

University of Michigan Health System

Program and Operations Analysis

Analysis of First Case Start Time Delays in the Operating Room of C. S. Mott Children's Hospital: Pre-Med, History and Physical, and Consent Issues

Final Report

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Date: December 12, 2006

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Executive Summary

The analysis of first case start time delays in the operating rooms (OR) of C. S. Mott Children's Hospital is a study requested by the Nurse Manager of Operating Rooms and the Nurse Manager of Post Anesthesia Care Unit (PACU). The purpose for this study was to identify the reasons for delays associated with pre-medication and history and physical (H&P)/consent. These delays lead to an increase in overtime and facility costs, and lead to a perception of decreasing patient and employee satisfaction.

Approach and Methodology

Initial meetings with our client and coordinators were utilized to further understand the problem, determine the scope, and develop a plan to complete the project. Observations and data collection were conducted over fifteen days, from October 9 to October 31, 2006 excluding weekends. Data was divided between non-Thursday (Monday, Tuesday, Wednesday and Friday) and Thursday cases. To identify data collection methodologies and possible solutions proposed by other health systems, our team conducted a literature search and sent an e-mail was sent to The University HealthSystem Consortium (UHC) – a group of hospital administrators from university health systems.

Our team interviewed preoperative staff, PACU nurses and anesthesia staff. A Swim-lane value stream diagram was mapped to demonstrate the process from patient arrival to departure for the OR the morning of surgery. The interview results were used to construct an Ishikawa (fishbone) diagram to identify root causes, and a diagram mapping the types (electronic vs. verbal) of communication was constructed.

Findings

Data collection, observations, interviews, the literature search and the e-mail to UHC yielded the following findings. A more thorough discussion of the findings can be found in “Data Analysis and Findings,” below.

- Data collection, observations and interviews revealed the following relevant findings:
- On average, the patients arrived in the preoperative waiting room for check-in at 6:12 am (non-Thursday)/7:06 am (Thursday).
- Patients were taken to the PACU for an initial evaluation at 6:33 am (non-Thursday)/7:24 am (Thursday).
- PACU nurses arrived to evaluate the patient at 6:40 am (non-Thursday)/7:38 am (Thursday). PACU nurses labeled the patient “Review” (outstanding issues) or “Go” at 6:54 am (non-Thursday)/7:52 am (Thursday), spending an average of 14 minutes with the patient.

- Communication of outstanding issues and paperwork completion to the PACU nurse was often poor.
- The “Review” and “Go” forms were sometimes unavailable and required extra movement.
- Clocks in the PACU are not synchronized to each other or the Computer clock for the OR Management Information System (ORMIS) which collects delay data.
- The first anesthesia staff arrived, on average, at 7:11 am (non-Thursday)/8:07 am (Thursday) and departed at 7:21 am (non-Thursday)/8:15 am (Thursday), spending an average of 10 minutes evaluating the patient.
- Pre-meds were identified, on average, at 7:07 am (non-Thursday)/8:02 am (Thursday) and administered at 7:20 am (non-Thursday)/8:20 am (Thursday). The average wait time between initial identification of the pre-med and administration was 13 minutes.
- Anesthesia staff was often unable to locate their patients and relied on the PACU nurse for assistance.
- Anesthesia adjusts the daily schedule for surgeon lateness.
- The “Review” and “Go” forms are a good visual cue for staff members to identify outstanding issues; however, definitions inconsistent between staff members.
- Interest exists to establish a more extensive anesthesia screening clinic.
- The OR nurse arrived to evaluate the patient at 7:21 am (non-Thursday)/ 8:19 am (Thursday) and departed at 7:26 am (non-Thursday)/8:25 am (Thursday), with an average interview length of 4 minutes.
- The communication of OR readiness was complicated and involved a series of pages and phone calls to anesthesia staff.

Conclusions

The findings were utilized to develop the following list of conclusions. A more thorough discussion can be found in “Conclusions,” below.

- There is a significant amount of rework completed by the preoperative staff in checking *Care Web* for updated patient H&Ps and consents.
- No standardized process exists for contacting the service to resolve outstanding issues.

- There is a significant amount of rework completed by the PACU nurses in rechecking *Care Web* and locating staff members to complete, or who have already completed, the outstanding issues.
- Patient issues are not resolved effectively because: the patient is not properly labeled “Review” because the form tray is empty, and when staff members arrive to update H&Ps and consents it is not communicated to the PACU nurse.
- Delays in patient evaluation occur because multiple staff members are trying to evaluate the patient in the same time frame.
- The clocks in the PACU are not synchronized to each other and therefore staff members cannot accurately pace their morning activities.
- The staff members throughout the OR lay blame for delays on each other. There is little investment in solving delays.
- A more thorough preoperative screening process should be explored.
- Poor communication between anesthesia and OR staff leads to delays bringing patient from the PACU to the OR.

Recommendations

Once data analysis was completed, the following recommendations were developed:

- Re-evaluate the red “Review” sheet: A space should be provided for the pager number of the person completing the surgical H&P and consent. This will eliminate delays if the H&P/consent cannot be located.
- Re-evaluate the blue Outpatient Cover Sheet: A date and time section should be added for when the service was contacted for an H&P.
- Visually set par levels for “Go” and “Review” sheet: Either a tear out book of sheets or a visual signal to indicate the need to replenish sheets.
- Relocate “Go” and “Review” sheet:
 - Laminate and attach to patient bays
 - Provide each bay with a supply
- Guarantee completion of paperwork:
 - No scheduling patient without H&P and consent
 - Visual cue for date on H&P and consent
 - Preoperative anesthesia clinic

- Synchronize clock times in PACU: The PACU clocks should be synchronized to the computer clocks in the OR which determine patient arrival in the OR. Also switch the clocks in the PACU from analog to digital, so that times can be easily read at a glance.
- Automatic paging system: This will notify staff members that a patient has not arrived and would aid in identifying patients after the first case of the day.
- Education: This is imperative for maintaining consistent standards for paperwork and patient care in the OR.
- Beeper Study: A beeper study should be conducted to determine staff work load. This study should allow staff management to gauge what percentage of work done by Registered Nurses is administrative and can be shifted. This study may also reveal that a new staff member should be added to coordinate H&P and consent with the services and patient arrival from inpatient floors.
- Continuous Outcomes Measurement and Improvement Technique (COMIT) Model: The COMIT model is a method to build team dynamics while making impacts on reducing first case start time delays. This model is an eight step process that involves the identification of variances or outcomes, building of a team that can effectively implement change, brainstorming root causes and developing implementation plans. After implementation of the action plans developed by the team, post implementation studies are conducted both on the variance and on the delays themselves. In one study this method produced a 26% increase in cases starting on time with a 50% reduction in surgeon lateness, despite the issue not being addressed. (Windle P.E. et. al., *Lippincott's Case Management – Appendix 14*)

Implementation of these recommendations should result in: improved first case start time accuracy, reduced costs for overtime and facility operations, improved quality of patient care, improved patient and employee satisfaction, greater understanding of existing OR standards at other university health systems, and improved communication between staff.

Introduction

The scheduling of cases in C. S. Mott Children's Hospital Operating Room (OR) is a complex process involving the coordination of patient arrival and staff availability. Despite best efforts, data collected from the OR Management Information System (ORMIS) between February 1, 2006 and June 30, 2006 shows that 78% of first cases do not start on time. This is particularly problematic for starting subsequent cases on time. Such delays lead to an increase in overtime and facility operating costs as well as a decrease in patient and employee satisfaction. To date, a survey conducted by the Nurse Manager of C. S. Mott Children's Hospital OR has identified several broadly defined reasons for the delays. Therefore, the OR Nurse Manager requested our team analyze two common reasons for delays: medication (pre-med) issues, and history and physical (H&P)/consent issues. Our team examined if the current method for collecting data is consistent with other hospitals' policies. To achieve this, our team performed observations of patient arrival and surgery preparation, interviewed the nursing and anesthesia staff, recorded duration of the circulator nurses' patient interview, and conducted a comprehensive literature search to determine benchmarking standards from other university health systems. From our conclusions, our team has developed recommendations to act as solutions to increase the accuracy of first case start time in C. S. Mott Children's Hospital OR. This report presents our data and findings as well as suggests possible recommendations to reduce delays associated with pre-med and H&P/consent.

Background

C. S. Mott Children's Hospital OR in the University of Michigan Health System performs more than 10,000 surgeries per year with a variety of specialties, including: Neurosurgery, Congenital Heart Surgery, Craniofacial Surgery, Otolaryngology, Ophthalmology, Plastic Surgery, Pediatric Surgery, Urology, and Orthopedic Surgery. Patients range from less than 1000 gram premature infants to adults with congenital defects.

The operating facilities include nine ORs, which are scheduled to start the first case of the day at 7:30am, and two treatment rooms, which are currently scheduled to start the first case of the day at 7:45am. Patients arrive on the morning of surgery and check-in at the preoperative waiting room. Patients are then taken from the preoperative waiting room to the Phase II Recovery Rooms of the Post Anesthesia Care Unit (PACU) where they are assessed. (See Appendix 1a,b)

Preliminary data collected from ORMIS between February 1, 2006 and June 30, 2006 indicates that 78% of first cases do not start on time. Furthermore, data collected between August 21, 2006 and November 22, 2006 by the Nurse Manager indicates that pre-med issues account for 9.8% of the delays while H&P/consent issues accounts for 11.5% of the delays. (See Appendix 2)

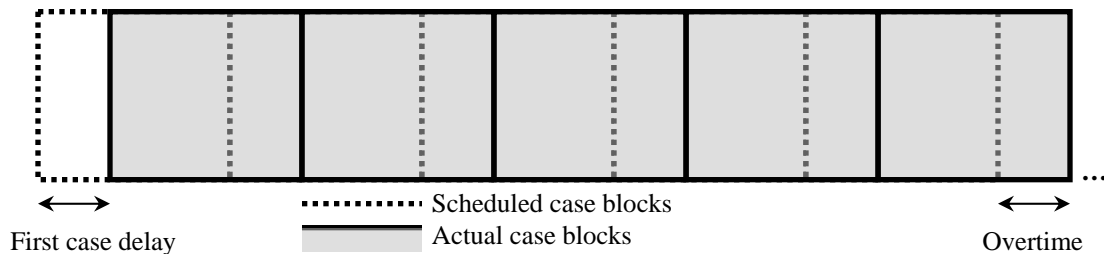
During the patient preparation in the PACU, patients may require medications 20 minutes prior to surgery (pre-med). These needs are identified on the morning of surgery by anesthesia staff who must then write an order for the appropriate medication. Anesthesia staff should be present with the patient by 7:00am, following a daily lecture that all anesthesia residents attend. Once the order is written and filled, a nurse must be available to administer the medication. The anesthesia staff is unaware of the patient's primary PACU nurse. Often, an anesthesia staff member stops a nurse and asks that the patient be given a certain medication. After administration of the medication, the PACU nurse must then locate the patient's primary nurse to notify them that a pre-med was administered.

A patient H&P is valid for 30 days while consents are valid for 6 months from the initial signature. The nurses in charge of the preoperative phone, calls the patient the day prior to surgery. When the patient is initially scheduled, Care Web is repeatedly accessed to check if updated H&Ps and consents are available. The preoperative clerks also access Care Web to identifying whether the H&P/consent are current and completes the Outpatient Cover Sheet (Appendix 3) indicating the status of these documents. The clerk then attaches a form to the patients' files indicating the status of their H&P and consent. The night prior to surgery, the clerk contacts the respective services to complete consents; however, the services' physicians or physician's assistant (PA) are not called until the morning of surgery to update the H&P and/or consent.

To make sure the H&P/consents are completed prior to surgery, a red tag is attached to each of the patients' files if the PACU nurse notices required information is missing. (See Appendix 4a) Additionally, some surgical sites must be marked by a staff member; however, there is misunderstanding between management and staff about which surgical procedures require marking. When these issues are resolved, the red tag is removed and the patient chart is labeled with a green tag reading "Go." (See Appendix 4b) This green tag indicates that all the preoperative paperwork is complete, but does not indicate that all the appropriate staff members have arrived to see the patient, namely: anesthesia, OR nurse and surgical team. Given the necessary coordination of patients, PACU nurses, PAs, physicians, residents and anesthesia staff, communication is essential.

OR case start delays have two impacts: an increase in overtime and facility operating costs, and a decrease in patient and employee satisfaction. The first impact we looked at is the increased overtime and facility operating costs. When the first case of the day starts behind schedule, the delay can set the rest of the cases in a given day behind schedule. The current OR scheduling model defines a case as starting on time if the patient is in the room by the scheduled case start time with a five-minute allowance. Cost analysis of financial statements from Fiscal Year 07 (FY07) through October for C.S. Mott Children's Hospital OR revealed that the lost revenue is \$56/minute unoccupied with a direct cost of \$15/minute of operation. Figure 1 demonstrates the effect on subsequent cases due to a delay in the start of the first case, while ignoring any potential further delays throughout the day. Starting the first case late leads to staff, both surgical and ancillary, having to stay later and contributes to overtime costs. There are also costs associated with using the facilities longer than scheduled.

Figure 1: Effect on Subsequent Cases Due to First Case Delay



The second problem to be addressed is the impact of delays on patient and employee satisfaction. During the preoperative phone calls the OR patients are classified as Nothing by Mouth (NPO), meaning that they are instructed not to consume food for a defined number of hours before surgery. In addition, patients are instructed to arrive an hour before their scheduled surgery. If cases are running behind schedule, the patients and their families must wait even longer before the surgery begins. This study was requested, therefore, to make recommendations to improve the accuracy of the start time for the first case through a better understanding of the root cause of pre-med and H&P/consent delays.

Goals and Objectives

Based on the timeframe of this project, our clients and coordinators agreed that predefining metrics to measure the impact of our recommendations would be difficult. The observation was made that eliminating pre-med and H&P/consent delays may highlight other causes for delays. This observation is consistent with other OR studies monitoring on-time performance in ORs (Lapierre et. al. *Health Care Manag. Sci.* – Appendix 5).

Thus, to determine why pre-med issues and H&P/consent issues are among the two most prevalent reasons for decreased accuracy in first case start time, our team accomplished the following tasks:

- Observed the processes involved in preparing patients for surgery
- Interviewed nursing staff to determine reasons for delays
- Analyzed whether H&P and consent status was identified during the preoperative phone calls
- Analyzed whether the pre-meds are given in time for surgery
- Collected data on the duration of OR nurses' interviews with patients
- Completed a comprehensive literature search on data collection methodologies

With the above information, we developed recommendations to:

- Eliminate two common reasons for delays: pre-med issues and H&P/consent issues
- Increase the accuracy of first case start time
- Increase patient and employee satisfaction
- Provide administration and staff with benchmarks from other university health systems

Project Scope

This project looked at only the first surgical cases in each room on a given day in C. S. Mott Children's Hospital in the University of Michigan Health System (UMHS). The project scope included the following:

- Three types of patients:
 - Inpatients: arrive in the OR from patient care units in the University of Michigan Health System (UMHS)
 - Outpatients: arrive in the OR based on a previously scheduled appointment and return home post surgery
 - Admit-day-of-procedure patients (ADP): arrive in the OR based on a previously scheduled appointment, however, these patients are admitted to hospital care units post surgery
- All services that perform surgeries in C. S. Mott Children's Hospital
- ORs 2 through 9 were included, as well as the two treatment rooms
- The staff whose activities fell within the project scope included:
 - OR nurses
 - Anesthesia staff
 - Clerks

- PACU nurses
- Patients and families
- Nurses in charge of preoperative phone calls

The following were excluded from this project:

- The transportation of inpatients to the OR
- Emergency cases: cases that are identified as urgent
- OR-1, due to current room renovations
- Surgeons' schedules and activities, however process input was sought
- Anesthesia Procedure Room (APR) patients
- Procedures scheduled for Saturday and Sunday

Approach and Methodology

The following is a discussion of the approach and methodologies utilized to conduct: Mott OR PACU observations, value stream mapping, interviews, and literature search and University HealthySystem Consortium email.

MOTT OR PACU Observations

Data collection was conducted between October 9 and October 31, 2006 in the C. S. Mott Children's Hospital PACU. These observations helped our team develop a deeper understanding of the processes that occur prior to the patient entering the OR as well as to provide a timeline for when staff members arrive to complete their evaluation.

Patients arrive in the preoperative waiting room and are greeted by a clerk who checks the patient in and provides a preoperative anesthesia interview form. Patients are then greeted by a Medical Assistant (MA) who either weighs and measures the patient in the preoperative waiting room or takes the patient and family directly to the PACU to be evaluated by the PACU nurse. (See Appendix 1a)

A copy of the data collection form used during the three weeks of observations is provided in Appendix 6. The data collection form was pilot tested on Friday, October 6, 2006 and any necessary changes were made at that time. The form is divided into four sections: Patient Information, PACU Nurse Interview, OR Nurse Interview and Anesthesia.

Our team arrived on the OR surgical floor of C.S. Mott Children's hospital at 6:00 am on Monday, Tuesday, Wednesday and Friday during the data collection period. Cases on

Thursday are delayed one hour due to a surgical in-service, so we arrived at 7:00 am. The following data was collected:

Data Collected in Patient Information:

- Arrival time in the preoperative waiting room
- Gender
- OR assignment
- Service performing the surgery
- Whether the surgery was a first case
- Patient admissions status (Inpatient, Outpatient, or Admit Day of Procedure)
- Who answered questions in the preoperative waiting room
- What time the patient left the preoperative waiting room.

Data Collected in PACU Nurse Interview:

- Arrival and departure time
- Interview start and end time
- Patient introduction
- Who answered questions in the PACU concerning:
 - NPO
 - Allergies and reaction type
 - Health issues
 - Medications
- Vitals start and end time
- Pre-med identification time (if pre existing order)
- Additional comments

Data Collected in OR Nurse Interview:

- Arrival and departure time
- Interview start and end time
- Patient identification and introduction
- Question types asked:
 - NPO
 - Allergies and reaction type
 - Health issues
 - Medications
 - Additional questions already asked
- Additional Comments

Data Collected in Anesthesia:

- Arrival and departure time
- Interview start and end time
- Patient identification and introduction
- Pre-med identify, request, written and given times
- H&P start and end times

- Whether the surgeon arrived
- Incision mark time
- Additional questions already asked
- Additional comments

Additionally, the time the OR was ready and who took the patient to the OR was collected.

The data was entered into a spreadsheet in *Microsoft Excel* and analyzed using the functions available in the program.

Value Stream Mapping

After one week of observations, our team developed a value stream model for the processes that occur from the preoperative waiting room through the PACU leading up to the patient's departure to the OR. Patient evaluation involves the coordination of several groups of staff and, therefore, our team decided to utilize a Swim-Lane Value Stream (See Appendix 7).

The Swim-Lane Value Stream tool was chosen because it allowed our team to illustrate the processes, responsible parties, and locations. It also allowed our team to illustrate where patients were being handed off to other staff members for evaluation. Our model includes the activities of the PACU nurses, OR nurses and anesthesia staff.

The arrows crossing the three lanes of the diagram indicate patient handoff and the "silo" culture that exists in the Mott OR PACU, demonstrated by the communication that currently exists in the PACU between the different staff groups. Once the value stream had been developed, it was reviewed with three PACU nurses to assure it accurately reflected their activities.

Interviews

Interviews were conducted to better understand the internal operations. In addition, delays were thought to have a large impact not only on cost but patient and employee satisfaction. As such, our team conducted interviews to gauge the level of employee satisfaction.

To better understand the nature of employee frustrations and to identify a root cause for the pre-med and H&P/consent delays, interviews were conducted with: preoperative staff, PACU nurse staff and anesthesia staff.

Preoperative Staff Interviews:

The preoperative staff is composed of preoperative clerks, PACU nurses and Medical Assistant (MA). The preoperative clerk checks patients in and contacts services for H&P. The PACU nurses call patients the day before surgery to given them preoperative

instructions. The MA transports patients from the preoperative waiting room to the PACU.

Interviews were conducted informally during periods of lighter patient load so staff members could complete daily activities. During observations, our team made note of any obstacles, rework or unneeded motions and then used interview periods to discuss them with preoperative staff members. Staff members were also asked to clarify any actions they took throughout the process.

PACU Nurse Staff Interviews:

PACU nurses are responsible for completing the initial patient evaluation and vital signs (blood pressure, temperature, weight, height etc.). Interviews were conducted informally during periods of lighter patient load to assure the nurses could complete daily activities.

During observations, our team made note of any obstacles, rework or unneeded motion and then used opportunities of lighter patient load to address these issues and discuss them with the staff members. Staff members were also asked to clarify any actions they took throughout the process.

Anesthesia Staff Interviews:

Anesthesia staff handles many cases throughout the day. Faculty members can be assigned to two cases at a time. As such, it proved difficult to interview anesthesia staff while working in the PACU. Therefore, our team arranged interviews with anesthesia faculty (2), residents (2) and certified registered nurse anesthetists (CRNAs) (2). A list of questions was generated (See Appendix 8). Interviews lasted between 30 and 45 minutes.

The data collected from interviews was utilized to construct an Ishikawa or Fishbone cause and effect model (Appendix 10). This diagram illustrates the contributing factors for delays.

Literature Search and University HealthSystem Consortium (UHC) E-mail

The precedent set by other university health systems can be used to determine standards and definitions for first case start times as well as provide methods to improve first case start time accuracy. As such, our team utilized *Pubmed* to search for published literature from other hospital ORs. Our team concentrated our search on large university health systems with pediatric OR suites, similar to UMHS. However, this search criterion proved to be too limiting to return any results, so “First Case Start Time Analysis” and “OR” were used as the primary search criterions.

The goal was to determine if other health systems’ standards were consistent with C.S. Children’s Hospital OR’s standards and if there were any data collection methods that could improve the reporting and accuracy of first case start time delays. In addition, primary literature was utilized to gain insight into possible improvement measures.

Additionally, a group of university hospital administrators exist through the University HealthSystem Consortium (UHC). Our group utilized these administrators to determine definitions of first case start time, and if any quality initiatives were currently being examined or implemented at other university health systems. The UHC group consists of 245 full and associate members. Our team drafted an e-mail (See Appendix 9) and after reviewing it with our coordinators, the e-mail was sent out.

Data Analysis and Findings

The following are the findings collected from: Mott OR PACU observations, value stream mapping, interviews, and literature search and University HealthSystem Consortium email.

MOTT OR PACU Observations:

After a trial run of data collection on October 6, 2006, data collection began on October 9 and was completed on October 31. Data was collected Monday through Friday and did not include October 16 and 17. Fifteen days of data collection were completed. Within these days, data was collected on between two and four patients. Our team had a total of 73 data points at the end of data collection.

Patient Information Observation Findings:

Data on patient arrival in the preoperative waiting room was collected and analyzed to get an average patient arrival time and associated standard deviation. Data was also collected and analyzed on the time that the patient arrived in the PACU, which correlated with the time that the patient left the preoperative waiting room. Table 1, below, shows the average time and standard deviation of patient arrival in and departure from the preoperative waiting room.

Table 1: Average patient arrival in and departure from the preoperative waiting room for non-Thursday versus Thursday cases (n = 29)

	Average (am/pm)	Standard Deviation (min)
Patient Arrival in Waiting Room		
Non-Thursday	6:12 am	9 min
Thursday	7:06 am	8 min
Patient Arrival in PACU		
Non-Thursday	6:33 am	13 min
Thursday	7:24 am	13 min

The data collected is subdivided between cases on Monday, Tuesday, Wednesday or Friday (non-Thursday), and Thursday. The standard deviations for arrival to and departure from the preoperative waiting room are almost equal for the non-Thursday and Thursday cases.

PACU Nurse Observation Findings:

After patients arrive in Phase II Recovery of the PACU, they are met by a PACU nurse who introduces him/herself and identifies the patient, family and procedure. The PACU nurse takes the patient's weight, height and vital signs and records them in the surgical flow sheet.

Our team recorded the times at which the PACU nurse arrived and departed. The time at which the PACU nurse began and ended her interview with the patient was also collected. This period represents actual patient touch time. The time associated with the beginning and end of the vital signs was collected. The times for these three aspects were used to calculate an average duration. Tables 2 and 3, below, show the average time and standard deviations for the associated tasks.

Table 2: Average and standard deviation for PACU nurse arrival/departure time, PACU nurse interview start/end time, PACU nurse vital start/end time and associated duration for non-Thursday cases (n = 58)

	Average	Standard Deviation (min)
PACU Nurse		
Arrival	6:39 am	14 min
Departure	6:55 am	14 min
Duration	15 min	4 min
PACU Nurse Interview		
Start	6:40 am	13 min
End	6:54 am	15 min
Duration	14 min	5 min
PACU Nurse Vital Signs		
Start	6:43 am	15 min
End	6:51 am	14 min
Duration	7 min	2 min

Table 3: Average and standard deviation for PACU nurse arrival/departure time, PACU nurse interview start/end, PACU nurse vital start/end time and associated duration for Thursday (n = 15)

	Average	Standard Deviation (min)
PACU Nurse		
Arrival	7:37 am	15 min
Departure	7:54 am	16 min
Duration	16 min	5 min
PACU Nurse Interview		
Start	7:38 am	16 min
End	7:52 am	17 min
Duration	14 min	4 min
PACU Nurse Vital Signs		
Start	7:42 am	15 min
End	7:49 am	15 min
Duration	8 min	3 min

The data indicates that the PACU nurse is spending on average between 15 and 16 minutes evaluating the patient and getting patient vitals. Of this, the nurse spends on average 14 minutes actually interacting with the patient. Vitals signs take on average 7 to 8 minutes. It is important to note that the data indicates the arrival/departure, interview start/end, vital sign start/end and the associated duration and standard deviation are similar for both the non-Thursday and Thursday cases.

Also collected from the PACU nurse during the observation period was the percentage of cases the PACU nurse asked the patient and the family questions on NPO, allergies, health issues and medications. Table 4, below, shows the percentage of observed cases during which the PACU nurses asked these questions of the patient and/or family.

Table 4: Percentage of observed cases that the PACU nurse asked the patient and/or family questions concerning NPO, allergies, health issues and medications (n = 73)

	Percentage (% of cases observed)
NPO	99 %
Allergies	93 %
Health Issues	97 %
Medications	96 %

The table indicates that in approximately 99 % of cases, the PACU asked the patient and/or family at what time the patient last had anything to eat or drink. The rest of the percentages for the questions vary from 93 % to 97 % of cases.

Data was also collected on who answered these questions. This data indicates that in 99 % of the cases, the family answers the questions. In 54 % of cases, the nurse is collecting data from the medical records and in 17 % of cases the patient is providing the preoperative information. Data may be collected from more than one source, indicated by the fact that the percentages do not add to 100 %. Since the nurse can collect data from several sources, this could account for why the patient is not asked questions concerning allergies in 100 % of cases.

During our observation period, it was observed that preoperative and PACU staff members were in charge of activities including: checking patients in, directing families to waiting rooms, handling calls from surgeons and anesthesia, organizing patient arrival from inpatient floors, contacting services to update H&P and consent.

While completing observations, our team noted that of the four clocks in the PACU each read a different time. In addition, the range of times from the clocks varied by as much as five minutes.

The red “Review” sheets and green “Go” sheets (See Appendix 4a,b) are pieces of paper which are not reused. They are kept in two central location where nurses must go to retrieve the sheets after they have completed patient evaluations and determined if all the paperwork has been completed (labeled “Go” Appendix 4b) or if some paperwork is still required (labeled “Review” Appendix 4a). It was observed that the PACU nurses attempt to couple movements to the nurses’ station to retrieve these forms with other activities. Additionally, our team observed instances of wasted time, such as when the PACU nurse was forced to retrieve a new vitals machine because the one at the bay was not working.

The H&P and consent is not always completed on the appropriate form and is easily lost within the patients’ files. This is necessary for completing the “Review” sheet and labeling the patient “Go.”

OR Nurse Observation Findings:

Our team recorded the times at which the OR nurse arrived and departed and the times at which the OR nurse began and ended her interview with the patient. Tables 5 and 6, below, shows the average time and standard deviations for the associated tasks.

Table 5: Average and standard deviation for OR nurse arrival/departure time, PACU nurse interview start/end, OR nurse vital start/end time and associated duration for non-Thursday cases (n = 45)

	Average	Standard Deviation (min)
OR Nurse		
Arrival	7:21 am	12 min
Departure	7:26 am	11 min
Duration	4 min	3 min
OR Nurse Interview		
Start	7:22 am	12 min
End	7:25 am	11 min
Duration	3 min	3 min

Table 6: Average and standard deviation for OR nurse arrival/departure time, PACU nurse interview start/end, OR nurse vital start/end time and associated duration for Thursday cases (n = 11)

	Average	Standard Deviation (min)
OR Nurse		
Arrival	8:19 am	6 min
Departure	8:25 am	6 min
Duration	5 min	4 min
OR Nurse Interview		
Start	8:19 am	7 min
End	8:24 am	5 min
Duration	4 min	4 min

The data indicates that the OR nurse is spending on average between 4 to 5 minutes evaluating the patient. Of this, the nurse spends on average between 3 to 4 minutes actually interacting with the patient. It is important to note that the data indicates there is a difference in standard deviations between the non-Thursday and Thursday cases.

Anesthesia Observation Findings:

Our team recorded the times at which the anesthesia staff arrived and departed and the times at which the anesthesia staff began and ended their interviews with the patient. Interview time indicates actual patient touch time. Tables 7 and 8, below, is the average time and standard deviations for the associated tasks.

Table 7: Average and standard deviation for anesthesia staff arrival/departure time, anesthesia interview start/end and associated duration for non-Thursday cases (n = 56)

	Average	Standard Deviation (min)
Anesthesia		
Arrival	7:11 am	9 min
Departure	7:21 am	8 min
Duration	10 min	6 min
Anesthesia Interview		
Start	7:11 am	8 min
End	7:20 am	9 min
Duration	9 min	6 min

Table 8: Average and standard deviation for anesthesia staff arrival/departure time, anesthesia interview start/end and associated duration for Thursday cases (n = 15)

	Average	Standard Deviation (min)
Anesthesia		
Arrival	8:07 am	13 min
Departure	8:15 am	12 min
Duration	9 min	9 min
Anesthesia Interview		
Start	8:07 am	13 min
End	8:15 am	11 min
Duration	9 min	5 min

The data indicates that the anesthesia staff is spending on average between 9 and 10 minutes evaluating the patient. Of this, anesthesia spends on average 9 minutes actually interacting with the patient. It is important to note that the data indicates there is a difference in standard deviations between the non-Thursday and Thursday cases, but not a significant difference. One common problem encountered in the PACU was an inability of anesthesia staff to find their assigned patients.

Also collected from the anesthesia portion of the observations were the times at which a pre-med was: identified, requested, the order written and the patient actually given the pre-med. Of the 73 cases observed, 20 of these cases involved a pre-med (approximately 27% of cases). Table 9, below, presents the average and standard deviations for the pre-med identification, request, order writing and actual administration of the medication for non-Thursday cases.

Table 9: Average and standard deviations for the pre-med identification (n = 20), request (n = 19), order writing (n = 20) and actual administration (n = 25) of the medication for non-Thursday cases

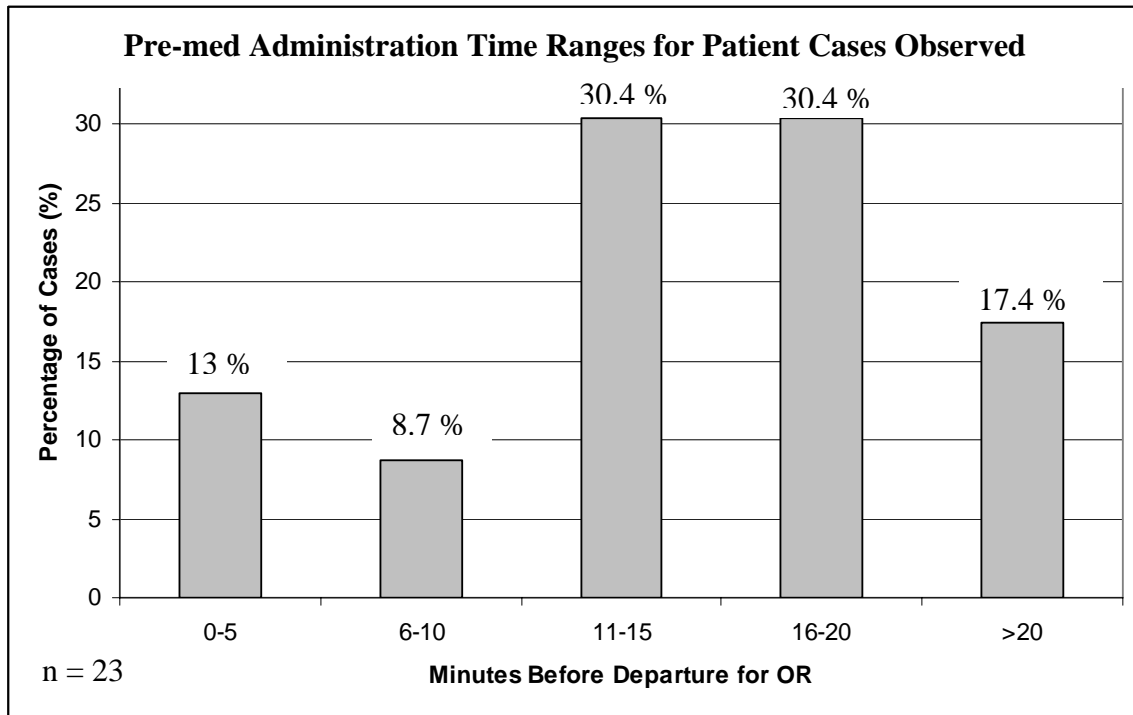
	Average (am/pm)	Standard Deviation (min)
Non-Thursday		
Identify	7:07 am	13 min
Request	7:12 am	6 min
Write	7:13 am	5 min
Administer	7:20 am	9 min

The data shows that, on average, the pre-med is administered 10 minutes before the case start. The data set for Thursday was too small to include.

Pre-med identification occurred, on average, at 7:07 am; however, the pre-med was not administered until 7:20 am. This is 13 minutes of wait time between identification and administration.

The data collected on pre-med administration time was correlated to the time the patient left the PACU to go to the OR. Figure 2, below, illustrates the percentage of cases observed the patients were given their pre-meds: 0-5 minutes, 6-10 minutes, 11-15 minutes, 16-20 minutes and > 20 minutes prior to surgery.

Figure 2: Percentage of patient cases observed that received pre-meds 0-5, 6-10, 11-15, 16-20 and < 20 minutes prior to leaving the PACU to go to the OR



Pre-med administration is 10 minutes prior the patient entering the OR. Pre-meds should be administered 5-20 minutes prior to entering the OR. The data indicates that 30.4 % of patients do not receive pre-meds within this range.

Our team noted that the delay for pre-med delivery was often associated with an inability to find a PACU nurse to access *Omniceil* to withdraw the pre-med. Additionally, the PACU nurse in charge of the patient was not necessarily the staff member contacted to administer the medication. Subsequently, the nurse that administered the medication would then be required to inform the patient’s nurse.

When a pre-med was administered, the average and median wait times between each of the following were calculated: Identification (I) to Request (R), Request (R) to Order Written (W), Order Written (W) to Administration (A). The average wait times and associated standard deviations are provided in Table 10, below.

Table 10: Average and median wait times from pre-med identification to request (I to R) (n= 18), request to order written (R to W) (n= 14), order written to administration (W to A) (n= 16), and identification to administration (I to A) (n = 23) with standard deviations

	I to R	R to W	W to A	I to A
Average	4 min	< 1 min	4 min	13 min
Median	< 1 min	< 1 min	3 min	5 min
Standard Deviation	12 min	1 min	3 min	14 min
Range	< 1 – 40 min	< 1 – 4 min	< 1 – 13 min	< 1 – 59 min

Table 10 indicates that while the average wait time between the different stages leading from pre-med identification to actual administration are not significant there is a high degree of variability for each of the wait times. In particular for the time from pre-med identification to request (I to R) indicated by the 3 minute difference between the average and the median and the large range of wait times observed. The wait time between pre-med request to administration (R to A) was determined to be 6 minutes with a 6 minute standard deviation. However, the median is 5 minutes which indicates that while the data ranges from < 1 minute to 25 minutes, the data is evenly distributed around the average of 6 minutes. The wait time between pre-med identification to administration (R to A) was determined to be 13 minutes with a 14 minute standard deviation. The data range is from < 1 minute to 59 minutes.

The incision mark time was collected (7:15 am +/-14 min for non-Thursday cases and 8:14 am +/- 15 min for Thursday cases) as well as the average time the PACU was notified the OR was ready (7:36 am +/- 10 min for non-Thursday cases and 8:31 am +/- 6 min for Thursday cases).

Our team observed that prior to the patient leaving the PACU, communication, either verbal or electronic, must exist between the anesthesia staff member bringing the patient and the OR nurse setting up the room. This communication was difficult to coordinate and relied occasionally on the OR nurses' estimate of when the room would be ready.

Value Stream Mapping

Our team flowcharted the process from patient arrival in the preoperative waiting room to departure from the PACU for the OR. This swim-lane can be found in Appendix 7. In addition to illustrating the associated processes for first case patient preparation, the swim-lane diagram illustrates the timeline for the associated tasks divided between non-Thursday and Thursday cases.

The swim-lane diagram provided in Appendix 7 illustrates the timeline from patient arrival in the preoperative waiting (6:12 am/7:06 am) room to the time the patient leaves for the OR (7:36 am/8:32 am). Based on the average time between patient arrival, it shows that the patients spend, on average, between 18 and 21 minutes in the preoperative waiting room.

From the arrival in the PACU, the patient is evaluated by the PACU nurse for, on average, 21 minutes. Once the patient has been labeled “Go” or “Review,” the patient waits on average between 15 and 17 minutes before anesthesia arrives and 27 minutes before the OR nurse arrives.

Interviews

The PACU nurse interviews were conducted informally. The interviews with anesthesia staff were conducted formally and a list of questions can be found in Appendix 8. The results of the interviews, along with the observations, were utilized to construct the Fishbone Diagram (Appendix 10).

The results of the interviews with the three different staff members were compiled and put into an Ishikawa Diagram (a.k.a. Fishbone diagram). This diagram is used to represent the root causes associated with the pre-med and H&P/consent delays as collected from the preoperative staff interviews, the PACU nurse interviews and the anesthesia staff interviews. This diagram is included in Appendix 10.

For each of H&P, pre-med, and consent delays, three common causes were identified. For H&P delays, the three causes were: poor communication, service not contacted and lack of education. For pre-med delays, the three causes were: lack of education, poor communication and external (those not related to the OR or preoperative area). For consent delays, the three causes were: poor communication, lack education and service not contacted. Several contributing factors were determined for the causes of these three delays as a result of the observations and interviews. These factors can be found in Appendix 10.

The observations and interviews revealed a need to evaluate communication between different staff members. A diagram of the communication that occurs between staff members and patients is provided in Appendix 11. The diagram is divided between day prior to surgery and day of surgery. It illustrates the movement of patients, staff and paperwork related to the patient. Although the straight (verbal communication) and jagged lines (electronic communication) exist between each staff member, these pathways are not consistently utilized.

Preoperative Staff Interview Findings:

Interviews with the preoperative staff revealed the process involved with scheduling and checking *Care Web* for patient records. Patient’s surgeries are scheduled as many as several months prior to the surgery date. Given this extended time frame, it is not always possible to guarantee that H&Ps and consents will be up to date for the day of surgery. Currently, the PACU nurses in charge of the preoperative phone calls keep files on each of the patients scheduled for future surgeries. There are currently two such files: the extended file and the next week file.

Several weeks before a new patient's surgery the nurse accesses *Care Web* and determines if any of the necessary paperwork was completed in the surgical clinic prior to scheduling. Available forms are printed and the patient's information is added to the folder for the appropriate date. As the surgical day draws closer, these files are periodically reevaluated to determine if the paperwork has been updated, but no further action is taken.

One week prior to the scheduled surgery, the patient files in the extended file cabinet are moved to the cabinet which holds patient information for the surgical schedule one week out. Some nurses access *Care Web* daily to reevaluate these patient's charts while other nurses do not reevaluate as regularly. The services and clinics are not contacted at this point if the H&P or consent is unavailable.

Two days prior to surgery, the clerks in the preoperative area are given the patients' charts. It is their responsibility to check to see if H&Ps and consents have been added to *Care Web*. H&Ps and consents are marked complete by the preoperative clerk even though the date is not correct or, in some instances, missing. The clerks complete the Outpatient Cover Sheet (Appendix 3). If a patient's consent is out of date, they will contact the service the night before the surgery so that, if possible, phone consent can be completed. The time and date of the phone call is recorded on the Outpatient Cover Sheet.

If a patient's H&P is out of date, the clerk will contact the service the morning of surgery to complete the H&P; however, this is not for all services (e.g. Urology) and the time and date of phone call is not recorded on the Outpatient Cover Sheet. Some services are not contacted for consent and H&P due to a fear on behalf of the staff that the service will be upset. Nurses have developed methods to work around these barriers (i.e. calling an OR nurse to remind the service that an H&P is out of date).

The preoperative staff also perceives it to be the anesthesia staff that sets the pace of a given day.

PACU Nurse Interview Findings:

Informal interviews with PACU nurses revealed that the nurses believe that anesthesia staff is not always punctual in arriving to assess patients. The perception is that when the anesthesia runs out of time, they will deliver an intranasal pre-med, because it works faster. This pre-med is more difficult to deliver and more traumatic to the patient and the family. PACU nurses also perceive it to be the anesthesia staff that sets the pace of a given day.

The interviews with the PACU nurses revealed concerns regarding the completion of the H&Ps and consents. The nurses felt personally liable and, therefore, were concerned that these documents were not always completed prior to the patient leaving for the OR. It is the preoperative clerk who is in charge of calling the services to update H&Ps and consents; however, the PACU nurses felt the clerks were overworked and occasionally did not contact the services.

Anesthesia Interview Findings:

Five of the six anesthesia staff members interviewed stated that they felt the PACU staff was overworked. In addition, one staff member stated that the preoperative staff is overworked and often blamed for outstanding paperwork issues not being resolved. Also, five of the six anesthesia staff members felt that the PACU staff evaluations not being completed prior to anesthesia evaluation hindered their evaluations and the assessment of a pre-med.

All anesthesia staff interviewed stated that a pre-med cannot be given until consent is signed. Our team was told that even if they attempt to give a pre-med prior to consent, the PACU nurse will refuse. After discussing this issue with our client, we were informed that this is no longer the standard and could account for why pre-meds are not given to patients 15 to 20 minutes prior to entering the OR. In addition, only two of the anesthesia staff members were able to provide a definition of “Go” consistent with the definition provided by our client and the PACU nurses.

The anesthesia interviews revealed that pre-meds should be given 5 to 20 minutes prior to surgery, but no more than 30 minutes prior to surgery. Interviews revealed that the actual time for delivery is dependent on the surgical staff working with the anesthesia team on a given day. The anesthesia staff will adjust their schedules if they perceive they are working with a surgeon who will be late.

Discussions concerning the anesthesia morning process revealed that is considered routine to locate patients in the PACU after the morning conference. The anesthesia staff is aware of the immanent automatic paging system, but is hesitant because they stated that automatic pages would be annoying for the first case. However, if the patient is late the anesthesia staff will return to the OR to complete setup of equipment and will not be notified of patient arrival until they return to the PACU.

Discussions of the paperwork revealed that the anesthesia staff utilized the “Review” sheet (see Appendix 4a) and believe it to be a good visual cue. Additionally, the Outpatient Cover Sheet, which is completed by the preoperative clerks, has sections dedicated for the anesthesia staff to complete. All anesthesia staff interviewed were unaware of the sheet and never utilized the form.

Some staff members were interested in potentially pursuing a more extensive clinical screening process; however, there are concerns that standardization in such a clinic would be difficult since anesthesia evaluations are not standardized. Additionally, patients traveling from further distances might not be able to arrive.

Literature Search and University HealthSystem Consortium (UHC) E-mail

This search revealed several key sources which are summarized in Appendix 5. Our team utilized these articles to aid in making recommendations and determining a common definition of first case start time.

The UHC e-mail resulted in 3 responses. Responding health systems included: University of California San Diego (UCSD), Cedar-Sinai and University of Virginia Health System. The responses to the e-mail can be found in Appendix 12.

Literature Search and UHC E-mail Findings:

The literature search and UHC emails were compiled and the results for first case start time definition and collection method (electronic vs. non-electronic) are provided as a summary below, Table 11.

Table 11: Start time definitions and delay collection methods by health system

Health System	Definition	Collection Method
Medical University of South Carolina	Patient in room, anesthesia ready, surgical preparation and procedure start	Non-electronic – OR nurse on standard form
SMBD – Jewish General Hospital, McGill University	Patient in room	Non-electronic - charted
University of Chicago	Patient in room	N/A
University of California San Diego	Patient in room	Electronic – ORSOS charting via circulator nurse
Cedar-Sinai	Patient in room	Electronic – online charting Non-Electronic – public scoreboard displaying data
University of Virginia	Patient in room	Electronic – GE information system with time stamp

Five of the six health systems use “patient in room” as the definition of their start time while one health system utilizes procedure start to monitor case starts. Two of the five health systems with known collections systems utilize non electronic data collection methods. One health system, University of Virginia, utilizes a General Electric (GE) data collection system and a publicly displayed delay board for each OR.

Additionally, a study conducted at the Medical University of South Carolina looked at the effectiveness of a two week multidisciplinary education period. Post implementation studies showed a 22 minute improvement in first case start time with a reduction of turnover time to 16 minutes. In addition, unavailability of surgical and anesthesia staff decreased significantly ($p < 0.05$) and scheduling was improved. (Overdyk, F. J. et. al. *Anesth. Analg.*)

A review of an article discussing a 2001 study looking at first case start delays in the OR of St. Luke's Episcopal Hospital (SLEH), a 949 tertiary-bed hospital with 30 OR suites, revealed a possible model for improving first case start time accuracy. The team involved in the study acknowledged the trickle down effect that delays in the first case can have causing delays and costs to be amplified throughout the course of a day. As such, the OR management attempted to use a model called the Continuous Outcomes Measurement and Improvement Technique (COMIT) to improve outcomes by reducing or eliminating variances. This is a team orientated model which relies on internal expertise and a concerted effort on the part of all participants. It is an eight step model and a step by step evaluation of this model is provided in Appendix 13. (Windle P.E. et. al., *Lippincott's Case Management*)

The research team at SLEH noted that according to the American Practice Management Model the delay and cancellation rate should be $< 5\%$. After collecting data for five months, SLEH determined that between 56% and 72% of first cases started on time. (Windle P.E. et. al., *Lippincott's Case Management*)

After executing the COMIT model to address first case start time delays and implementation of team defined improvement steps to reduce variances, a five month long study saw an increase in first case start time accuracy of 26%. Additionally, this team decided only to target a handful of delays; however, after five months saw improvements in first case start time accuracy across the board. Even more noteworthy, this team decided to put surgeon schedules out of scope, but at the end of this study found a 50% increase in surgeon timeliness. Interviews with the surgical staff revealed that, prior to the study, they did not trust the timeliness of the OR staff. (Windle P.E. et. al., *Lippincott's Case Management*)

The SLEH study of first case start time delays revealed a screening technique which required that surgeons have their patients arrive two weeks prior to surgery for preoperative training and paperwork completion. If a patient did not arrive two weeks prior, the OR staff would contact the surgeon 72 and 48 hours prior to surgery to contact the patient and remind them to comply with preoperative testing requirements. If the patient could not travel to the hospital, the patient would be contacted via phone for preoperative training. A position was in place called the "Day of Surgery" Manager who monitored patient flow and paperwork completion. This staff member would check online resources only 72, 48 and 24 hours prior to surgery and would contact surgeons if the paperwork was not available. This study saw an increase in first case start time accuracy from 56-72% to 80-87%; however, this was not the only improvement

measurement and was part of a five month study. (Windle P.E. et. al., *Lippincott's Case Management*)

Conclusions

The findings, provided above, yielded the following conclusions relevant to our team's recommendations. The conclusions are ordered according to the tasks completed by our team: Mott OR PACU observations, value stream mapping, staff interviews, and literature search and UHC e-mail.

MOTT OR PACU Observations:

The following conclusions were drawn from the findings identified during our team's observation period.

Patient Information:

- Patients arrived late to check-in in the preoperative waiting room
- Patients departed from the PACU to enter the OR late

PACU Nurse Observations:

- Delays in updating patient vitals on the surgical flow sheet caused by multiple staff members attempting to interview the same patient
- PACU nurses interview questions standardized to surgical flow sheet
- PACU nurses complete administrative tasks: calling services/inpatient floors, checking *Care Web*, and directing patients' families
- PACU nurses waste movement to retrieve the "Review" and "Go" forms
- PACU nurses are not always able to access the "Review" and "Go" forms
- Delays in labeling a patient "Review" and "Go," result from forms being too distant from the patient's bay
- Poor communication to the PACU nurse on the time the service was contacted to complete patient paperwork
- Poor communication to the PACU nurse when the paperwork was completed and where it was placed
- Unsynchronized clocks in PACU result in inconsistent pacing of activities

OR Nurse Observations:

- No standard exists for communication and anesthesia often waits in the PACU for a page or phone call from the OR
- Delays occur when the staff members are unaware if the OR nurse had arrived to interview the patient

Anesthesia Observations:

- Delay in anesthesia evaluation caused by the presence of multiple staff members (i.e. surgical team, PACU nurse and OR nurse)
- Rework when the PACU nurse who administered the pre-med is not the patient's primary nurse
- Poor communication between the OR nurse and anesthesia staff concerning the time the OR is ready

Value Stream Mapping

The following conclusion was drawn from the swim-lane diagram.

- Patients waited longer than necessary between completion of the PACU nurse evaluation and the arrival of the next staff member

Interviews

The following conclusions were drawn from the interviews completed with the preoperative staff, the PACU nurses and the anesthesia staff members.

Preoperative Staff Interviews:

- Rework occurs when the nurse checking completion of patient paperwork rechecks *Care Web* over an extended period of time
- Patient issues are not always properly identified and addressed when the paperwork date and time is not checked
- Poor communication about the time and date of the call to the appropriate service to complete patient paperwork
- No standardized process exists for contacting the appropriate service to address outstanding issues
- Anesthesia staff is blamed by preoperative staff for delays related to first cases

- The current timing for contacting the service to rectify outstanding issues (i.e. the night prior or morning of surgery) is too short
- Phone call questions are highly standardized to the surgical flow sheet

PACU Nurse Interviews:

- Anesthesia staff is blamed by the PACU nurses for delays related to first cases
- Rework by the PACU nurse calling services to complete paperwork because there was poor communication concerning the date and time the service was contacted
- Poor communication to the PACU nurse concerning the completion of patient paperwork when the service arrives
- Delays occur because of rework completed by the PACU nurse attempting to identify the location of patient H&P and consent

Anesthesia Interviews:

- Surgeons are occasionally blamed by anesthesia staff for late first case start time
- Delays occur in pre-med administration when anesthesia is unable to complete the appropriate evaluation because other staff members are interviewing the patient
- Enforcement of outdated policies due to a lack of consistent and updated education for both permanent and rotating staff
- Inability of anesthesia staff to locate the appropriate patient leads to wasted time for both anesthesia staff and the PACU nurse who aids in identifying the patient
- Poor communication about patient arrival leads to interruptions in anesthesia morning set-up process
- “Review” and “Go” sheets are good visual cues for the anesthesia staff to easily identify outstanding issues
- Interest exists in further developing the anesthesia prescreening process; however, a lack of standardization in the anesthesia patient evaluation process may hinder this project

Literature Search and University HealthSystem Consortium (UHC) E-mail

The following conclusions were drawn from the findings related to the completion of the literature search and the responses from the UHC e-mail.

- The literature search and UHC e-mail revealed that the current definition of first case start (i.e. “patient in room”) is consistent with a majority of the health systems polled
- The reviews did reveal a potential updated data collection method.
- Delay data should be publicly displayed to allow open communication and involvement
- Possible management models exist to aid in correcting first case delays while building teamwork and improving trust

Recommendations

Our team used the conclusions drawn from the findings to develop the following recommendations to address first case start time delays related to pre-med and H&P/consent issues.

Re-evaluate Red “Review” Sheet and Outpatient Cover Sheet

To alleviate the identified issues associated with the “Review” sheets, our team recommends that a space should be provided on the red “Review” sheet so that when H&P and consent are completed, the person who completed this paperwork can leave their pager number so the PACU nurse knows who to call to locate the paperwork. This provides both a responsible person and reduces the amount of phone calls that the nurse must make to locate the appropriate staff members. (See Appendix 13)

Additionally, a date and time section should be added to the Outpatient Cover Sheet for when the service was contacted for an H&P. The sections for anesthesia are not utilized and should be removed or education should be provided to ensure proper usage.

Establish Par Levels of “Go” and “Review” Sheets

The unavailability of these forms and associated delays this has caused has led our team to develop the following recommendations:

1. Visually Set Par Levels of the “Go” and “Review” Sheets

Our team recommends that par levels be set for these sheets so that the forms will always be available. One option includes a tear out book of sheets with another

visual cue so that when the sheets reach a critical level, a new book of sheets can be added.

A second, and perhaps simpler, solution may be to establish a visual cue in the current sheet holder. The importance of this visual cue is that when the forms reach critical level, new forms can be located before the supply is completely gone.

2. *Relocate the “Go” and “Review” sheets*

a. *Laminate and attach to patient bays*

Currently, the “Go” and “Review” sheets are not reused. Thus, when the supply of forms is gone, the MA is required to print more forms to replenish the supply. One solution may be to laminate the “Go” and “Review” sheets and attach them to the patient tables in each bay. Dry erase markers could be provided to mark the forms and then the forms could be hung on the edge of the table.

b. *Provide each bay with a supply*

Another solution is to have individual holding slots for the “Go” and “Review” sheets attached to the wall in the preoperative bays. This eliminates the need for the PACU nurse to walk across the PACU to retrieve the forms.

Guarantee Completion of Paperwork

Observations and interviews highlighted rework done on part of the staff members of the preoperative area and the PACU. Our team has developed the following recommendations which will result in: reduced or eliminated rework and a more consistent completion of H&Ps and consents.

1. *No scheduling without H&P and consent*

Through the observations of this process and the interviews with the PACU nurses, it is apparent that there is a great deal of rework and wasted employee hours.

Our team recommends that a process be established to guarantee that either no patient will be added to the schedule without an H&P and consent or that a method be established to assure that H&P and consent is completed prior to the patient arriving for surgery.

2. *Visual cue for date on H&P and Consent*

Another recommendation is to add a line to the OR schedule to illustrate the acceptable date range for H&Ps and consents. This will act as a visual cue for the preoperative clerk so that, hopefully, outdated H&Ps and consents will not be marked complete.

3. Preoperative anesthesia clinic

Anesthesia faculty interviews showed interest in improving screening techniques for patients coming to the OR. As such, our team recommends an investigation into the utility of such efforts being implemented in C.S. Mott Children's Hospital OR.

Synchronize Clock Times in the PACU

Since the clocks in the PACU are utilized to pace morning activities and since these clocks are not synchronized, our team recommends that the PACU clocks be synchronized to the computer clocks in the OR which determine patient arrival in the OR. Also, our team recommends that the clocks in the PACU be switched from analog to digital, so that times can be easily read at a glance.

Automatic Paging System

Currently, the OR in the Main portion of UMHS utilizes a system known as *Centricity* to track patient flow, indicate bay and OR assignment, and automatically page staff. This system allows for staff members to be paged automatically when the patient arrives and when the OR is ready for surgery. Our team was informed by our coordinator and client that this system is already being explored for C.S. Mott Children's Hospital OR.

Our team, therefore, recommends that this system be implemented in the C.S. Mott Children's Hospital OR. *Centricity* should: aid in identifying outstanding patient issues, permit tracking of which staff members have arrived to complete their evaluation, and allow staff members to know when their patients arrive and where they have been placed. Currently, the utilization of *Centricity* in the UMHS' Main ORs requires a staff member to coordinate and operate the system. A similar position may be necessary in Mott.

Education

Every month, new staff rotate through C.S. Mott's OR training in fields of nursing, anesthesia or surgery. Education is imperative for maintaining consistent standards for paperwork and patient care in the OR.

Our team, therefore, recommends that staff members must be educated on standards for paperwork and patient care on a regular basis and new staff members must also be educated. This form of renewed education is important for improving first case start time accuracy not only related to pre-med and H&P/consent delays but across the board. In addition, new standards must be communicated to staff members so that education can be consistent.

Educational periods should also be utilized to define employee roles and requirements. Interviews and observations revealed that staff members perceive that delays are unrelated to their tasks.

Beeper Study

To determine if and what work can be shifted from the preoperative staff members and PACU nurses, our team recommends that a work load analysis, such as a beeper study, be conducted to determine work load.

This analysis utilizes random work sampling to allow management to gauge what percentage of work done by Registered Nurses is administrative and should be shifted. This study may also reveal that a new staff member should be added to coordinate H&P and consent with the services and patient arrival from inpatient floors.

Continuous Outcomes Measurement and Improvement Technique (COMIT) Model

The COMIT model has reduced other hospital systems first case start time delays, therefore, our team recommends that a similar model be considered for C.S. Mott's Children's Hospital OR. In all six interviews with anesthesia, staff members revealed that they felt no pressure to be on time if the surgeon was not on time. Similarly, surgeons have contacted our client concerning timeliness and have stated that they do not feel pressure to be on time if anesthesia and the rest of the surgical staff will not be on time. Preoperative and PACU nurses also revealed that they feel no pressure to complete their tasks if they know that anesthesia will not arrive until just prior to the time the patient enters the OR. The team dynamics established by this model, although potentially problematic to coordinate, would be beneficial to establishing a culture of trust among OR staff.

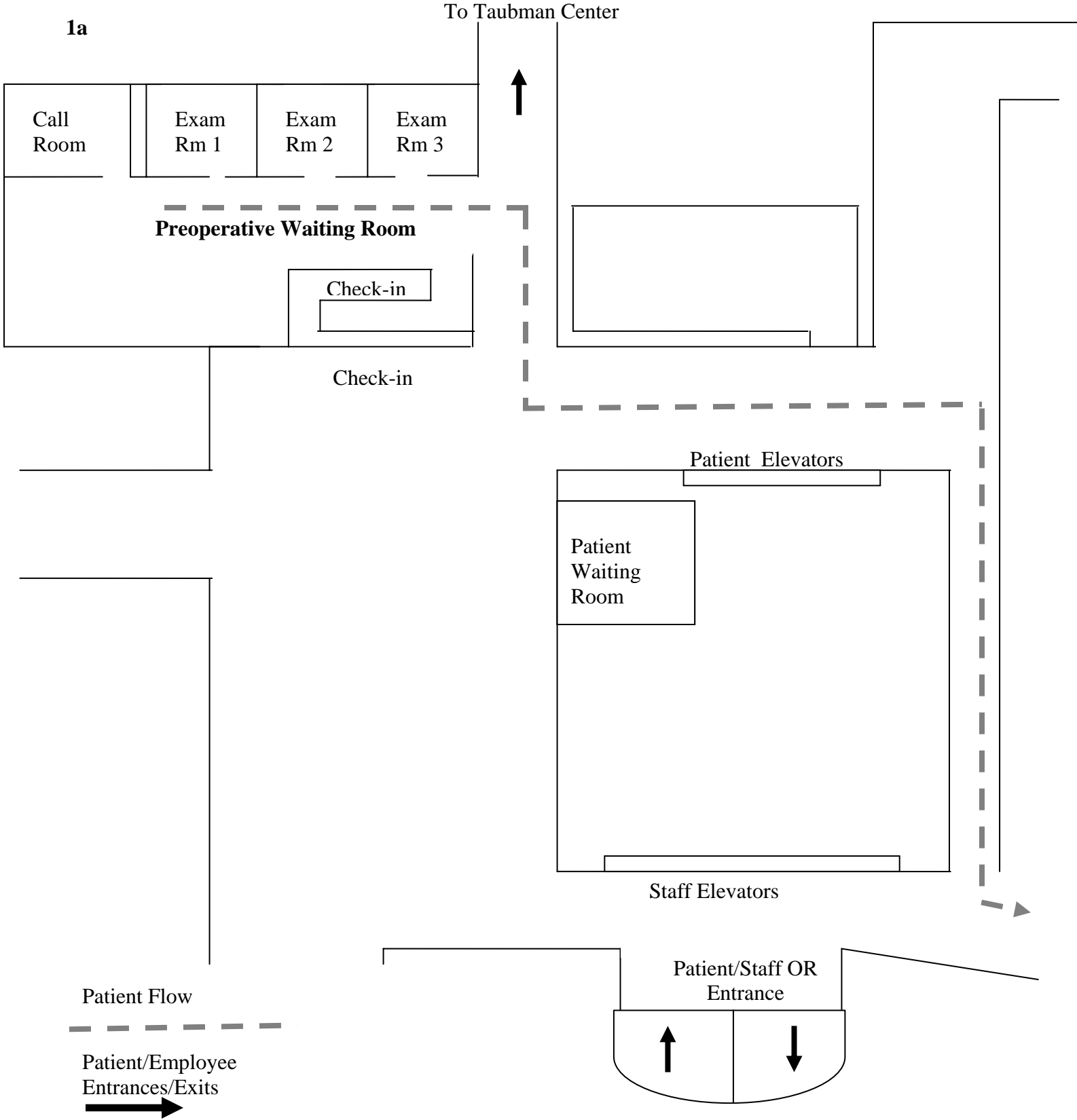
Expected Impact

Implementation of these recommendations should result in:

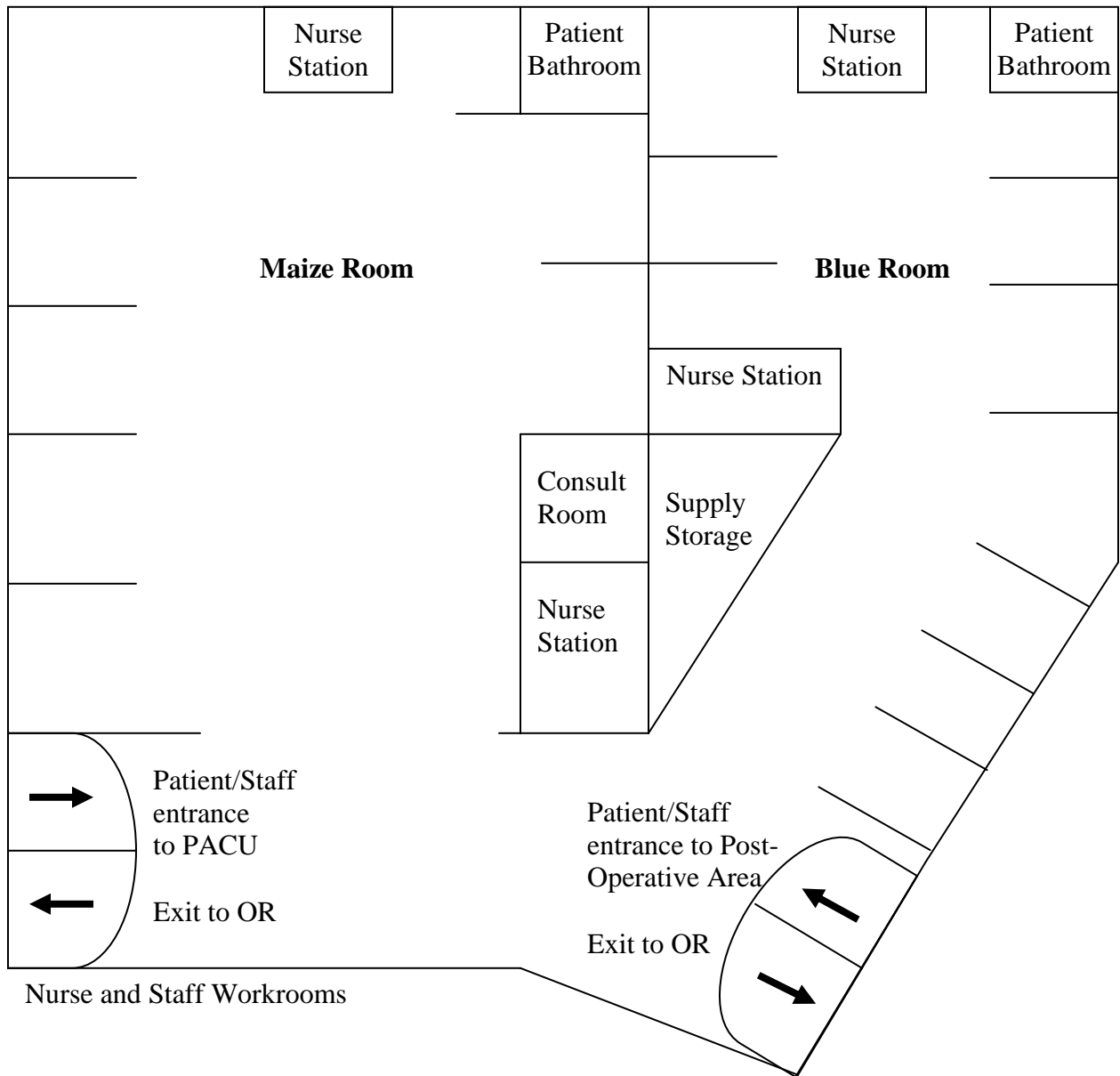
- Improved first case start time accuracy
- Reduced costs for overtime and facility operations
- Improved quality of patient care
- Improved patient and employee satisfaction
- Greater understanding of existing OR standards at other university health systems
- Improved communication between staff

Appendix 1: Patient Flow and Facility Layout for C. S. Mott Children's Hospital OR

1a



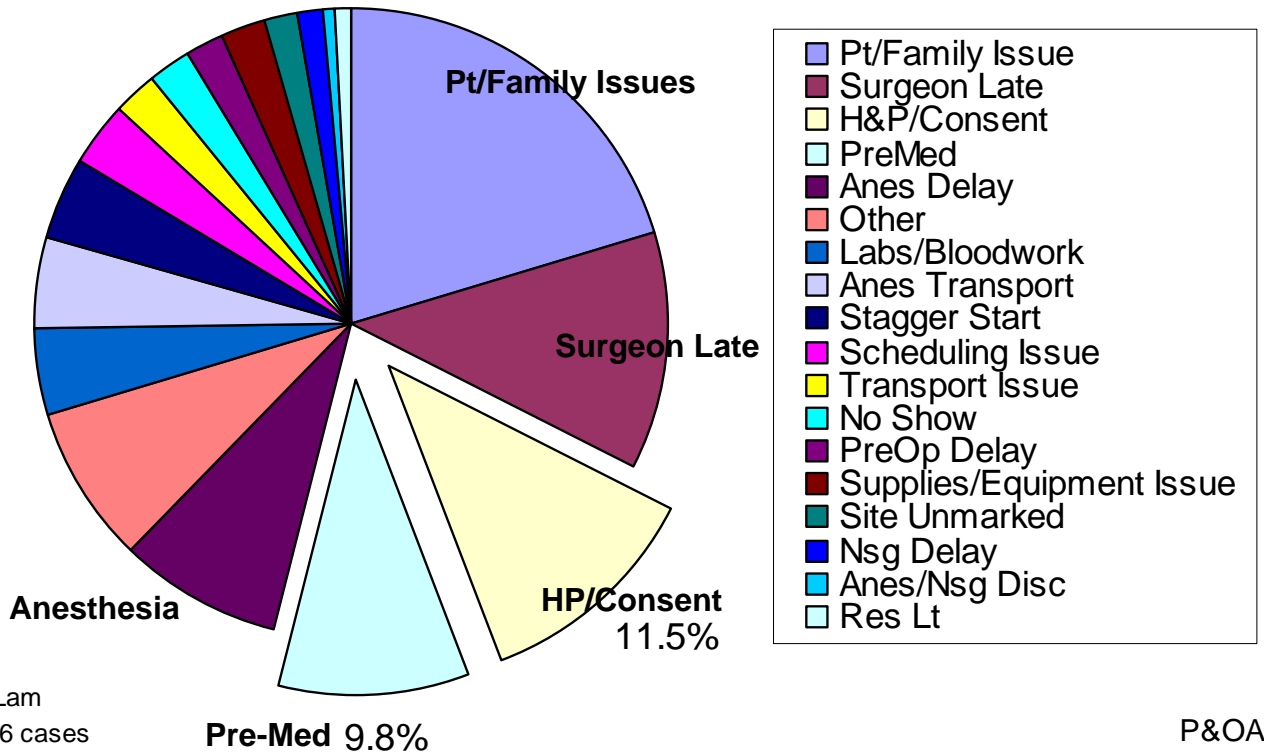
1b



Patient/Employee
Entrances/Exits
➔

Appendix 2: OR Delay Data Divided by Delay Category

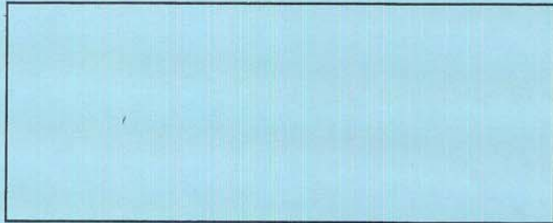
1st Case Delay Summary: 8/21/06 - 11/22/06



Source: Karen Lam
 Sample size: 286 cases

P&OA

Appendix 3: Outpatient Cover Sheet for Patient Check-in and Chart Completion



OUTPATIENT COVER SHEET

Surgery Consent								
Needs: _____			Done: _____					
Paged: _____ @ _____			am/pm					
Surgery H & P: Needs: _____			Done: _____					
Anesthesia								
Patient Seen by Anes: Yes: _____			No: _____			Not used by anesthesia		
Is Pre-med order written? Yes: _____			No: _____					
Patient Status								
Weight: _____ kg			Height: _____					
Acetaminophen Given: Yes _____			No _____			SEE FLOW SHEET		
Allergies: Yes _____			No _____					
Comments								
Location								
TR	1	2	3	4	5	6	7	8
		Pacu	Off1	Off2				
							Not consistently	
Check when your section is complete							Not utilized	
Anes	_____	Surgery	_____	Preop RN	_____	OR RN	_____	

Section should be added for H&P

Only section utilized by staff

Not used by anesthesia

Not consistently

Not utilized

Appendix 4a,b: Red "Review" and Green "Go" Sheet Used for Patient Status

4a

Stop


This Patient is **not** ready to go.

Patient still needs:

_____ Consent	_____ H & P
_____ Tylenol	_____ RN Signature
_____ Labs	_____ side / site marked

Nurse who worked up patient: _____

Delays and why: _____



4b

GO



Appendix 5: Selective Literature Search Completed

Information Obtained from Literature Search

1. Friedman, D. M., Sokal, S. M., Chang, Y., Berger, P. “Increasing Operating Room Efficiency Through Parallel Processing.” *Annals of Surgery*. Vol. 242 (1). Jan. 2006

Hospital: General Hospital. Boston, MA

Definition: N/A

Data Collection Method: N/A

Main Investigative Point: “Parallel processing of patients would shorten the total time spent on each patient without impacting operative time.” In addition, improving patient care and satisfaction was a goal of the project.

Project Implications: Many staff members in C.S. Mott Children’s Hospital OR complain that several groups of staff members will attempt to evaluate the patient at the same time. Potentially, this acts as a block to stop patient evaluation, pre-medication, consent and H&P.

- Parallel processes could mediate these frustrations and improve evaluation.

Project Limitations: Did not look at first cases, but overall saw a 33% reduction in OR block time usage. Study also limited observations to a single surgery type, hernia repair.

2. Ferschl, M. B., Tung A., Switzer, B., Huo, D., Glick, D. B. “Preoperative Clinic Visits Reduce Operating Room Cancellations and Delays.” *The Journal of the American Society of Anesthesiology*. Vol. 103 (4), pp 855-59. Oct. 2005.

Hospital: University of Chicago Hospitals

Definition: Patient in room

Data Collection Method: N/A

Main Investigative Point: Investigate the impacts of a preoperative clinic on the day of surgery. Study looked at “whether a visit to an anesthesia preoperative medicine clinic (APMC) would reduce day-of-surgery case cancellations and/or case delays.”

Project Implications: Interviews with an anesthesia faculty member revealed current efforts to look at adding a preoperative clinic where paperwork could be completed prior the patient arriving at the OR for surgery. Retroactive chart study observing patients who went through the APMC versus patients who did not revealed:

- 5.2 % reduction in cancellations ($p < 0.001$).
- 2 minute longer wait time for non APMC patients ($p = 0.015$)

Project Limitations: No current clinic exists in UMHS.

3. Mazzei, W. J. "Operating Room Start Time and Turnover Times in University Hospitals." *J Clin. Anesth.* Vol. 6 (5): pp. 405-8. Sept. 1994.

Hospital: University of San Diego. San Diego, CA.

Definition: Patient in room

Data Collection Method:

Main Investigative Point: Measure the start time for the first case of the day and the turnover times for subsequent cases in the OR.

Project Implications: A lack of a consistent definition in OR start time led to "a strong perceptual difference among anesthesiologist, OR nurses, and surgeons when viewing start and turnover times.

Project Limitations: Did not look at reasons for first case delays.

4. Overdyk, F. J., Harvey, S. J., Fishman R. L., Shippey F. "Successful Strategies for Improving Operating Room Efficiency at Academic Institutions." *Anesth Analg.* 1999 Apr; 88:963.

Hospital: Medical University of South Carolina. Charleston, SC.

Definition: Patient in room, anesthesia ready, surgical preparation start and procedure start

Data Collection Method: OR nurses on a standardized form without notification of other surgical or anesthesia staff.

Main Investigative Point: Evaluation of the OR delays in academic institutions, examination of multidisciplinary strategies to improve efficiency and establishment of OR timing benchmarks for future studies.

Project Implications: Through the interviews and observations, it was revealed that standards were not being consistently and thoroughly communicated to staff members. Staff members had varying definitions for the green "Go" sheets and were not aware of other standards that had been set in place.

This research group conducted a 2 week multidisciplinary OR efficiency awareness education for nursing, surgical and anesthesia staff. A post educational study revealed:

- First cases started 22 minutes earlier than other cases
- Turnover time decreased 16 min
- Unavailability of surgical and anesthesia staff decreased significantly ($p < 0.05$)
- Improved scheduling

Project Limitations: Not a pediatric suite.

5. Lapierre, S. D., Batson, C., McCaskey, S. "Improving On-time Performance in Health Care Organizations: A Case Study." *Health Care Manag Sci.* 1999 Jan; 2 (1):27-34

Hospital: Ecole Polytechnique. Montreal Quebec, Canada.

Definition: N/A

Data Collection Method: N/A

Main Investigative Point: "Propose a strategy to build a measurement system that helps improve on-time performance in healthcare organizations."

Project Implications: Surgeons in this health system, is, as in UMHS, one of the leading causes for delays in the OR. Study illustrates the utilizing the Pareto principle of tackling the major sources of delays are not always the best method to eliminate delays and that by targeting other delays created a "snowball" effect which caused surgeon delays to be reduced.

Project Limitations: Not a pediatric suite and not an extensive study.

6. Truong, A., Tessler, M. J., Kleiman, S. J., Bensimon, M. "Late Operating Room Starts: Experience with an Educational Trial." *Can J Anaesth.* 1993 (12): 1233-46.

Hospital: SMBD-Jewish General Hospital and McGill University. Montreal, Quebec.

Definition: Patient in room

Data Collection Method: Retroactive chart audit

Main Investigative Point: Determine if late starts of first cases in the OR remained a problem after identifying causes and implementing remedial actions.

Project Implications: Similar to C.S. Mott Children's Hospital, 78% of cases did not start on time. A retroactive chart audit was completed to determine reasons for the delays in the first case and actions plans were developed and implemented. After notifying attending surgeons and discussing the plan during departmental rounds.

A second audit showed:

- 65.5 % of cases did not start on time after implementation
- Delays decreased from 15.73 +/- 4.56 min to 10.54 +/- 3.92 min ($p < 0.05$)

Team concluded that only mild improvements could be achieved without the cooperation of anesthesia and surgical staff to arrive on time.

Project Limitations: Not a pediatric suite and not an extensive study.

7. Dufek S., Gaucher, E., Gialanella, J., Kratochwill, E., Learned, D., Sonda, P., Wood, J., Greenfield, L., Lyons, P., Zuidema, G. "The Total Quality Process Applied to the Operating Rooms and Other Clinical Processes." *Surgery.* 1993; 113: 255-9.

Hospital: University of Michigan Health System. Ann Arbor, MI.

Definition: N/A

Data Collection Method: N/A

Main Investigative Point: Establish countermeasures and observe effect on utilization and correct scheduling.

Project Implications: Our team concluded from staff interviews that as the reasons for delays are being collected, staff members try to avoid blame. Staff doubts the credibility of the delay data. As such, this study utilized story boards and public posting of data to encourage team collaboration and discussion. Group dynamics are vital to improving this process and our team feels that such methods could work to improve these measures.

Project Limitations: Not a pediatric suite and not related to first case start time

C. S. Mott Children's Hospital Data Collection Sheet

Date: ___/___/___ (month/day/year)

PATIENT INFO

First Case: Afternoon Case: Inpatient: Outpatient: ADP:
 Patient Arrival: ___:___(time) Gender: Male Female
 Service: _____ Questions Answered By: Family Patient
 OR Assignment: _____ Patient Leaves Pre-Op: ___:___

PACU NURSE INTERVIEW

Arrival: ___:___ Start Interview: ___:___ End Interview: ___:___ Leave: ___:___
 Introduction to Family/Patient: Yes No
 RN Obtained Info From: Patient Family Medical Record
 Is H&P Valid: Yes No Vitals Start: ___:___ Vitals End: ___:___
 Did RN Ask About: Pre-med Identify Time: ___:___
 NPO Instructions: Yes No
 All Allergies: Yes No Reaction Type Identified: Yes No
 All Health Issues: Yes No Comments: _____
 All Medications: Yes No Comments: _____
 Comments: _____

OR NURSE INTERVIEW

Arrival: ___:___ Start Interview: ___:___ End Interview: ___:___ Leave: ___:___
 Introduction to Family/Patient: Yes No Patient Identification: Yes No
 Did OR Nurse Ask About:
 NPO Instructions: Yes No
 All Allergies: Yes No Reaction Type Identified: Yes No
 All Health Issues: Yes No Comments: _____
 All Medications: Yes No Comments: _____
Questions Repeated?: Yes No Comments: _____
 Comments: _____

ANESTHESIA

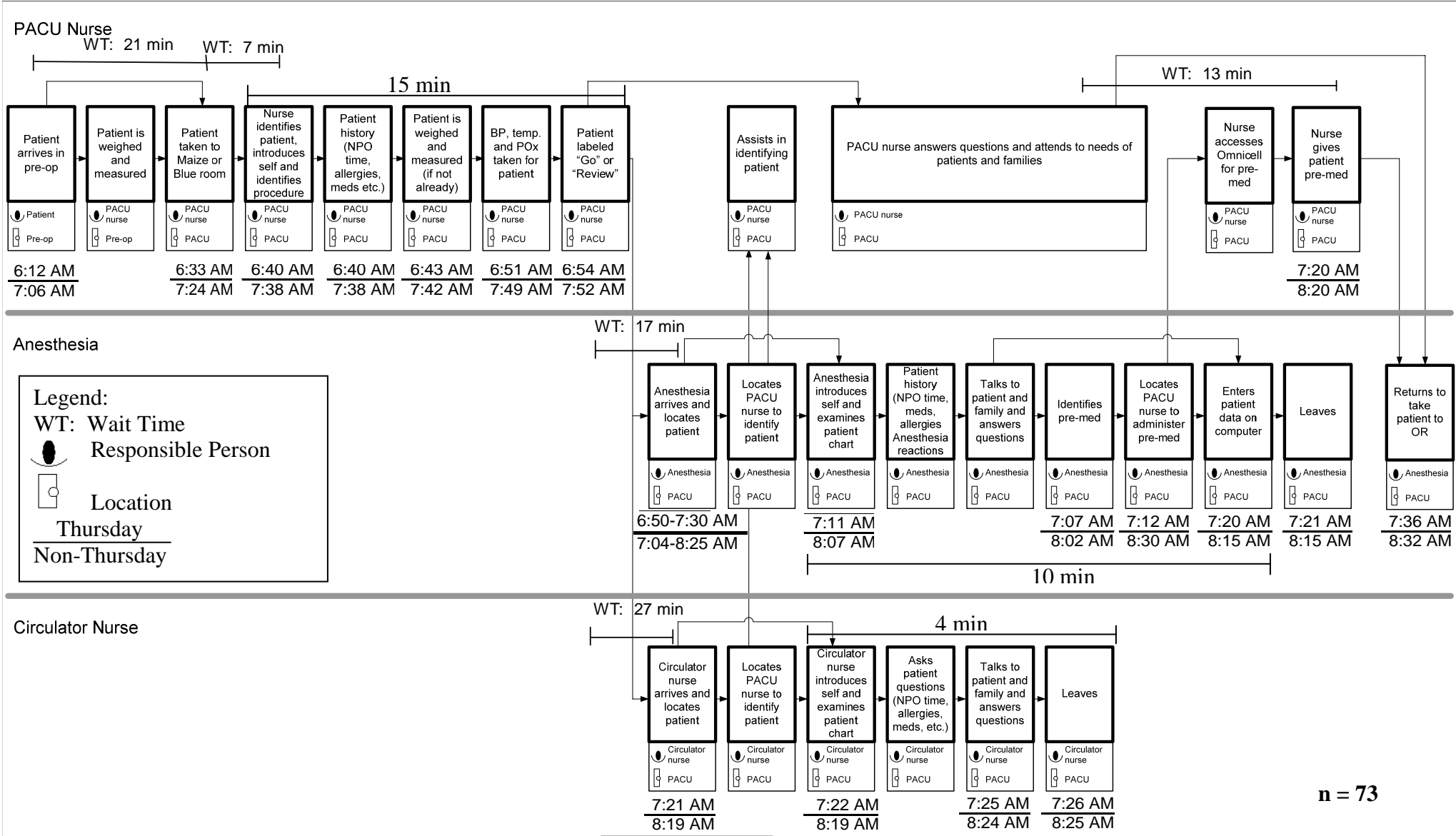
Arrival: ___:___ Start Interview: ___:___ End Interview: ___:___ Leave: ___:___
 Introduction to Family/Patient: Yes No Procedure Explained: Yes No
 H&P: Yes No H&P Start: ___:___ H&P End: ___:___

Pre-med Identify Time: ___:___	Pre-med Request Time: ___:___
Order Written: ___:___	Pre-med Given: ___:___

 Surgeon Stopped By: Yes No Incision Mark Time: ___:___
Questions Repeated?: Yes No Comments: _____
 Comments: _____

Time Notified OR Ready: ___:___ Method: ⁴⁶(if not in person) _____
 Collector: _____ Number: _____

Appendix 7: Swim-Lane Diagram Illustrating Patient Flow and Process Timeline



Appendix 8: Questions for Anesthesia Interviews

Anesthesia Interview Questions:

1. Walk through of morning activities.
 - a. Ask for any further clarification on what is said during this especially related to the H&P and Pre-med issues. Anesthesiologists are not concerned with consents.
2. What requirements does an Anesthesiologist have when looking at an H&P and is the H&P used to make the assessment of the patient.
 - a. If an H&P is incomplete or missing, does it stop you from doing your assessment of the patient?
3. What requirements do you have when determining pre-med needs
 - a. When/Are you notified that the patient has arrived?
 - b. Do you have a “rule of thumb” as to when you need to decide to give a pre-med to a patient in order for it to take effect prior to that patient entering the OR?
 - c. What cause the pre-med to not be administered at the time you would like?
4. Have you been instructed as to the meaning of the different patient forms attached to the patient charts, and, if so, what do the following mean to you:
 - a. Blue Patient Checkoff Form
 - b. Red/Green PACU patient status slips
5. What would you do to improve the process?

Appendix 9: University HealthSystem Consortium E-mail Draft

Attention University HealthSystem Consortium:

A group of senior engineering students and the department of Program and Operations Analysis at the University of Michigan Health System (UMHS) are conducting a study analyzing first case start time accuracy in the operating rooms of C.S. Mott Children's Hospital. Our pediatric efforts are different than those for our adult population. Our adult OR runs at 95% accuracy. Our pediatric OR was at 25% and with efforts in the last year is up to 60% with an initial goal of 80%.

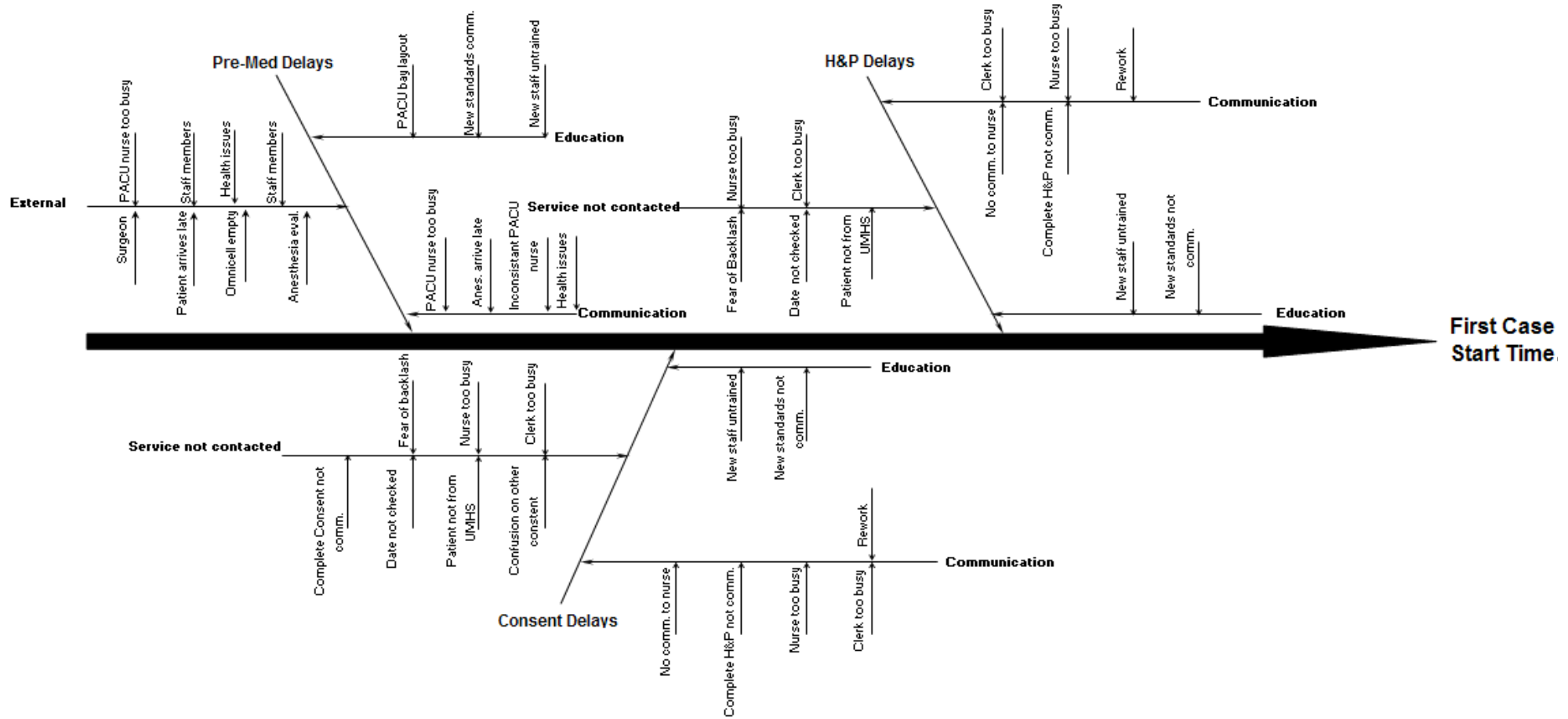
We would like to determine if other hospitals in the University HealthSystem Consortium have undertaken or will be undertaking a similar analysis (particularly with Pediatric ORs, but not exclusively). Please respond to the following questions:

1. What is your definition of first case start time accuracy? (Our definition is patient in the room within 5 minutes of the scheduled time)
2. How do you collect first case start time accuracy data?
3. Do you report first case start time accuracy?
4. If you report first case start time accuracy, what metrics do you collect and how and where do you report them?
5. What process improvement actions do you take to improve or maintain first case start time accuracy?
6. Are there any special efforts for your Pediatric population versus your adult population?

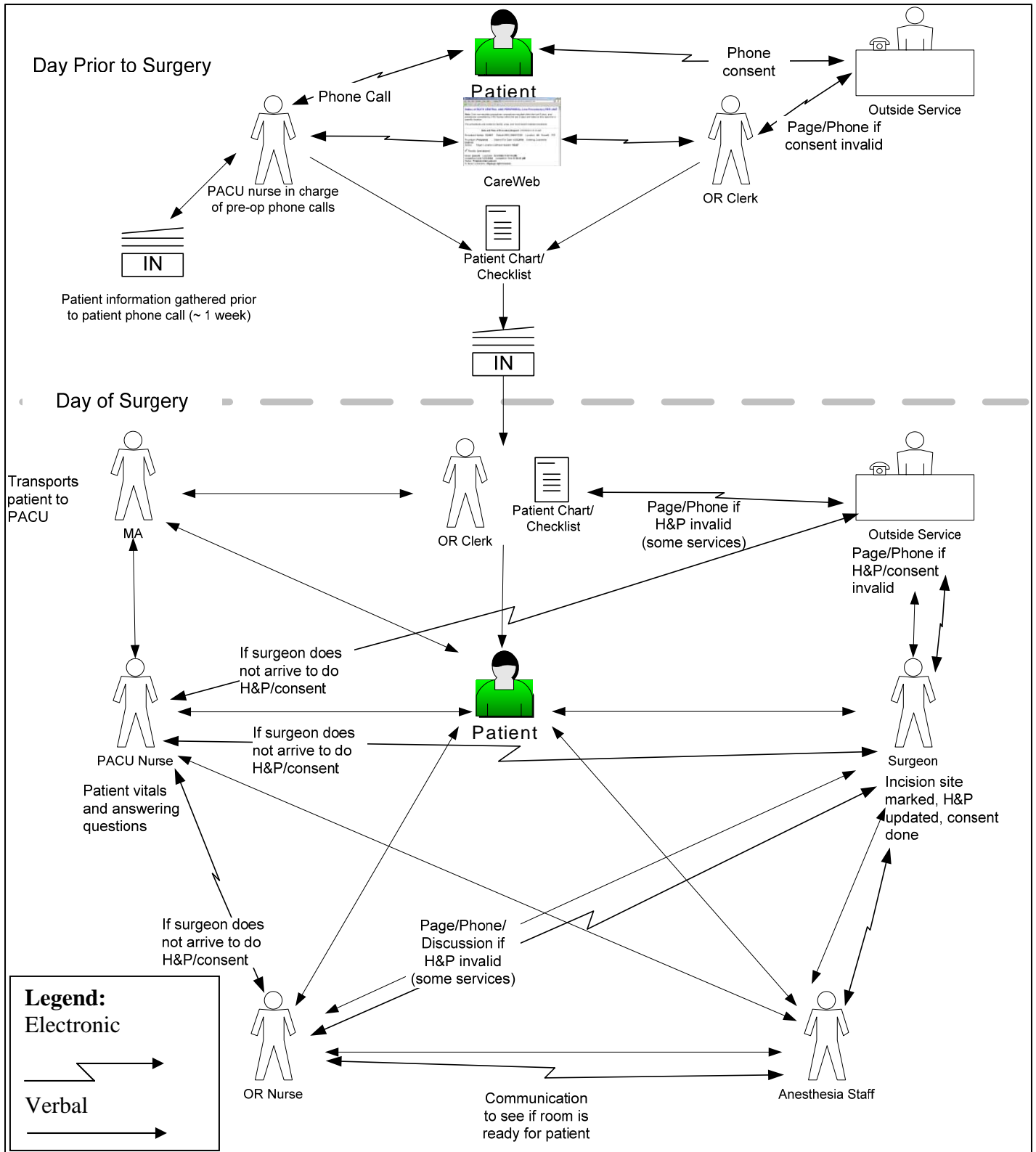
Hopefully, by understanding how other hospitals have measured start time accuracy in ORs (particularly Pediatric), we can better understand and measure this in our own health system.

Thank you for your time and consideration

Appendix 10: Cause and Effect Fishbone Diagram from Staff Interviews



Appendix 11: Mott OR Communication Diagram



Appendix 12: University HealthSystem Consortium E-mail Responses
Dear University HealthSystem Consortium Compatriots:

A group of senior engineering students and the department of Program and Operations Analysis at the University of Michigan Health System (UMHS) are conducting a study analyzing first case start time accuracy in the operating rooms of C.S. Mott Children's Hospital. Our pediatric efforts are different than those for our adult population. Our adult OR runs at 95% accuracy. Our pediatric OR was at 25% and with efforts in the last year is up to 60% with an initial goal of 80%.

We would like to determine if other hospitals in the University HealthSystem Consortium have undertaken or will be undertaking a similar analysis (particularly with Pediatric ORs, but not exclusively). Please respond to the following questions:

1. What is your definition of first case start time accuracy? (Our definition is patient in the room within 5 minutes of the scheduled time) **We base first time start on Anesthesia Ready. Anesthesia ready should be 0730 on Mon, Tue, Thu, & Fri and at 0830 on Wed. A case is considered on time if it occurs within 10 minutes of that time.**
2. How do you collect first case start time accuracy data? **All data is collect in ORSOS via the circulating nurse's online chart.**
3. Do you report first case start time accuracy? **It is as accurate as the data entered by the nursing staff and run through a number of data verifications.**
4. If you report first case start time accuracy, what metrics do you collect and how and where do you report them? **All data is regarding first case starts, turnover time, and utilization is collected on a monthly basis and reported via the OR dashboard.**
5. What process improvement actions do you take to improve or maintain first case start time accuracy? **Every effort is made to make sure that all the paper work is in order prior to the date of surgery and that the patient knows when and where to report the morning of surgery. The patient is processed through the admitting area and when the patient arrives in the OR the nurse manager "gently" urges the staff to get the patient in the room and to get the case started.**
6. Are there any special efforts for your Pediatric population versus your adult population? **We don't really have pediatric cases.**

Hopefully, by understanding how other hospitals have measured start time accuracy in ORs (particularly Pediatric), we can better understand and measure this in our own health system.

Thank you for your time and consideration

Dear University HealthSystem Consortium Compatriots:

A group of senior engineering students and the department of Program and Operations Analysis at the University of Michigan Health System (UMHS) are conducting a study analyzing first case start time accuracy in the operating rooms of C.S. Mott Children's Hospital. Our pediatric efforts are different than those for our adult population. Our adult OR runs at 95% accuracy. Our pediatric OR was at 25% and with efforts in the last year is up to 60% with an initial goal of 80%.

We would like to determine if other hospitals in the University HealthSystem Consortium have undertaken or will be undertaking a similar analysis (particularly with Pediatric ORs, but not exclusively). Please respond to the following questions:

1. What is your definition of first case start time accuracy? (Our definition is patient in the room within 5 minutes of the scheduled time) ? **Patient in room at 7:15 am M, T, Th, Friday and 8:15 am on Wednesday. All of our “first” cases are scheduled for 7:15 am except on Wednesdays when we have staff meeting.**
2. How do you collect first case start time accuracy data? **For the last 18 months, each month we audited the electronic intraoperative note for “time patient in room.” Over the last month, we have been having staff report the info on a “scoreboard” located in the operating room and so each day, there is a visual report for all members of the OR team to evaluate first case start time compliance.**
3. Do you report first case start time accuracy? **Yes.**
4. If you report first case start time accuracy, what metrics do you collect and how and where do you report them? **First case delay and reason for delay.**
5. What process improvement actions do you take to improve or maintain first case start time accuracy? **We have implemented numerous changes including improving compliance with pre-operative documentation, providing re-education to staff and physicians regarding the definition of “first case start time,” improvements in pre-op flow, and changes in instrument/room preparation.**
6. Are there any special efforts for your Pediatric population versus your adult population? **No**

Hopefully, by understanding how other hospitals have measured start time accuracy in ORs (particularly Pediatric), we can better understand and measure this in our own health system.

Thank you for your time and consideration

Dear University HealthSystem Consortium Compatriots:

A group of senior engineering students and the department of Program and Operations Analysis at the University of Michigan Health System (UMHS) are conducting a study analyzing first case start time accuracy in the operating rooms of C.S. Mott Children's Hospital. Our pediatric efforts are different than those for our adult population. Our adult OR runs at 95% accuracy. Our pediatric OR was at 25% and with efforts in the last year is up to 60% with an initial goal of 80%.

We would like to determine if other hospitals in the University HealthSystem Consortium have undertaken or will be undertaking a similar analysis (particularly with Pediatric ORs, but not exclusively). Please respond to the following questions:

1. What is your definition of first case start time accuracy? (Our definition is patient in the room within 5 minutes of the scheduled time)[**McGowan, James E (HS Admin) *HS] In room by 0720 -0730**
2. How do you collect first case start time accuracy data? [**McGowan, James E (HS Admin) *HS] GE Information system with time stamps**
3. Do you report first case start time accuracy?[**McGowan, James E (HS Admin) *HS] We do not routinely report but do evaluate PRN**
4. If you report first case start time accuracy, what metrics do you collect and how and where do you report them?[**McGowan, James E (HS Admin) *HS] Reported to OR Committee and we use % of on time starts of all first starts for that service.**
5. What process improvement actions do you take to improve or maintain first case start time accuracy?[**McGowan, James E (HS Admin) *HS] We have previously used 6-sigma as our tool for evaluating and making changes accordingly.**
6. Are there any special efforts for your Pediatric population versus your adult population?[**McGowan, James E (HS Admin) *HS] No.**

Hopefully, by understanding how other hospitals have measured start time accuracy in ORs (particularly Pediatric), we can better understand and measure this in our own health system.

Thank you for your time and consideration

Appendix 14: COMIT Model Summary from SLEH Study

COMIT Model Utilization Model from St. Luke’s Episcopal Hospital (SLEH)

In 2001, SLEH utilized the Continuous Outcomes Measurement and Improvement Technique (COMIT) and achieved a 26% improvement in first case start time accuracy across the board. Additionally, a 50% decrease in surgeon lateness was observed because a culture of trust was established in the OR. Provided below is a summary of the eight step process associated with the COMIT model with notes from the SLEH study.

Step	Step Name	Notes from SLEH study
1	Select a variance or outcome measure	<ul style="list-style-type: none"> • Select a variance or outcome that can be initially quantified (i.e. room turnover time or first case start time accuracy)
2	Select team members	<ul style="list-style-type: none"> • Select team members who: <ul style="list-style-type: none"> ○ Can facilitate change and process improvement ○ Are willing to commit to change ○ Are involved in the process ○ Able to avoid turf battles • The group should be diverse and represent different disciplines and levels of status.
3	Determine associated care processes	<ul style="list-style-type: none"> • Analyze the associated care processes utilizing mapping tools (e.g. flowcharting) • Method should highlight possible contributing factors
4	Determine causative factors	<ul style="list-style-type: none"> • Determine root causes • Create a cause and effect diagram (e.g. fishbone diagram) • Root cause analysis should involve a brainstorming session with the entire team
5	Select high-impact causative factors	<ul style="list-style-type: none"> • Determine which causative factors contribute most the variance or outcome • Develop an action plan for improving the selected causative factors, for example: <ul style="list-style-type: none"> ○ Request patient pre-admit two weeks prior to surgery

- Check patients' charts 72, 48 and 24 hours prior to surgery
 - Improve communication to OR
- | | | |
|---|---------------------------------|---|
| 6 | Implement an action plan | <ul style="list-style-type: none"> ● Implement the action plans with efforts of the team |
| 7 | Determine performance measures | <ul style="list-style-type: none"> ● Predetermine measure for measuring improvement in chosen high-impact causative factors <ul style="list-style-type: none"> ○ Should be defined prior to implementation |
| 8 | Measure the variance or outcome | <ul style="list-style-type: none"> ● Utilize the initial method of measuring variance and outcome to measure impact that action plans have on variance or outcome |
-

Windle, P.E., Barron, K., Walker, D., Cormier, J. "A COMIT Model Utilization to Improve First Case Start Time." *Lippincotts Case Manag.* 2001 Jan-Feb; 6 (1): 38-46.