% to 85% FCOTS. The purpose of this final report is to present the current state of FCOTS at the EAASC, detail the tasks performed by the IOE 481 student team, provide the findings and conclusions from the tasks performed by the team, and offer recommendations to achieve the desired goal.

Background

EAASC was opened in 2006 as an outpatient surgery center located in Ann Arbor, Michigan. The facility was focused on performing minimally invasive surgeries on patients with low acuity. It is financially structured differently than other UMHS facilities and operates under policies unique to the surgery center. The EAASC uses the Funds Flow Model, which provides annual payouts to each surgery department with ownership at the EAASC. In 2014, the EAASC generated $8.8 million in revenue, the profits of which were distributed among the departments with ownership. Once payouts are received, each department may allocate funds internally.

The EAASC has six ORs that perform outpatient surgeries. In addition to the ORs, there are ten pre-operative bays and ten post-operative bays. Medical staffing includes surgeons, anesthesiologists, surgery residents, anesthesia residents, nurses, and medical assistants. The surgeons are scheduled through a block scheduling format, and anesthesiologists are assigned to rooms on specific days. The nursing staff rotates between pre-operative, post-operative, and circulator nurse positions. The EAASC does not currently have a formal policy for the pre-operative process for providers. There is no established time to arrive to the EAASC, nor are there well-defined tasks that must be completed before the patient enters the OR. As a result, the pre-operative tasks may vary among surgeons and anesthesia providers.

The Nurse Manager of pre-operative care instructs the first case patient to arrive to the center at 6:15 AM. The first cases are scheduled to begin at 7:30 AM, except on Thursdays, which begin at 8:30 AM. Cases are scheduled to continue until 5:00 PM each day. Patients are six years old and above, and have an ASA rating from one to three, which indicates a low severity physical
status on a six-point scale. Patients are expected to arrive on-time, dress in appropriate attire, take pre-surgery medications, and ensure pre-surgery personal care. Once a patient checks in at the EAASC front desk, the pre-operative nurse meets the patient in the waiting room and leads the patient to the pre-operative bay to begin the pre-operative process. After all pre-operative tasks are completed, patients are wheeled into the OR. The EAASC defines on-time as the patient has completed all pre-operative tasks and has entered the OR at or before the scheduled start time.

**Project Scope**

This project includes all processes before the first case enters the OR. The pre-operative process begins when the patient arrives at EAASC and ends when the patient is wheeled into the operating room. The team observed the work flow of all staff members during pre-operative procedures for the first case each day to understand opportunities for improvement.

This project does not include any tasks during or after surgery, or any patients following the first case of the day. Additionally, the team will not analyze block scheduling. Any surgical procedures outside of EAASC will not be studied during this project. The scope will not include the work of the scrub technician or post-operative nurses.

The team initially considered the processes involved with preparing the OR; however, the MiChart operative record data showed that 73% of ORs are ready before the case is scheduled to begin. Additionally, the Nurse Manager informed the team that at EAASC, all rooms are assumed to be ready unless there is a last-minute change in equipment. Therefore, the team concluded no further analysis was needed into this parallel process.

**Methodology and Findings**

During the project, the team interacted with the EAASC nurses, surgeons, anesthesiologists, anesthesiologist residents, surgeon residents, and administrative staff. To collect and analyze data, the team used a literature search, observations, time studies, value stream mapping, historical data analysis, survey from surgeons, and a sweep log.

**Literature Search: Multidisciplinary approach**

The team examined four academic papers from the PubMed and University of Michigan databases on creative and feasible solutions that have been successful in preventing case delays at various medical centers. Specifically, the articles cover first case on-time starts in neurological operating rooms where a multidisciplinary medical team was utilized to increase FCOTS [1], first case on-time starts in an academic institution where processes were re-designed with visible and time-specific goals [2], a qualitative analysis where medical professionals were surveyed about start time delays [3], and an analysis of on-time starts in Canadian hospitals where the staff implemented morning huddles [4].

Based on information provided by the Lean Coach, the team studied two additional papers that investigate pre-operative studies. A study titled *Emergency Department - Medical Admissions*
Faculty Handoff Study and Recommendations [5] was conducted at University of Michigan Hospital (UH). The report provides examples of Value Stream Mapping (VSM) and time study analysis in a healthcare setting, which the team used as a model for VSM on pre-operative processes. The second report, titled Inpatient Tracking Analysis and Process Standardization at Mott Children’s and Women’s Hospital [6], also provides examples of VSM and time studies for improving the full care episode of admission, care delivery, and discharge.

Observations and Time Studies: 14 Steps Pre-Operative Process
The team observed tasks in the pre-operative bays at EAASC and collected quantitative data on the duration and sequence of pre-operative tasks required to prepare the patient. Specifically, the team investigated the interactions and coordination between surgeons, anesthesiologists, nurses, medical assistants, and patients.

The team observed 24 patients over four days, where each morning included six first cases to fill each of the six ORs. The team collected data Monday through Thursday mornings, with first cases scheduled for 7:30 AM Monday to Wednesday, and 8:30 AM on Thursday. Through these observations and collaboration with the Nurse Manager, the team created 14 standardized tasks that chronicle the pre-operative steps.

The following list describes the standardized pre-operative steps or medical provider working with patient:

1. Arrival in waiting room
2. Arrival in pre-operative bay
3. Bathroom
4. Changing
5. Medical Assistant
6. Pre-operative Nurse
7. Shaving
8. Research
9. Anesthesiologist
10. Anesthesiologist Resident
11. Surgeon
12. Surgical Resident
13. Ready for OR
14. Wheels in to OR

The team used Microsoft Excel to generate summary statistics, shown below in Table 2. The longest task is the Pre-operative Nurse caring for the patient, which takes an average of 17.9 minutes. There are two optional tasks, shaving and research, that only occur for 25% of patients. Task 13 shows that the patient was ready to be wheeled in 40% of the time, but did not immediately travel to the OR. Steps 1, 2, and 14 are not shown because they do not include duration of time. Rather, they indicate when certain tasks have been completed. The team also used the time study information to generate a VSM. Table 1 shows the minimum, average, and maximum amount of time for each task or provider.
Table 1: Time Study Summary Statistics

<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
<th>Min. Time</th>
<th>Average Time</th>
<th>Max. Time</th>
<th>% of Patients</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waiting Room</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Pre-Op</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Bathroom</td>
<td>2.00</td>
<td>4.39</td>
<td>11.00</td>
<td>90%</td>
<td>3.95</td>
</tr>
<tr>
<td>4</td>
<td>Changing</td>
<td>3.00</td>
<td>7.12</td>
<td>17.00</td>
<td>100%</td>
<td>7.12</td>
</tr>
<tr>
<td>5</td>
<td>Medical Assistant</td>
<td>3.00</td>
<td>9.53</td>
<td>24.00</td>
<td>100%</td>
<td>9.53</td>
</tr>
<tr>
<td>6</td>
<td>Pre-op Nurse</td>
<td>5.00</td>
<td>18.84</td>
<td>36.00</td>
<td>100%</td>
<td>18.84</td>
</tr>
<tr>
<td>7</td>
<td>Shaving</td>
<td>5.00</td>
<td>9.40</td>
<td>14.00</td>
<td>25%</td>
<td>2.35</td>
</tr>
<tr>
<td>8</td>
<td>Researcher</td>
<td>0.00</td>
<td>4.00</td>
<td>7.00</td>
<td>25%</td>
<td>1.00</td>
</tr>
<tr>
<td>9</td>
<td>Anesthesiologist</td>
<td>1.00</td>
<td>6.00</td>
<td>15.00</td>
<td>75%</td>
<td>4.50</td>
</tr>
<tr>
<td>10</td>
<td>Anesthesia</td>
<td>2.00</td>
<td>12.64</td>
<td>30.00</td>
<td>70%</td>
<td>8.85</td>
</tr>
<tr>
<td>11</td>
<td>Surgeon</td>
<td>1.00</td>
<td>5.11</td>
<td>20.00</td>
<td>100%</td>
<td>5.11</td>
</tr>
<tr>
<td>12</td>
<td>Surgical Resident</td>
<td>2.00</td>
<td>4.62</td>
<td>9.00</td>
<td>65%</td>
<td>3.00</td>
</tr>
<tr>
<td>13</td>
<td>Ready Time</td>
<td>0.00</td>
<td>2.43</td>
<td>8.00</td>
<td>40%</td>
<td>0.97</td>
</tr>
<tr>
<td>14</td>
<td>Wheels in</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>84.08</td>
<td></td>
<td></td>
<td>65.22</td>
</tr>
</tbody>
</table>

Swim Lane Diagram and Value Stream Map

Using the observation and time study data, the team developed a Swim Lane Diagram with lanes for each medical staff member involved in the patient pre-operative process, shown in Appendix 1. The steps that are shown do not necessarily occur in chronological order from left to right. Rather, after the patient has completed changing, the medical staff, surgeons and anesthesiologists, and researchers interact with the patient in no particular order or sequence. Any optional tasks are shown with the dotted border of the task box in Appendix 1.

The Swim Lane Diagram allowed the team to document sequential and parallel tasks, and helped the team create a VSM, shown in Appendix 2. The VSM outlines similar information to the swim lane diagram, but also includes process times from the time study data. In addition, the VSM shows the percentage of patients, on average, who experience each pre-operative step.

From the VSM, the value-added time for pre-operative tasks was an average of 61 minutes, which was less than the available time of 75 minutes. This confirmed the staff did not need more time to finish their pre-operative tasks and patients, on average, did not need to arrive earlier.

Historical Data Analysis

The team requested three months of MiChart operative records, from September to November 2014, from the Lean Coach and Ambulatory Care Project Manager. Before the team received the data it was cleaned by the Ambulatory Care Project Manager. This data set had 288 records. The
team then analyzed the data in order to identify potential drivers to delays in FCOTS. After the team performed preliminary analysis of various attributes, the team discovered a large variation in FCOTS between surgery faculty, anesthesia faculty, and surgery department. From this preliminary analysis, the team determined that a year’s worth of data was required to make statistically sound conclusions on drivers for delays in FCOTS.

The team received the new set of data for 2014 calendar year, which included 1,196 records. Based on analysis, the team discovered that FCOTS are 17.5% for 2014. When the team analyzed the time the OR was ready versus the scheduled start time, the data indicated about 73% of the rooms were ready before the scheduled start time for first cases. Based on this finding, the team concluded the OR preparation conducted by the scrubs did not contribute significantly to delays in FCOTS. After obtaining this result, the team investigated potential drivers in the pre-operative area. The team stratified the data by Surgery Department, Surgery faculty, Anesthesia faculty, ASA rating, month, and day of week. The results of this analysis, which are highlighted below and can be seen in more detail in Appendix D, show the cases of several surgeons start on-time far more often than others. This is shown in figure one below. Additionally, the data indicated that, on average, when a surgeon's case started late, some surgeon’s cases started later than others, which is shown in Figure 2 on the following page. Additionally, in order to gain an understanding of the magnitude of the problem, the team created a distribution of minutes late, which is shown in Figure 3 on the following page.

It should be noted the team removed from the analysis surgeons who have double bookings. A double booking defined as one surgeon scheduled for two cases in two ORs with the same start time. Depending on the surgery procedure type, the surgeon would switch between both ORs in an effort to reduce surgeon downtime.

The following figures show the percent and extent delays by surgeon and surgery department.

![Figure 1: Percent FCOTS by Surgery Faculty](image)

Source: MiChart Operative Records, Jan 2014 - Dec 2014, Sample Size 957
Figure 2: Average Minutes Late by Surgery Faculty
Source: MiChart Operative Records, Jan 2014 - Dec 2014, Sample Size 744

Figure 3: Distribution of First Case Minutes Late
Source: MiChart Operative Records, Jan 2014 - Dec 2014, Sample Size 964
**Sweep Log**

The team developed a Sweep Log in order to identify the reasons for delays that result in first cases not starting on-time. Delay reasons used in the sweep log were based on a similar UMHS first case start project. [7] After the sweep log was created the charge nurse recorded the delay reasons on the sweep log for all first cases (Appendix E). The data was collected and analyzed manually by the team in order to identify reasons for delays. From analysis of the pre-operative process and debrief process, the team identified the opportunity to add delay reason codes into the debrief form. This debrief occurs at the end of each surgery and would be completed by the entire surgical team.

**Survey**

The team surveyed three surgeons who were identified as having the highest percentage of first cases that start on-time based on the findings from the historical data analysis. These surveys included the following questions:

1. What time do you generally arrive to EAASC for your first case?
2. What time do you generally talk to your first case patient in the pre-operative bay?
3. Do you change into scrubs before you visit your patient in the pre-operative bay?
4. What time do your residents arrive at the EAASC in the morning? What specific instructions do you give them?
5. Do you send your patients to the pre-operative clinic to complete H&P forms?
6. Do your patients typically to have an H&P completed before the day of surgery?
7. What other factors do you believe allow your cases to start on-time?

The team identified several trends and findings from the surgeons’ responses. The first finding is the surgeon arrival time. Two out of the three surgeons indicated that they arrive at, or prior to, 7:00 AM. The third surgeon indicated that they arrive at the latest between 7:10 AM and 7:15 AM. Additionally, the team found all three surgeons indicated they visit their patient within five minutes of arriving at the EAASC. The final finding from the survey was information regarding H&P forms. Two out of three surgeons indicated they refer all patients to use the pre-operative clinic and have the H&P completed prior to the day of surgery, except in rare circumstances (e.g. a prominent athlete, or an out of town patient). The third surgeon indicated they complete approximately 50% of their H&P’s prior to the day of surgery.

Conclusions

1. **H&P completion has an effect on case start times.** Based on the findings from the observation data and the surgeon survey, the team concluded that having H&P completed prior to the day of surgery for a surgeon’s cases has a positive effect on case start times, and increases the portion of cases that start on-time. Additionally, the data indicated that having H&P completed prior to the day of surgery results in shorter total pre-operative times.

2. **Surgeon pre-operative process effects case start times.** Based on the findings from the observation data and the surgeon survey, the team concluded that having a surgeon arrive and visit their patient early has a positive effect on case start times, and increases the portion of cases that start on-time for a surgeon.

3. **Patient Arrival.** Patients have different factors surrounding their personal case and situation. These factors can result in extra attention being needed during the pre-operative process. Some of these factors cannot be anticipated, such as going to the wrong location. However, other factors can be prepared for, such as shaving and research. With controllable factors in mind, the EAASC can instruct patients who need extra attention to arrive at an earlier time than patients who do not need extra attention.

4. **Continuous Improvement.** A fundamental concept of Lean and process improvement is a constant strive for continuous improvement. When multidisciplinary teams are on the same page in a working environment, they are better equipped to handle challenges that come along their way. The team concludes a sweep log incorporated with the Debrief Form will provide an avenue for constant analysis of delay reasons. By ensuring everyone agrees on why and how certain delays occurred, the team at the EAASC can continue to work towards more efficiency.

Recommendations

1. **Require H&P completed before day of surgery.** The team recommends all surgeons require their patients to have their H&P completed within 30 days prior to the day of
surgery. H&P forms can be completed during the initial consultation with the surgeon, at a UMHS pre-clinic, or with the patient’s primary care physician. Completed H&P forms will reduce the total time required to complete pre-operative processes, ensuring the patient is ready to be wheeled in at the scheduled start time.

2. **Standardize surgeon pre-operative process.** The team recommends a standard surgeon pre-operative process which includes a standardized surgeon arrival times at the EAASC.

   Recommended Standard Process:
   - The surgeon should arrive 30 minutes before the scheduled case start time.
   - The surgeon should change into scrubs and perform initial consultation with the first case patient 20 minutes before the scheduled case start time.
   - The surgeon should consult with nurses, anesthesiologists, and other medical team members prior to the case start.

3. **Adjust patient arrival times based on predetermined factors.** The team recommends the patient arrive to the EAASC either 75 minutes or 90 minutes before the scheduled case start time, dependent on patient factors. The observation data showed cases with predetermined factors, such as being a candidate for research or requiring shaving, needed additional time. Therefore, the patient will be assigned to arrive 90 minutes before the scheduled case start time if they meet either of the two predetermined factors.

<table>
<thead>
<tr>
<th>Please check all that apply. Select the column that contains the highest number of satisfied criteria.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗ Patient is scheduled for standard surgery operation.</td>
</tr>
<tr>
<td>✗ Patient has completed H&amp;P at pre-operative clinic or primary care physician.</td>
</tr>
<tr>
<td>✗ Patient requires block anesthesia.</td>
</tr>
</tbody>
</table>

Patien should arrive to EAASC **75 minutes** before their scheduled surgery time. Patient should arrive to EAASC **90 minutes** before their scheduled surgery time.

**Figure 5: Recommended Checklist for Pre-Operative Phone Call**

4. **Include Sweep Log in the Debrief Form.**

   The team recommends a post-surgery huddle in the OR during the debrief process of each case. The huddle will require a multidisciplinary team of the surgeon, anesthesiologist, and circulating nurse to agree on a delay reason code for cases that were wheeled in to the OR after the scheduled start time. The online Debrief Form will include a new section to be filled out with standardized reason codes to implement a system of continuous improvement, this is shown below.
**Case delays**

- Patient Issue
- Surgeon Issue
- Nursing Issue
- Anesthesia Issue
- OR Not Ready
- Wait for consent or H&P
- Staggered/Planned Late Start
- Equipment/instrument Issue
- Preop orders incomplete
- Scheduled procedure did not include equipment needed
- Site Unmarked
- Other (explain)

**Describe the problem**

**Describe the implemented or proposed solution**

---

**Figure 6: Recommended Debrief Form**

Reasons for delays change over time, therefore a Sweep Log will be integrated in the current process to continuously address FCOTS. Data from the Debrief Form will be captured in the EAASC internal report system for future analysis.

**Future Work**

The team identified five areas for future work. These will continue to push forward the recommendations made for continuous improvement.

1. **Conduct detailed observations and time studies to remove rework in pre-operative process.** Caring for surgery patients requires the coordination of many medical providers during the pre-operative process. During initial observations, the team recognized the need for effective communication and team work among all medical providers. The delivery of patient’s care can be interrupted or inhibited in order to allow another provider to care for the patient, which may result in rework. Future work should analyze the sequential and consecutive steps in the pre-operative process to eliminate rework amongst many providers.

2. **Analyze factors for patients with pre-operative tasks requiring more than 75 or 90 minutes.** The time study and historical data identified patients who may need more than 90 minutes in the pre-operative process. The team recommends further analysis to identify more patient factors that require a longer pre-operative time. For example, qualitative data suggests block anesthesia requires a significantly longer preparation time than other forms of anesthesia. Further analysis should be conducted into the most appropriate scheduling and handling of block cases, and whether block anesthesia is a factor for longer pre-operative time.

3. **Continuously analyze trends in Debrief Form.** The Debrief Form was designed as a tool for continuous improvement. It will quantify the number of cases delayed and the corresponding reasons for delay. The Debrief form will prompt further changes to address the most common delays. Ultimately, the EAASC should continue work to increase FCOTS.
4. Analyze financial impact of all case delays. The scope of the project only included first cases at the EAASC. Delays may apply to all cases, and the financial impact may be significantly larger than the team’s financial analysis. The team recommends investigating the financial impact of all cases, specifically with regard to overtime and over-appointment costs. The Funds Flow Model may be used to identify the financial impact by department, which may provide further financial incentives to increase on-time cases.
References


Appendix

Appendix 1: Swim Lane Diagram
Appendix 2: Value Stream Map
Appendix 3: Historical Data Analysis

**FCOTS Percentage by Anesthesiologist**

- [Graph showing FCOTS percentage by anesthesiologist with a legend for Percent On Time and Cumulative Percent of Cases.]

**Average Minutes Late by Anesthesiologist**

- [Graph showing average minutes late by anesthesiologist with a legend for Average Minutes Late and Cumulative Percent of Cases.]
First Case Sweep Log

**Instructions:** For each first patient of the day, please fill out the corresponding reason code number for delay. If patient was on-time and wheeled in before 7:30 or 8:30 AM, use reason code 1. Thank you!

**Reason Codes**

1. No Delay  
2. Patient Issue  
3. Nursing Issue  
4. Surgeon Issue  
5. Anesthesia Issue  
6. OR Not Ready  
7. H&P/Consent  
8. Stagger/Planned Late Start  
9. Supplies/Equipment Issue  
10. Site Unmarked  
11. Process Change Impact  
12. Unknown  
13. Other (Add Notes)

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