SWAT Process Improvement at Michigan Medicine

Final Report

Submitted to:
Ms. Denise Landis, RN, BSN, MS, CNML, CMTE, EMT-P
Manager of Critical Care Transport Survival Flight, SWAT
1500 E. Medical Center Drive
Ann Arbor, MI, 48109 - 5307

Ms. Mary Schafer, RN, BSN, CCRN
Clinical Nurse Supervisor SWAT
1500 E. Medical Center Drive
Ann Arbor, MI, 48109 - 5307

Dr. Mark P. Van Oyen
Professor, University of Michigan Industrial and Operations Engineering
1205 Beal Avenue #2853
Ann Arbor, MI, 48109 - 2117

Submitted by:
IOE 481 Team 11
Julian Covos
Tasha Gillum
Alexandra Mukavitz
Thomas White

Date Submitted: April 18, 2017
# Table of Contents

**EXECUTIVE SUMMARY**

- Introduction and Background
- Methods
  - On-site observations including SWAT shadowing, interviews, and time studies
  - Analysis of historical data from SWAT and a previous IOE 481 team
  - Bedside nurse interviews from inpatient units of interest
  - Literature search to identify methods for improved intrahospital transport
- Findings & Conclusions
- Recommendations & Expected Impact
  - Use Huddles Between SWAT and Bedside Nurses to Solve Problems
  - Communicate with Nurses Before Return to Inpatient Unit
  - Adjust 15 Minute Policy to Plan for Variation

**INTRODUCTION**

**BACKGROUND**

- SWAT Team
- Policy Change
- Current Transportation Process
- Key SWAT Metrics

**KEY ISSUES**

**GOALS AND OBJECTIVES**

**PROJECT SCOPE**

**METHODS**

- SWAT Shadowing, Interviews, and Time Studies
- Analysis of SWAT Database
- Bedside Nurse Interviews
- Literature Search
  - Improved Communication Between Groups Leads to Improved Process Efficiency

**FINDINGS & CONCLUSIONS**

- Shadowing and Time Studies Show High Variability
- 15 Minute Policy Involves Built-In Waste
- Analysis of SWAT’s Database Shows Inpatient Units of Focus
- Analysis of SWAT Clipboard Data Shows Additional Ready/Not Ready Categories
- Interviewed Bedside Nurses Desire Improved Reliability and Communication from SWAT
Summary of Conclusions

RECOMMENDATIONS & EXPECTED IMPACT

Use Huddles Between SWAT and Bedside Unit Nurses to Solve Problems

Huddle Logistics

Standard Huddle Procedure

Key Metrics to Track for Huddles

Page Bedside Nurses to Improve Coordination

Inform Nurses of SWAT Delay

Inform Nurses of Procedural Delays

Inform Nurses of SWAT’s Return

Adjust the 15 Minute Policy to Plan for Variation

Summary of Recommendations and Expected Impacts

References

Appendix A: 90th Percentile Process Map

Appendix B: SWAT Data Entry Clipboard Sheet

Appendix C: SWAT Database

Appendix D: SWAT Huddle Design

Appendix E: The 8 Wastes
List of Figures and Tables

Figure 1: Current SWAT patient transport process 2
Figure 2: Process map of SWAT transport with average times and standard deviations 7
Figure 3: SWAT’s 15-minute policy involves built-in waste 8
Figure 4: SWAT’s most frequently visited inpatient units 8
Figure 5: Percent of patients not ready per unit, highlighting most frequented units 9
Figure 6: SWAT Clipboard readiness categories 10
Figure 7: Current policy and proposed timeline when bedside nurses prepare patient 14
Figure 8: Current policy and proposed timeline when nurses request preparation assistance 15

Table 1: Method and amount of data collected from each method 4
Table 2: Bedside nurse interview summary matrix 11
Table 3: Summary of recommendations and expected impacts 16
EXECUTIVE SUMMARY

Introduction and Background
At Michigan Medicine, the Specialized Workforce for Acute Transport (SWAT) is a group of nurses and paramedics responsible for the safe and efficient transport of high-risk patients to temporary diagnostic or procedural locations. In June of 2016, Michigan Medicine implemented an intrahospital transportation policy change that required the SWAT team or equivalent nurse to transport certain moderate-risk patients in addition to all high-risk patients within the hospital. This policy change has resulted in a 76% increase in SWAT transport requests and a 190% increase in turfed calls, or calls turned away by SWAT due to lack of resources. When SWAT is unavailable for transport, the patient’s bedside nurse is required to go with them to the procedure, increasing the workload on the intrahospital unit. Although SWAT recently added additional employees to assist with this increase in calls, there are still perceived inefficiencies and communication issues in the transport process that, if resolved, could allow SWAT to serve more requests and improve coordination.

The main goal of this project was to analyze the current process flow for transporting patients and identify key areas for improvement. Team 11 focused on coordination between SWAT and outside units. Coordination issues may include awareness, communication, readiness, or efficiency.

Methods
Team 11 performed the following tasks to identify key areas for improvement in SWAT’s patient transport process:

On-site observations including SWAT shadowing, interviews, and time studies
Team 11 performed on-site observations, shadowing, interviews of SWAT team members, and time studies over the course of 8 weeks. Team 11 shadowed 25 transport runs, interviewed 16 SWAT team members, and recorded 23 time studies.

Analysis of historical data from SWAT and a previous IOE 481 team
Team 11 analyzed data from the SWAT Database, SWAT clipboard data from February 2017, and a previous IOE 481 team’s time studies. A total of 6683 entries were collected from the SWAT Database from fiscal year 2017, which spanned from July 2016 - January 2017. Team 11 also analyzed clipboard data containing 910 entries from February 2017 to get a better understanding of the handwritten data that is transferred to the database.

Bedside nurse interviews from inpatient units of interest
Team 11 conducted interviews with 12 bedside nurses over the course of 1 week. These interviews enabled Team 11 to get a better understanding of bedside nurses’ perspectives on the transport process as well as any discrepancies in expectations for SWAT and the bedside nurses.

Literature search to identify methods for improved intrahospital transport
Team 11 researched lean methods that could be adapted to form recommendations. Beyond recommendation formation, the research helped Team 11 estimate expected impacts.
Findings & Conclusions

Team 11 completed 8 weeks of observations, including shadowing, interviews, and time studies. Observations provided a complete understanding of SWAT’s process, including causes for variability and waste. From time studies, Team 11 calculated averages and standard deviations for each step in SWAT’s process and found that bedside preparation, travel and procedure prep, completion of MiChart, and patient drop off have the highest variations relative to their completion time. For example, bedside preparation took an average of 6 minutes, with a standard deviation of 3 minutes.

From shadowing and SWAT team member interviews, Team 11 learned about SWAT’s 15 minute policy, in which SWAT leaves the office for transport runs 15 minutes before the scheduled procedure time. On average, SWAT arrives to procedures on time; however, on certain runs, SWAT may be early or late. When SWAT is early, SWAT spends time waiting at the procedure unit rather than fitting more transport runs into their schedule. When SWAT is late to procedures, they risk lost table time, or time a patient is scheduled to undergo a procedure but is not undergoing the procedure. If SWAT were able to plan for bedside preparation variation, departure time could be adjusted to reduce opportunity costs and better serve patients, bedside nurses, and procedural units.

Team 11 analyzed SWAT’s database to identify inpatient units to focus on. There are seven inpatient units that make up 63% of SWAT’s total runs. The remaining 37% of runs include 50 other units, which each make up less than 5% of the total number of SWAT runs. The seven most frequently visited units consist of: 4C, 4D, 7C, CVC5, 6D, 8D, and 5D. Additionally, Team 11 analyzed each inpatient unit’s performance by not ready percentage, the percentage of patients that are not ready for transport when SWAT arrives. The unit with the highest not ready percentage is 7C, at 36%. The remaining six most frequently visited inpatient units represent a broad range of not ready percentages.

After analyzing the SWAT database, Team 11 investigated the handwritten clipboard data for the month of February 2017, which SWAT uses to input into the Access database. Team 11 discovered that some categories in the clipboard are not distinguished in the database. For example, the Ready/Not Ready column in the Access database is a checkbox, true or false, where a check (true) means Not Ready; however, an unchecked box in the database could mean a variety of things in the clipboard. There are 8% of the total entries for the month of February 2017 in the clipboard data containing categories other than Ready/Not Ready. In the SWAT database, this 8% leads to an artificial inflation of the amount of patient’s ready for SWAT transport; however, does not affect the accuracy of the Not Ready percentage.

To better understand coordination between SWAT and inpatient units, Team 11 interviewed 12 bedside nurses from four different inpatient units. The 12 interviewed nurses and SWAT team share the same definition for patient readiness; however, 9 out of the 12 nurses often postpone patient preparation because it is uncomfortable for patients to wait on a stretcher and patients require constant supervision once transferred to travel monitors. Furthermore, Team 11 discovered that SWAT tells the nurses to be ready 15 minutes before the procedure, yet SWAT transporters usually leave the office at that time. Therefore, the nurses find that SWAT is consistently arriving 4 minutes late; this, combined with having to stay with patients on travel
monitors, does not motivate nurses have patients ready exactly when SWAT is scheduled to arrive.

**Recommendations & Expected Impact**

The following recommendations are expected to improve the coordination between SWAT and the bedside nurses from inpatient units, and thus improve the efficiency of SWAT’s process.

*Use Huddles Between SWAT and Bedside Nurses to Solve Problems*

Team 11 noticed that problems between SWAT and bedside nurses upon patient transfer were not being adequately discussed between the parties involved. Providing SWAT and the bedside nurses a platform to discuss the issues promotes consistency so areas of excellence can be duplicated, and problems can be identified so issues are resolved. Team 11 recommends a representative bedside nurse from each of the seven most frequented inpatient units and representatives from SWAT meet weekly for 30 minutes to address recent problems and successes. SWAT will designate one person to lead each meeting and be responsible for follow-ups. Team 11 has provided a template and standard meeting procedure, as shown in Appendix D. This template will keep the discussion on track, set expectations for all parties involved, and includes metrics Team 11 recommends SWAT track to gauge how changes affect SWAT’s process. These huddles are expected to help SWAT pilot other recommendations and further improve coordination and relations with bedside nurses.

*Communicate with Nurses Before Return to Inpatient Unit*

Team 11 recommends that SWAT send bedside nurses pages to improve communication and preparation. Team 11 recommends three kinds of pages to inform nurses of SWAT delays, procedural delays, and completed procedures. Sending a notification to the bedside nurse when SWAT will be late due to a previous run will improve SWAT reliability, save nurses valuable time, and prevent patients from waiting on stretchers. Unpredictable procedural delays will allow bedside nurses to be informed of when the patient will return. Delays are infrequent and will only affect 9% of runs. Lastly, Team 11 recommends SWAT pages bedside nurses when leaving the procedural units for every transport, which would act as an early “call light” to help nurses prepare for patient handoffs.

*Adjust 15 Minute Policy to Plan for Variation*

Team 11 recommends that SWAT reconsider the current 15-minute policy. If bedside nurses inform SWAT the patient preparation process will take additional time and resources, SWAT can plan for variation in patient mobility. When help is solicited, bedside nurses will expect SWAT to arrive 15 minutes before the procedure time to aid with patient preparation. If a request is not made, the bedside nurse will need to have the patient ready for transport before SWAT arrives 5 minutes before the procedure. This new policy has the potential to increase value added time and should be piloted with one inpatient unit and reviewed and adjusted at huddles.
INTRODUCTION

At Michigan Medicine, the Specialized Workforce for Acute Transport (SWAT) is a group of nurses and paramedics responsible for the safe and efficient transport of high-risk patients to temporary diagnostic or procedural locations. In June of 2016, Michigan Medicine implemented an intrahospital transportation policy change that required the SWAT team or equivalent nurse to transport certain moderate-risk patients in addition to all high-risk patients within the hospital. This policy change has resulted in a 76% increase in SWAT transport requests and a 190% increase in turfed calls, or calls turned away by SWAT due to lack of resources. When SWAT is unavailable for transport, the patient’s bedside nurse is required to go with them to the procedure, increasing the workload on the intrahospital unit. The main goal of this project is to analyze the current process for transporting patients and identify key areas to improve.

IOE 481 Team 11 observed the SWAT patient transport process, including coordination between SWAT, bedside nurses, and procedural units and collected data on site as well as from the historical SWAT database and the previous semester IOE 481 team’s time studies. Team 11 analyzed the data, formulated conclusions, and developed recommendations to improve SWAT’s current process. This report details the completion of the project, including: background, key issues, project scope, methods, findings, conclusions, recommendations, expected impact, and supporting documentation.

BACKGROUND

The SWAT Team is divided into two main task teams: transport and scheduling. In June of 2016, a policy approximately doubled the number of calls that SWAT received and therefore, increased the number of calls that SWAT turfed, or cancelled due to insufficient resources from SWAT.

SWAT Team

The Specialized Workforce for Acute Transport (SWAT) is a group of nurses and paramedics responsible for transporting high-risk patients to temporary diagnostic or procedural locations safely and efficiently. SWAT team members perform one of two tasks each day: transport or scheduling. SWAT staffs two schedulers throughout the day to handle incoming transport requests, the scheduling of procedures from those requests, and communication regarding the scheduled procedure and transport run to the SWAT team members on the transport run, the bedside nurse, and the procedural unit. The remaining team members go on “runs” to transport patients.

Policy Change

Prior to June 2016, SWAT was solely responsible for the transport of high-risk patients to a diagnostic or procedural units throughout the hospital. However, a policy change in June of 2016 required SWAT to transport certain moderate-risk patients in addition to the high-risk patients SWAT was already responsible for. This policy change has resulted in a 76% increase in transport requests by SWAT and a 190% increase in turfed calls. When SWAT is unavailable for transport, the patient’s bedside nurse is required to go to the respective procedure, increasing workload on the intrahospital unit.
Current Transportation Process
Currently, the SWAT transportation process involves collaboration between SWAT, bedside nurses, and procedural units. SWAT’s current policy requires bedside nurses to have the patient ready for transport 15 minutes before the procedure is scheduled to begin. Patient readiness is defined as the patient being on the stretcher with necessary monitoring machines and any other necessary equipment, such as an arrest box or oxygen tanks. The steps in the current transportation process are shown in Figure 1 below.

1. **Triage and Scheduling**
   The SWAT scheduler receives a request for transport and identifies whether the patient requires SWAT. They then work with the procedure unit to schedule the patient’s procedure for a time that fits into the procedure unit’s, as well as SWAT’s, schedule.

2. **SWAT Preparation**
   SWAT looks up patient information on MiChart, fills out their standard Patient Info Sheet, and prepares any necessary materials that patient may require.

3. **SWAT Travels to Bedside**
   One or two SWAT team members leave the SWAT office 15 minutes before the patient’s scheduled procedure time to arrive at the bedside.

4. **Bedside Preparation**
   If the patient is not ready upon SWAT’s arrival, SWAT works with the bedside nurse to finish preparing the patient for transport. Patient readiness includes the patient on a stretcher, hooked up to necessary monitors, and containing any extra equipment, as necessary. The bedside nurse gives report on the patient’s current status.

5. **Travel and Procedure Preparation**
   SWAT travels with the patient to the procedure location and helps prepare the patient for the procedure.

6. **Procedure**
   SWAT waits or assists the patient while the procedure is completed.
7. **Return to Bedside**
   SWAT travels with the patient back to the patient’s room.

8. **Patient Drop Off**
   Upon arrival at the patient’s room, SWAT turns on the call light to alert the patient’s bedside nurse of SWAT’s arrival. SWAT gives report to the bedside nurse on the patient’s status during the run and any other important information they need to know.

9. **Complete MiChart**
   SWAT completes the input of key patient information such as any vitals taken on the transport run into the patient’s chart using MiChart.

10. **Return to SWAT Office or Next Run**
    SWAT either returns to the office for their next assignment, or head immediately to the location of their next transport run.

**Key SWAT Metrics**
SWAT tracks multiple metrics on a monthly basis. For example, turf rate is a key metric that tracks how many calls are cancelled by SWAT due to insufficient resources. Additionally, patient readiness is tracked on each run to measure whether or not the patient is ready for transport upon SWAT’s arrival. If a patient is not ready when SWAT arrives, SWAT potentially cancels the call upon arrival or the run is delayed, which might require SWAT to turf other calls later in the day.

**KEY ISSUES**
Following the policy change in June 2016, SWAT has faced an increase in transport calls. Management and SWAT transporters are dissatisfied with perceived coordination issues that may be delaying transport runs and subsequently keeping SWAT from maximizing the utilization of team members and the number of runs completed in a given time period. Delays may be related to readiness and efficiency that stem from a lack of standardization in the current process. For example, nurses may not have prepared the patient for transport by the time the SWAT team arrives. When inpatient units fail to be ready, it affects SWAT’s efficiency. These issues delay SWAT and thereby delay procedural units. Delays lead to suboptimal patient care and high costs to the hospital. For example, according to a SWAT administrative fellow and registered nurse, being 15 minutes late to an MRI procedure costs the hospital ~$6,000 in lost table time.

The following key issues summarize the need for this project:
- Increased number of patient transportation and procedure requests
- Increased number of transports turfed, or cancelled, by SWAT
- Perceived coordination issues between SWAT and bedside nurses
- Room for improvement in the SWAT transport process

**GOALS AND OBJECTIVES**
The main goal of this project was to analyze the current process flow of transporting patients and identify key areas for improvement. Team 11 focused on coordination between SWAT and outside units. Coordination issues may include awareness, communication, readiness, or efficiency.
The three main objectives to achieve this goal are as follows:

- Identify coordination issues in the current patient transport process
- Formulate solutions for improvement
- Make recommendations on how these solutions should be implemented

**PROJECT SCOPE**

The scope of this project included analyzing each step of the SWAT patient transport process. This process begins once SWAT schedules the transport, includes when the SWAT team leaves the office, and ends after delivering the patient to their end destination once the SWAT team returns to the office or starts a new transport run. The scope of the process included SWAT coordination with bedside nurses and preparation steps these nurses take in order to prepare the patient for transport.

The scope of this project did not include procedures outside the responsibilities of SWAT, such as medical operations and surgical procedures. The scope also did not include operations of the bedside nurse that do not directly relate to SWAT coordination or any part of the SWAT scheduling process, except for crucial information relayed between the SWAT scheduler and person scheduling the patient’s transport.

**METHODS**

In order to make recommendations to improve SWAT’s process, Team 11 utilized many tools including: on-site shadowing, observations, interviews of SWAT team members, bedside nurse interviews, time studies, analysis of SWAT’s historical data, and a literature search. Table 1 summarizes the methods used and sample size collected by Team 11 throughout the duration of the project.

<table>
<thead>
<tr>
<th>Task</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site Observations</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Shadowing Transport Runs</td>
<td>25 runs</td>
</tr>
<tr>
<td>SWAT Team Interviews</td>
<td>16 nurses</td>
</tr>
<tr>
<td>Team 11 Time Studies</td>
<td>23 runs</td>
</tr>
<tr>
<td>Previous IOE 481 Team Time Studies</td>
<td>180 runs</td>
</tr>
<tr>
<td>Analysis of SWAT Database</td>
<td>6683 entries</td>
</tr>
<tr>
<td>Analysis of SWAT Clipboard Data</td>
<td>910 entries</td>
</tr>
<tr>
<td>Bedside Nurse Interviews</td>
<td>12 nurses</td>
</tr>
</tbody>
</table>
**SWAT Shadowing, Interviews, and Time Studies**

Team 11 performed on-site observations over 8 weeks. These observations were recorded while Team 11 shadowed 25 transport runs. During these transport runs Team 11 interviewed 16 SWAT team members. Team 11 recorded the date, pick up location, procedural unit, scheduled procedure time, patient status upon arrival, times between process steps, and reasons for process variation for example patient mobility, nurse responsiveness, or procedure related complications.

Team 11 timed SWAT on 23 of the transport runs to inform the time studies. During the runs, team members would time each step of the transport process from the moment the SWAT transporters left the office to go pick up the patient, to the moment SWAT returns to the office after dropping the patient back off in their respective room. The time studies and observations helped quantify SWAT’s process steps and identify variation, waste, and coordination issues.

**Analysis of SWAT Database**

Team 11 received two Access databases containing information about every SWAT run during Fiscal Year 2016 and the current Fiscal Year 2017. SWAT’s fiscal year spans July through June; therefore, the databases contain every SWAT run from July 2015 to January 2017. Team 11 focused on the FY 2017 data, as this contained every run since the implementation of the new policy change that increased the transport requests SWAT receives. The FY 2017 database contained 6683 non-turfed transport runs and included transport runs from July 1, 2016 through January 31, 2017. Team 11 also received the SWAT clipboard data for February 2017 containing 910 entries. This clipboard data contains the handwritten information that is entered directly into the database.

In addition to these databases, SWAT shared an excel worksheet containing a breakdown of the data from both the FY 2016 and FY 2017 database, which contains key metrics SWAT tracks monthly as well as visuals reflecting trends in these metrics throughout FY 2016 and FY 2017. Team 11 stratified this data by variables such as: unit, patient readiness, and day of the week to find trends in the past data that could explain things Team 11 noticed on-site during the 8 weeks of observations.

In addition to SWAT’s database, Team 11 received 186 entries from the time study data done by the Fall 2016 IOE 481 Team that previously worked with SWAT. The previous team’s data was collected during November 2016 and was entirely self-reported by SWAT using the same process step start and end points Team 11 used during time studies taken by the team.

**Bedside Nurse Interviews**

Team 11 coordinated with four inpatient units to interview the nurses to get a better understanding of the bedside nurses’ perspective on patient readiness. Team 11 observed differing definitions of patient readiness, even within SWAT; therefore, collecting bedside nurse perspectives helped Team 11 understand what causes this variation. The interviews also gave Team 11 a better understanding of any communication barriers during bedside nurse and SWAT interactions that cause delays in patient transports, and cause delays in SWAT’s process.

**Literature Search**

Team 11 conducted a literature search to understand various methods to intrahospital transport and how these methods could apply to the SWAT transport team.
Improved Communication Between Groups Leads to Improved Process Efficiency

An article from the *Journal of Emergency Nursing*, “Quality Control Work Group Focusing on Practical Guidelines for Improving Safety of Critically Ill Patient Transportation in the Emergency Department” [1], discusses the use of group huddles as a way to improve communication and in turn, improve process efficiency. The article concluded that when those directly involved in a task have the ability to communicate frequently to discuss the strengths and weaknesses of the process they perform, it leads to a higher level of efficiency and effectiveness. Additionally, groups that use these huddles also follow up more frequently on the issues they have attempted to resolve than those who don’t utilize huddles. This research led Team 11 to consider the implementation of huddles between SWAT and bedside nurses.

A University of Michigan IOE professor’s dissertation, entitled “Improving Shift Handovers between Medical Residents: The Effect of Information, Access Cost, Metacognition, and Media Affordances” [2], contained an experiment that showed the correlation between accountability and performance. The result of this experiment confirmed that when someone is held accountable, they are more likely to perform the task more accurately than someone who is not held accountable. Team 11 aimed to improve coordination between SWAT and nurses, and this experiment assisted in generating ideas on how accountability can be increased to improve transports. This research helped Team 11 design an effective huddle format, discussed in recommendations.

**FINDINGS & CONCLUSIONS**

Team 11 drew numerous findings and conclusions from the methodologies of data collection and analysis performed. Team 11 discovered the perspectives of various roles in the SWAT transport process to ensure context driven recommendations were developed. The findings below were crucial in the team’s development of recommendations.

**Shadowing and Time Studies Show High Variability**

The information collected during the transport runs was included a process map of SWAT’s current workflow during a standard run. Figure 2 demonstrates the entirety of SWAT’s transport process, with the steps outside of Team 11’s scope shown in grey. An alternative visualization of the process with 90th-percentile times is available in Appendix A.

The SWAT transport process currently includes five of the eight wastes of lean processing (described in Appendix E), including: waiting, not utilizing talent, transportation, motion, and excess processing. Some of these wastes are inherent to the process, while others have the potential to be reduced or eliminated.
Figure 2: Process map of SWAT transport with average times and standard deviations

Each part of the process is shown with the average time a step takes and the observed standard deviations. The means were validated using a previous IOE 481 team’s time study data for 180 transports reported by SWAT during November 2016.

From Team 11’s time studies and the process map shown in Figure 2, it is evident that bedside preparation, travel and procedure prep, patient drop off, and completion of MiChart, have the highest variations relative to their completion time. Team 11 observed that bedside preparation variation was related to patient mobility and that patient drop off time depended on the nurse’s reaction time to the call light upon SWAT’s return. Team 11 focused on formulating solutions for reducing, communicating, and planning for variation associated with nurse interactions, as those were most relevant to the project scope. Additionally, there is inherent variation in procedure preparation and in completing MiChart because SWAT team members sometimes have time during the procedure to complete this task. However, the expedition of procedure preparation and MiChart completion depends on the demands of the procedure and patient. Sometimes SWAT has excess time and computer access while at the procedure unit, but this cannot be expected on all runs.

15 Minute Policy Involves Built-In Waste
SWAT currently leaves the office for transport runs 15 minutes before the scheduled procedure time. There are built-in wastes in this process in the form of waiting, nurse underutilization, and lost table time. When a bedside nurse spends time waiting for SWAT, time and talent is wasted. On average SWAT arrives to procedures on time; however, on individual runs SWAT may be early or late, as shown in Figure 3. Team 11’s time study found that on 29% of transports to procedures, SWAT was at least 5 minutes early or late.
When SWAT is early, time is spent waiting at a procedure unit rather than fitting more transport runs into their schedule. When SWAT is late to procedures, they risk costly lost table time and delays causing a delay on arrival to the next transport run. For example, for a MRI, 15 minutes of lost table time costs the institution approximately $6000, according to a SWAT Clinical Nurse Supervisor. If SWAT were able to plan for bedside preparation variation, they could adjust the departure time to reduce these opportunity costs and better serve patients, bedside nurses, and procedural units.

Analysis of SWAT’s Database Shows Inpatient Units of Focus
Team 11 used historical SWAT transport run data in its analysis of most frequently visited inpatient units as well as patient readiness across these units. Figure 4 shows the breakdown of the most frequently visited inpatient units.
As shown in Figure 4, the seven most frequently visited units make up 63% of SWAT’s total number of runs. The remaining 37% of runs is comprised of 50 other units, none of which make up more than 5% of the total number of SWAT runs. The seven most frequently visited units consist of: 4C, 4D, 7C, CVC5, 6D, 8D, and 5D.

Next, Team 11 analyzed the patient not-ready percentages from each unit and ordered them from highest not-ready percentage to lowest not-ready percentage. The results can be found in Figure 5, which also highlights where each of the eight most frequently visited units are located in this order.

As shown in Figure 5, the unit with the lowest not ready percentage is 11W with 6% and the unit with the highest not ready percentage is 7C, with 36%. Based on these results, Team 11 focused on the seven most frequented units for further investigation as they represent SWAT’s biggest clients as well as a broad range of readiness percentages. Therefore, Team 11 interviewed 12 nurses from four of these units to get the bedside nurse perspective on SWAT’s process. Team 11 concluded that SWAT should focus on these units moving forward.

**Analysis of SWAT Clipboard Data Shows Additional Ready Categories**

After reviewing the SWAT database and analyzing the Ready/Not Ready data, Team 11 further investigated how the data is transferred from the handwritten clipboard data each SWAT team member fills out after a run, to the Access database. When each run’s data is transferred, Team 11 discovered that some categories are excluded. For example, the Ready/Not Ready column in the Access database is a checkbox, true or false, where a check (true) means Not Ready. However, upon investigation of the clipboard data, an unchecked box in the database could mean a variety of things: the patient was ready, the call was cancelled, it was not applicable to the run, or the field was left blank. The breakdown of each occurrence is shown in Figure 6, below.
Figure 6 shows the percentage of entries in the clipboard data containing categories other than Ready/Not Ready. When totaled, these entries account for 8% of the total entries for the month of February 2017. In the SWAT database, this 8% is included with the Ready percentage, leading to an artificial inflation of the amount of patient’s ready for SWAT transport. However, the inclusion of these excess categories into the Ready field does not affect the accuracy of the Not Ready percentage.

**Interviewed Bedside Nurses Desire Improved Reliability and Communication from SWAT**

To better understand coordination between SWAT and inpatient units, Team 11 interviewed 12 bedside nurses from 4 different inpatient units. The bedside nurse perspective provided useful insight into definitions of readiness, nurse expectations, preparation methods, and sources of variation that influence the patient handovers. Interviews were structured and the results are summarized in Table 2 below.
Table 2: Bedside nurse interview summary matrix

<table>
<thead>
<tr>
<th>Bedside Nurse Interview</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shares SWAT definition of Patient Readiness</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Said SWAT plans a 15 minute buffer before procedures</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>n</td>
<td>n</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>n</td>
<td>y</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>Transfers patient to travel monitors before SWAT arrives</td>
<td>n</td>
<td>y</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>y</td>
<td>n</td>
<td>y</td>
<td>y</td>
<td>n</td>
</tr>
<tr>
<td>Would like pager warning before SWAT returns</td>
<td>~</td>
<td>y</td>
<td>n</td>
<td>~</td>
<td>y</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
</tbody>
</table>

Source: Nurse Interviews       Sample Size: 12 Nurses      Interview Period: March 2017

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>~</td>
</tr>
</tbody>
</table>

The 12 interviewed nurses and SWAT both define patient readiness as the patient being situated on the stretcher in the hallway with any necessary monitors and equipment. However, 9 out of 12 nurses reported often postponing patient preparation because it is uncomfortable for patients to wait on a stretcher in the hallway and high-risk patients require constant supervision once transferred to travel monitors. Additionally, there is no current standardization or communication for what monitors and equipment SWAT will provide on a given run and which ones the inpatient unit will provide.

Furthermore, Team 11 realized that SWAT tells the nurses to be ready 15 minutes before the procedure, yet SWAT transporters usually leave the office at that time. Therefore the bedside nurses find that SWAT is consistently arriving 4 minutes late; this sets a precedent that does not motivate nurses have patients ready exactly when SWAT is scheduled to arrive.

SWAT does not constantly warn nurses of their arrival or return from procedure. Specifically, nurses do not expect SWAT to notify them when SWAT will arrive late or the procedure is delayed significantly. All interviewed nurses would appreciate warnings when SWAT varies from the stated arrival time. Approximately half of the interviewed nurses would appreciate an additional page before SWAT returns with the patient, especially for lengthy procedures.
Summary of Conclusions
Team 11 investigated the SWAT process and had the following findings and conclusions:

- Shadowing and Time Studies Show High Variability
- 15 Minute Policy Involves Built-In Waste
- Analysis of SWAT’s Database Shows Inpatient Units of Focus
- Analysis of SWAT Clipboard Data Shows Additional Ready/Not Ready Categories
- Interviewed Bedside Nurses Desire Improved Reliability and Communication from SWAT

RECOMMENDATIONS & EXPECTED IMPACT
Based on the findings and conclusions, Team 11 would like to suggest the following recommendations. Some recommendations provide potential solutions that SWAT could pilot and implement, while other recommendations will help SWAT focus on problem areas to investigate and improve.

Use Huddles Between SWAT and Bedside Unit Nurses to Solve Problems
Throughout 8 weeks of observations and data collection, Team 11 noticed that problems between SWAT and bedside nurses upon patient transfer were not being adequately addressed or discussed between the parties involved. This lack of communication restricts the bedside nurses’ and SWAT’s ability to reach conclusions on process inefficiencies as well as their ability to improve the process as a whole. Providing SWAT and the bedside nurses with a platform where they can discuss the common issues they face promotes consistency so that areas of excellence can be duplicated, and problems resolved.

Huddle Logistics
A representative bedside nurse from the top seven most frequented units (4C, 4D, 7C, CVC5, 6D, 8D, and 5D) and SWAT will schedule a weekly 30 minute meeting to discuss recent problems and successes occurring during the patient handoff process upon SWAT’s arrival to an inpatient unit. Team 11 recommends SWAT designates one person to lead each meeting and be responsible for any necessary follow-ups to promote a culture of continuous improvement.

Standard Huddle Procedure
Team 11 has provided a template, as shown in Appendix D, to give SWAT and the bedside nurses a structured meeting that ensures all problems have been adequately addressed. The template will be used by the SWAT lead during each meeting to keep discussion on track and set expectations for all parties involved. The template follows the structure of the standardized huddle procedure Team 11 recommends, which can be found in Appendix D.

Key Metrics to Track for Huddles
As shown in the huddle template in Appendix D, Team 11 recommends that SWAT tracks key metrics to keep continuous improvement in SWAT’s process on track. The use of metrics in the huddles also allows for transparency between SWAT and the bedside units and opens the floor for discussion on any fluctuations in metrics from week to week.
Team 11 recommends that SWAT tracks and sets allowable thresholds for Patient Not Ready Percentage, Cancellation Rate, and Turf Rate. SWAT already tracks the data necessary for these metrics, but keeping an open dialog regarding the status will help SWAT continue to make continuous improvements in the process. We recommend SWAT reviews current metric tracking procedures to ensure accuracy for process improvement. Additionally, Team 11 recommends tracking general impressions on Communication, SWAT’s Punctuality, and Patient Preparedness. These impressions will lead to further discussion on what is going well and what can be improved in SWAT’s process during the huddles.

Team 11 expects the huddles to allow SWAT and nurses to track metrics, gauge impressions, communicate issues, identify problem solvers, brainstorm solutions, ensure follow-ups, provide accountability, and reduce inconsistency.

**Page Bedside Nurses to Improve Coordination**

Based on information gathered during interviews and time studies, Team 11 recommends that SWAT send bedside nurses pages at different points to improve communication and preparation. Pager numbers are easily accessible in MiChart during the transport process. Team 11 recommends three kinds of pages to inform nurses of SWAT delays, procedural delays, and completed procedures.

*Inform Nurses of SWAT Delay*

Team 11 recommends an additional point of contact when previous runs delay SWAT’s arrival at the next impatient unit. Specifically, SWAT should send out a page to the bedside nurses to let them know that they will be late to pick up the patient. In the rare case that SWAT is delayed on a run, all following transports may be affected. Sending out these notifications prior to pick up would improve SWAT reliability, save the bedside nurses valuable time, and prevent patients from waiting on stretchers.

*Inform Nurses of Procedural Delays*

Most bedside nurses can confidently predict procedure durations and SWAT’s return. However, there are unforeseen delays during procedures that delay SWAT’s return. Sometimes, unpredictable delays cause both SWAT and the bedside nurses to be less efficient because the nurses are unaware of these delays and therefore cannot accurately judge when the patient will return. During the nurse interviews, 5 out of 12 of the nurses expressed interest in having SWAT send a page if they expect to be late dropping the patient off, so the nurse can allocate their time accordingly.

Procedural delays are infrequent thus, based on Team 11’s time studies; this additional page would only be necessary on 9% of runs. If procedural delays occur, the nurses will know they can spend time assisting other patients, and not have to guess when SWAT will return. Team 11 recommends SWAT transporters send out return pages to the bedside nurses if there will be a delay in the overall run. This page allows for both the SWAT transporters and bedside nurses to be informed abnormalities that hinder the smooth and timely transition of patients. By notifying bedside nurses of procedural delays, bedside nurses could be more productive and more prepared for patient hand-offs, especially during the 9% of transports that experience delays of more than 10 minutes.
Inform Nurses of SWAT’s Return
In addition to the infrequent delay notifications, Team 11 proposes that SWAT look into sending a page to the bedside nurse when leaving the procedural unit on each transport. This page would act as an early “call light” to help nurses prepare for patient handoff. During the data analysis and interviews of both SWAT and the bedside nurses, Team 11 determined that a page letting the nurses know when SWAT leaving the procedure would improve coordination. According to the interviewed nurses, an additional page is not a problem and would be helpful.

Adjust the 15 Minute Policy to Plan for Variation
Team 11 found that SWAT consistently leaves the office 15 minutes before the procedure time for all patient transports. However, SWAT schedulers tell the bedside nurses to expect transporters to arrive at the inpatient unit at this same time. Although SWAT arrives on time to procedures on average, they sometimes arrive several minutes early or late, depending on patient readiness. Thus the SWAT 15 minute policy builds in waste in the form of waiting, underutilized nurses, and lost table time because it does not plan for variation in bedside preparation.

Team 11 recommends that SWAT reconsider their 15-minute policy. SWAT could add a field to the transport order form, which the nurses would use to request SWAT’s assistance preparing select patients. This request would be based on the bedside nurse’s assessment of the patient and impatient unit resources. SWAT schedulers could accept or deny the request based on transporter availability. The request would inform SWAT that the bedside nurses expects the preparation process to take additional time and resources and allow SWAT to plan for variation in patient mobility. See Figures 7 and 8 to compare the original policy to the proposed timelines.

Figure 7: Current policy and proposed timeline when bedside nurses prepare patient
If a request is not made, the bedside nurse will need to have the patient ready for transport before SWAT arrives 5 minutes before the procedure, as shown in Figure 7. When help is solicited and mutually agreed upon, nurses will expect SWAT to arrive at least 15 minutes before the procedure time to aid with patient preparation, as shown in Figure 8. This new policy should be piloted with one inpatient unit and reviewed at huddles where the exact arrival times can be adjusted based on performance. If successful, this flexible policy should be implemented for all other inpatient units.

This new policy is expected to positively impact inpatient units and the SWAT transport process. Planning for variation by adjusting the departure times and expectations accordingly will eliminate waste in the form of waiting time, underutilization of nurses and paramedics, and lost table time. SWAT would spend more time assisting patients while on runs and arrive closer to procedure when possible allowing more runs in each day. SWAT is at least 5 minutes early or late to procedures on 29% of runs. Thus, Team 11 estimates that the time saved, would accumulate to over 11 hours each week.

**Summary of Recommendations and Expected Impacts**

Team 11’s recommendations are expected to improve the coordination between SWAT and the bedside nurses from inpatient units. The recommendations target coordination, which includes: (1) awareness, (2) communication, (3) readiness, and (4) efficiency. A summary of each recommendation and the corresponding expected impacted can be found in Table 3, below.
Table 3: Summary of recommendations and expected impacts

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Expected Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add weekly huddle between SWAT and bedside nurses</td>
<td>Identify issues, reduce inconsistency, create accountability, improve coordination</td>
</tr>
<tr>
<td>Communicate with bedside nurse upon return to inpatient unit</td>
<td>Improve reliability, reduce waste, improve coordination, improve patient care</td>
</tr>
<tr>
<td>Adjust current 15 minute policy</td>
<td>Save at least 11 hours of SWAT transporter time per week</td>
</tr>
</tbody>
</table>

Each proposed change will both improve SWAT’s coordination with the bedside nurses and improve the accuracy of tracking key metrics, which will lead to the continuous improvement of SWAT’s process beyond this project.
References


Appendix A: 90th Percentile Process Map

Triage & Schedule → SWAT Preparation → Travel to Bedside 7 min → Bedside Prep 10 min → Travel & Procedure Prep 25 min → Procedure

Return to Office 8 min → Complete MiChart 8 min → Patient Drop Off 12 min → Return to Bedside 15 min

Source: IDE481 Team 11 Time Study  Sample Size: 23  Collection Period: February – March 2017
Appendix B: SWAT Data Entry Clipboard Sheet

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll Up</td>
<td>Location</td>
</tr>
<tr>
<td>Procedure Start Time</td>
<td>Procedure End Time</td>
</tr>
<tr>
<td>Total Time</td>
<td>SWAT Area</td>
</tr>
<tr>
<td>SWAT Drop off Time</td>
<td>SWAT Pick up area</td>
</tr>
</tbody>
</table>
| Comments | }
Appendix C: SWAT Database

The following images show the current fields located in the SWAT Access Database as they appear in the base, unfilled out, state. The second image is a continuation to the right of the first image.

<table>
<thead>
<tr>
<th>DATE</th>
<th>DAY</th>
<th>PICK UP LOCATION</th>
<th>WHAT WE DID</th>
<th>START TIME</th>
<th>END TIME</th>
<th>TOTAL TIME</th>
<th>BSP</th>
<th>SEDATION ON TRIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 PEOPLE</th>
<th>BEDSIDE RN</th>
<th>DROP OFF</th>
<th>READY</th>
<th>COMMENTS</th>
<th>BLUE</th>
<th>YELLOW</th>
<th>GREEN</th>
<th>TURF</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D: SWAT Huddle Design

Standard Procedure for Meetings:
1. Team meets and does Role Call (Name & Unit Represented)
2. Key Metrics Reviewed and Discussed
3. Team Identifies and Documents Problems Impacting Performance
4. Immediate Actions to Respond to Problems are Documented and Leads are Assigned
5. Review/Receive Update on Follow Up Problems from Last Meeting
6. Announcements, Recommendations, Celebrations are Discussed and Recorded

<table>
<thead>
<tr>
<th>Date: 4/18/2017</th>
<th>Reviewing Week of: 4/10/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units Attending: 4C: ✓</td>
<td>4D: ✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metrics</th>
<th>This Week</th>
<th>Our Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Ready %</td>
<td>22%</td>
<td>15%</td>
</tr>
<tr>
<td>Cancelations</td>
<td>4</td>
<td>&gt;2</td>
</tr>
<tr>
<td>Turf Rate</td>
<td>17%</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Overall Impression of Week:**

- Communication: 😛 😛 😞
- Preparedness: 😛 😛 😞
- Punctuality: 😛 😛 😞

<table>
<thead>
<tr>
<th>Problem</th>
<th>Ideas</th>
<th>WHO will do WHAT by WHEN?</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWAT canceled run b/c previous procedure was delayed</td>
<td>Tell SWAT office about delay asap, so they tell unit or send alternative transporter</td>
<td>Mike will send an email to SWAT before Tuesday</td>
</tr>
</tbody>
</table>
Appendix E: The 8 Wastes

In lean processing, anything that does not add value or decreases quality is considered waste. Waste should be reduced or eliminated when possible. Lean manufacturing is based on the idea of increasing value with less work, and anything that does not add value should be considered waste to immediately be removed. There are eight types of waste that form the acronym, DOWNTIME:

1. Defects
2. Overproduction
3. Waiting
4. Not utilizing talent
5. Transportation
6. Inventory excess
7. Motion
8. Excess processing