Emergency Department Admission Process Analysis
University of Michigan Health System
University Hospital

Final Report

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Date Submitted:
April 17, 2012
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Executive Summary

The Emergency Department (ED) at the University of Michigan provides initial treatment to patients with a wide variety of illnesses and injuries. Patients arrive at the ED and are examined by a physician; depending on the severity of their condition they are discharged, put into medical observation, or admitted to the hospital for further treatment. The process of admitting a patient from the ED to a bed in a hospital unit currently takes about 1 hour when the ideal process time is 15 minutes, as stated by the client. An IOE 481 student team from the University of Michigan has been asked to develop and recommend improvements to reduce this admission time.

Background

The Emergency Department at the University of Michigan Hospital has an average of 72,000 patient visits a year. Patients who visit the ED are either discharged or admitted to the hospital. Admitting patients to the hospital requires a series of steps between the inpatient bed being ready and the patient leaving the Emergency Department. According to the Nurse Manager and Nurse Supervisor, the process can take over an hour when it should take approximately 15 minutes. By collecting data and observing the process, bottlenecks have been identified and recommendations for improvement can be made.

Methodology

The student team examined the admission process from the ED to an inpatient unit. Data was collected through observations and team data collection of the bed slip process, ED staff data collection, historical data and a literature search.

Observed Data Collection
The team observed in the ED as well as on the inpatient units to understand the admission process for 4 weeks. Team data collection occurred from January 26 to February 22 and consisted of 47 data samples spread over 69 hours of observation.

As a final step to the observation process, the team informally interviewed the ED Nurses, ED Techs, ED Clerks, ED Medical Providers, ED Charge RNs, Unit Clerk, Unit RN and the ABCC to gain insight of where and why bottlenecks are happening.

ED Staff Data Collection
The ED staff helped collect data by performing self-collection of key times throughout the process. The staff data collection helped collect data ranging from all hours of the day as well as every day of the week. Perceptions of key reasons for delay were also gathered and recorded for admissions that exceeded 30 minutes. Staff data collection occurred from March 2- 19 and consisted of 36 data samples.

Literature Search
The team conducted a literature search to see what publications there may be from other institutions on similar subject matter.
Historical Data
Additionally, the team utilized electronic data from centricity to determine the overall lead time from bed ready to patient leaving the ED. This data was used to validate the collected data.

Value Stream Maps
The team created two value stream maps of the ED admission process based on the data collected, one for the Adult Medical Observation Unit (AMOU) process and one for the General Care process. The team used the collected time studies data to develop average and median process times, wait times, and the overall lead-time within the process flow. Delays were identified by times exceeding 30 minutes. An analysis of the effects of specific types of delays on the overall process lead time were performed.

Findings

The following findings were made and conclusions were drawn from the team’s data analysis regarding the following topics:

Value Stream Maps:
- The lead time for non-pilot floors is 36.1 minutes while the lead time for the transport pilot floors is 40.6 minutes
- The total overall lead time for General Care units is 37.1 minutes
- 90% of the time techs were used to transport patients while 10% of the time transport was used to escort patients
- The total overall lead time for the AMOU is 24.8 minutes

Time Study Validation:
- The times from the historical data pull were larger than the collected data, likely due to the Hawthorne Effect

Observation and Interview Analysis
- The team determined the steps in the process needed to be observed
- Common reasons for delay were developed based off of ad hoc interviews

Data Analysis Stratification by Destination Unit
- 32% of the samples had a total lead time less than 30 minutes for General Care
- 80% of the samples had a total lead time less than 30 minutes for the AMOU
- The tech has possession of the bed slip for 66% of the General Care admissions process
- The Charge RN has possession of the bed slip for 50% of the AMOU admissions process

Data Analysis Stratification by Reasons for Delay
- 29% of the reasons for delay in the admissions process were due to other reasons as indicated by staff
  - The majority of delays are isolated reasons as indicated by staff
Conclusions

From the findings the team was able to make the following conclusions:

- Lead time was greater for the transportation pilot than the non-pilot
- Majority of lead time comes between when the tech is informed to when the patient leaves
- Average time between paging the unit and the patient leaving is not the expected 15 minutes
- The longer lead time for the pilot in the General Care value steam map could be attributed to the transport as a reason for delay
- The Charge RN receiving the ‘Bed Ready’ page adds to the overall process lead time.
- There is not a consistent reason for why the process exceeds 30 minutes

Recommendations

To reduce these problems, the Operations and Analysis Team recommends the following:

- Eliminate Charge RN tasks
- Update Paperwork in patient room
- Change communication between Primary RN and Tech
- Future group work:
  - Analyze transport efficiency
  - Analyze impact of removing Charge RN tasks
  - Investigate the tasks of the unit floors to reduce 15 minute lead time
  - Investigate difference between data collected and data from historical pull
Introduction

The Emergency Department (ED) at the University of Michigan provides initial treatment to patients with a wide variety of illnesses and injuries. Patients arrive at the ED and are examined by a physician; depending on the severity of the ED patients’ condition they are discharged, put into a medical observation unit, or admitted to the hospital for further treatment. The process of admitting a patient from the ED to a bed in a hospital unit currently takes an hour, however, the ideal process time is 15 minutes as identified by the clients, the ED Nurse Manager and ED Nursing Supervisor. An IOE 481 student team from the University of Michigan had the task of analyzing the current ED admission process, finding the potential sources of waste, and developing recommendations for improvements to reduce the admission time.

Background

The Emergency Department at the University of Michigan Hospital has an average of 72,000 patient visits a year. Patients who visit the ED are either discharged or admitted to the hospital, averaging about 23,000 admissions per year. Admitting a patient to the hospital requires a series of steps between the inpatient bed being ready and the patient leaving the Emergency Department, as seen in Figure 1.

Figure 1: High level steps from bed ready to patient leave.

The process starts when the ‘Bed Ready’ page is sent and ends when the patient is escorted from the ED and is removed from Centricity. When the requested bed is ready, the Charge RN receives a page stating that the hospital unit bed is ready and looks for an ‘A’ icon on the Centricity whiteboard that indicates the patient is clear for admission. Once the care is completed within the ED, the Primary RN completes the paperwork in Centricity and prints the paperwork to the respective hospital unit. The Primary RN notifies a Tech to transport the patient out of the ED. If the patient is going to a pilot floor (5, and 6B) transport comes to the ED to escort the patient to their floor instead of the Tech or Primary RN. Finally, the Primary RN completes the patient’s medical chart, the ED bed is cleaned for the next patient, and the patient is removed from the Centricity census.

The scope of this project involves all patients that are admitted to the hospital through the ED. It excludes those admitted to Mott, deceased patients, and those who left the ED before their exam. This project determines the main causes delaying the patient leaving the ED and provides recommendations to decrease the time from bed ready to patient left.
**Key Issues**

The following issues are driving the need for the Emergency Department to evaluate the admissions process:

- Long average admission time from bed ready to patient leave
- Bottlenecks in the current process
- Unknown process on the units

**Goals and Objectives**

The primary goal of this project was to recommend improvements to reduce the process time in the current ED admission. Using this information the team created a current state value stream map for the admissions process. Additional goals included identifying bottlenecks in the current process and determining the main causes, isolating non-standard procedures, and developing recommendations for improvement.

**Project Scope**

The admission process begins when a “bed ready” page is sent to the ED informing the ED of bed availability within a particular unit. The process ends when the patients have left their room in the ED.

The project scope includes:

- All adult admissions including observations unit
- All process steps of admission from bed ready to patient left

The project scope does not include:

- Discharges/expired patients
- Left-Before-Exam patients
- Pediatric patients
- Process prior to bed ready page
- Process after patient leaves ED room

**Methods**

To meet the objectives, the IOE 481 Project Team worked in the Emergency Department to collect data on the current admissions process. These goals were met by performing the following tasks:

- Observing
• Conducting a data collection pilot
• Performing time studies
• Facilitating staff collected time studies
• Executing a literature search
• Pulling historical data
• Developing a value stream map

This section of the paper details the collection methodology.

Observation and Pilot

The team observed the ED admissions process January 26 to February 22. The observations consisted of informally interviewing Emergency Department staff, following patients through the admissions process, and determining the individual tasks in the overall process. Based on the information collected in observation, the team developed data collection sheets for team and staff use. The data sheets can be seen in Appendices A and B. The team separated the process into the following steps:

• Charge RN receives bed ready page
• Start of bed slip
• Finish bed slip
• Give bed slip to Primary RN
• Update vitals if necessary
• Start paperwork
• End paperwork
• Page unit Charge RN
• Inform tech
• Tech arrives
• Patient leave

The team conducted an initial pilot to isolate any issues before implementing the department-wide data collection. The pilot consisted of a team member following the change of hands of a data sheet around the ED, as it would during data collection, and taking note of any concerns or issues with the collection process. Unfortunately, many staff members did not complete portions of the slip or all of it entirely, and the pilot was deemed unsuccessful. To counteract this obstacle, the team members communicated with the Charge RN instructions to give the staff members when the bed slip is passed off. These instructions were further emphasized by the Nursing Supervisor through email, face-to-face interaction, and staff meetings.

Team Data Collection

During the team observations, the team recorded the specific tasks in the process that were then used to develop the data sheet in Appendix A. All team data collection was recorded using the
data sheets. The team observed and collected data for over 60 hours in the ED, totaling approximately 40 data samples.

**Staff Data Collection**

The data sheet used for staff data collection was developed through team observations in the ED as well as ad hoc interviews conducted with staff. As seen in Appendix B, the staff data collection sheet has a “reasons for delay” box and lists fewer tasks than the team data collection sheet shown in Appendix A. The reasons for delay were developed from interviews with staff members including the Charge RN, nurses, and technicians. The data sheets were reviewed and approved by the Senior Industrial Engineer, the Nursing Manager, and the Nursing Supervisor and then distributed to the Main ED for an initial pilot.

Once the pilot was complete, the team made the final edits to the data sheet and added instructions for staff on the back. The instructions are in Appendix C. The staff data collection began on March 2 and ended on March 19. To inform the ED about the data collection, the Nurse and Clerk Supervisors assisted in communicating the data collection steps to the staff. The specific steps in the data collection process were as follows:

The blank data sheets are located in a red folder at the Main ED Clerks' station. The team will replenish the blank data sheets as needed.

1. Once a patient has been admitted, the ED Clerk attaches a data sheet to the next Non-ICU bed slip that prints at 8:00AM, 12:00PM, 2:00PM, 4:00PM, 6:00PM, 12:00AM, 4:00AM.

2. The ED Clerk places the bed slip and with the stapled data sheet on the blue clipboard.

3. Once the Charge RN has received the bed ready page, the collection of times will begin.

4. The Charge RN will record the time the page is received and the time the bed slip is given to the Primary RN.

5. The Charge RN will explain the data sheet to the Primary RN and emphasize the completion of the sheet including the patient left time. The Primary RN will also be instructed to place the data sheet in the red folder at the Clerk station within the specific wing (Main, South, East, West, North).

6. The Primary RN records times on the remaining data points.

7. If the time between the bed ready page to patient left is greater than 30 minutes, the Primary RN will indicate reasons for delay (may be multiple reasons).

8. The Primary RN places the data sheet in the red folder at the Clerks' station.
Literature Search

A literature search was conducted from March 7 through March 16. Though there was no material found that related directly to the bed-ready to patient-left process, many articles were found regarding similar processes and methods. A summary of the articles found can be seen in Appendix D.

Value Stream Map

The team developed a Value Stream Map for the two primary flows, AMOU patient flow and General Care/Telemetry patient flow to analyze the current state. The analyzed data was used to calculate average and median process times, wait times, and the overall lead time within the process flow. The standard deviation, minimum, maximum and sample size are also displayed on the Value Stream Maps for each process and wait time. The team made two different maps, one for AMOU and one for General Care, due to the differences in the processes. The team went through 4 drafts of the maps and worked with the coordinator to edit and improve them. Due to a lack of data for certain tasks the team grouped multiple tasks together to show overall process times for certain groups of tasks. The process and wait times displayed on the AMOU Value Stream Map are the following:

- Receive bed ready page to start bed slip
- Prepare bed slip
- Finish bed slip to give bed slip to Primary RN
- Give bed slip to Primary RN to start paperwork
- Complete paperwork
- Complete paperwork to escort patient out of ED

The process and wait times displayed on the General Care Value Stream Map are the following:

- Receive bed ready page to start bed slip
- Prepare bed slip
- Finish bed slip to give bed slip to Primary RN
- Give bed slip to Primary RN to start paperwork
- Give bed slip to Primary RN to page unit Charge RN
- Complete paperwork
- Start paperwork to page unit Charge RN
- Transport arrives to escort patient out of ED
- Inform tech to escort patient out of ED

The lead times for both processes are also displayed on the Value Stream Maps as well as the lead times for non-pilot versus pilot floors in General Care.
Findings

This section discusses the findings from the observations, team collected data, and staff collected data. The findings include:

- Value Stream Maps
- Time Study Validation
- Observation Analysis
- Data Analysis Stratification by Destination Unit
- Data analysis Stratification by Reasons for Delay

Value Stream Maps
The value stream maps were created based off of observations and time studies performed in the Emergency Department. The findings are presented in a pictorial view of the overall admissions process, starting when the ‘Bed Ready’ page is received by the ED Charge RN to when the patient is escorted out of the ED. Below is the value stream map showing the process for patients admitted into General Care:
General Care Value Stream Map

Figure 1: Value stream map with wait times, process times, and overall lead times for General Care admissions.
From the value stream map, the team found that the overall lead time for non-pilot floors is 36.1 minutes, while the lead time for the transport pilot floors is 40.6 minutes. The overall lead time is on average 37.1 minutes. Additionally as seen in the figure 1, 75% of the time vitals would need to be updated by the Primary RN. Also, Techs were used to move the patient 90% of the time while 10% of the time transport was used to escort patients out of the ED. The findings in Figure 1 are further summarized in Table 1, showing the mean, median, standard deviation, 80th percentile, maximum value, and sample size for each step in the process.

<table>
<thead>
<tr>
<th>Event</th>
<th>Avg (min)</th>
<th>Med (min)</th>
<th>StDev (min)</th>
<th>80th Perc. (min)</th>
<th>Max (min)</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive bed ready page to start of bed slip</td>
<td>3.0</td>
<td>1.0</td>
<td>6.7</td>
<td>3.0</td>
<td>33.0</td>
<td>27</td>
</tr>
<tr>
<td>Start bed slip to end bed slip</td>
<td>0.9</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>23</td>
</tr>
<tr>
<td>End bed slip to give bed slip to Primary RN</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>11.0</td>
<td>11.0</td>
<td>22</td>
</tr>
<tr>
<td>Get bed slip to vitals update</td>
<td>6.4</td>
<td>5.5</td>
<td>5.3</td>
<td>9.0</td>
<td>21.0</td>
<td>36</td>
</tr>
<tr>
<td>Get bed slip to start paperwork</td>
<td>7.1</td>
<td>7.3</td>
<td>7.3</td>
<td>12.0</td>
<td>29.0</td>
<td>51</td>
</tr>
<tr>
<td>Start paperwork to end paperwork</td>
<td>3.4</td>
<td>2.0</td>
<td>3.8</td>
<td>6.6</td>
<td>12.0</td>
<td>23</td>
</tr>
<tr>
<td>Page unit Charge Nurse to inform Tech</td>
<td>3.9</td>
<td>2.0</td>
<td>6.5</td>
<td>5.0</td>
<td>34.0</td>
<td>33</td>
</tr>
<tr>
<td>Inform Tech to Tech arrives</td>
<td>10.2</td>
<td>10.5</td>
<td>4.5</td>
<td>13.8</td>
<td>17.0</td>
<td>12</td>
</tr>
<tr>
<td>Tech arrives to Patient leaves</td>
<td>6.2</td>
<td>4.0</td>
<td>8.3</td>
<td>7.8</td>
<td>38.0</td>
<td>19</td>
</tr>
<tr>
<td>Page unit charge nurse to Patient leaves</td>
<td>21.1</td>
<td>19.0</td>
<td>15.2</td>
<td>26.6</td>
<td>100.0</td>
<td>43</td>
</tr>
<tr>
<td>Bed slip Page to patient leaves</td>
<td>33.3</td>
<td>30.0</td>
<td>16.9</td>
<td>40.8</td>
<td>117.0</td>
<td>53.0</td>
</tr>
</tbody>
</table>

Table 1. Wait times and process times for the General Care admissions process.

As seen in Table 1, the majority of the time is spent between when the tech is informed to when the tech arrives and between the page to the unit Charge RN to when the patient leaves. The table shows that the average lead time is 33.3 minutes with a maximum of 117 minutes. It should be noted that the sample size for the transportation pilot is small.

A value stream map was created to show the patient admissions process for the AMOU. The map was created based off of steps observed through team observations and data collected by the team and staff.
Based on the findings of the value stream map, the team concluded that based on the data samples, the overall lead time for the AMOU is 24.8 minutes. It is important to note that only 5 samples were collected. All of the findings in Figure 2 are summarized in Table 2, showing the...
Table 2. Wait times and process times for the AMOU admissions process.

<table>
<thead>
<tr>
<th>Task</th>
<th>Avg (min)</th>
<th>Med (min)</th>
<th>StDev (min)</th>
<th>80th Perc. (min)</th>
<th>Max (min)</th>
<th>Num</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive bed ready page to start of bed slip</td>
<td>4.7</td>
<td>4.0</td>
<td>1.3</td>
<td>6.4</td>
<td>8.0</td>
<td>3</td>
</tr>
<tr>
<td>Start bed slip to end bed slip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End bed slip to give bed slip to Primary RN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get bed slip to vitals update</td>
<td>1.0</td>
<td>3.0</td>
<td>1.0</td>
<td>1.4</td>
<td>2.0</td>
<td>4</td>
</tr>
<tr>
<td>Get bed slip to start paperwork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start paperwork to end paperwork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page unit Charge Nurse to inform Tech</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
<td></td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Inform Tech to Tech arrives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tech arrives to Patient leaves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page unit charge nurse to Patient leaves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed slip Page to patient leaves</td>
<td>18.4</td>
<td></td>
<td></td>
<td></td>
<td>27.2</td>
<td>5.0</td>
</tr>
</tbody>
</table>

As seen in Table 2, the majority of the time is between the bed ready page to when the Charge RN starts the bed slip and the time it takes the Charge RN to complete the bed slip. Also, for tasks not involving the Charge RN there are low standard deviations.

**Time Study Validation**

Centricity is a web based reporting service that is used by hospital staff. Within Centricity an Admissions Report is stored with all admissions data recorded by the ED. The team pulled data from Centricity for the interval the time studies occurred: 1/26/2012 - 3/19/2012. The data pull was used to compare and validate the collected data. The pulled data also aided in completing the missing data points for incomplete data sheets. This allowed for a larger sample size, and therefore a more accurate representation of the admission process. The pulled data looked at consisted of the following:

- Time bed ready
- Time left ED
- Room Needs Adult
- Admit Unit ADT

The data from Centricity was edited to exclude all times between time bed ready and time left ED that were greater than 500 minutes. All patients that were not admitted, such as those who left before exam, were also excluded. A comparison of the differences between the collected data presented in this report and the Centricity data is shown below in Table 3.
<table>
<thead>
<tr>
<th></th>
<th>Collected Time</th>
<th>Centricity Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>AMOU</td>
<td>24.8</td>
<td>13.5</td>
</tr>
<tr>
<td>General Care non-pilot</td>
<td>36.1</td>
<td>29.0</td>
</tr>
<tr>
<td>General Care pilot</td>
<td>40.6</td>
<td>38.0</td>
</tr>
<tr>
<td>Overall General Care</td>
<td>37.1</td>
<td>30.4</td>
</tr>
</tbody>
</table>

Table 3: The relationship between collected and Centricity times.

Table 3 shows the differences in the two types of data: this studies and Centricity. The times from Centricity are larger than the collected data. This can be explained by the error in both sources. There may be a Hawthorne Effect in the collected time, where the time recorded is inaccurate since the members of the process know they are being observed. For the Centricity time, the time entered for Time left ED is not always accurate since the Primary Nurse fills in the time the patient left the ED once they notice the patient left.

Observation Analysis

In order to fully understand the process, the team conducted many hours of observation within the Emergency Department. Figure 4 below shows the hours covered by each team mate.

![Figure 4: Hours of observation in ED by team member. A total of 69 hours were observed.](image)

The team was able to cover 21.5 hours out of the 24 hours in a day. The 2.5 hours that were not covered include 2:00-4:00AM and 21:00-21:30PM. Based on the observations conducted in the ED, the team was able to divide the General Care process and AMOU process down into specific tasks. The analysis of each of the time intervals can be found in Tables 1 and 2.

Common reasons for delay were developed based off of ad hoc interviews with staff members. According to staff members, the most common reasons of delay include:

- ‘A’ icon not present
- Additional care needed
- Additional medication needed
• Admitting team doing assessment in ED
• Competing priorities- nurse
• Competing priorities- tech
• Patient was unavailable when bed slip arrived
• Other

These reasons were recorded on the data sheet and were checked off during the staff data collection.

**Data Analysis Stratification by Destination Unit**

To analyze the data stratified by destination unit, the team combined the team collected data with the staff collected data. This provided a larger sample size, however this also introduced a larger source of error to the data. The primary source of error is inconsistent time sources used by the team and the staff.

**Lead Times**
The data was stratified by two destination units, General Care and AMOU. The mean, median, standard deviation, 80th percentile, maximum, and sample size were calculated for each of the following task intervals in the General Care process:

- Receive bed ready page to start of bed slip
- Start bed slip to end bed slip
- End bed slip to give bed slip to Primary Nurse
- Get bed slip to vitals update
- Get bed slip to start paperwork
- Start paperwork to end paperwork
- Page unit Charge Nurse to inform Tech
- Inform Tech to Tech arrives
- Tech arrives to Patient leaves
- Page unit Charge Nurse to Patient leaves

The data and calculations can be seen in Table 1.

The team used the raw data to construct a histogram of the total lead time for admissions to General Care units. Figure 5 shows the histogram is skewed right, and shows the calculated total lead time for the 84 team and staff collected samples.
Figure 5: Histogram of total lead time for the admissions process to General Care units, skewed right with the majority of lead times taking 21-25 minutes.

As seen in the histogram above, 50% of the sample lead times were under 30 minutes. There is one extreme outlier with a two hour lead time.

In addition, the mean, median, standard deviation, 80th percentile, maximum, and sample size were calculated for each of the following task intervals in the AMOU process:

- Receive bed ready page to start of bed slip
- Start bed slip to end bed slip
- End bed slip to give bed slip to Primary Nurse
- Get bed slip to vitals update
- Get bed slip to start paperwork
- Start paperwork to end paperwork
- Tech arrives to Patient leaves

This data and calculations can be seen in Table 2.

Raw data collected by the team and staff was used to construct a histogram of the total lead time for admissions to the AMOU. Figure 6 shows the histogram and displays the total lead time found from the five data samples collected by the team and staff.
Figure 6: Histogram of total lead time for the admissions process to the AMOU, skewed right with the majority of lead times taking between 6 and 10 minutes.

Similarly to the General Care histogram, the lead time for the AMOU is skewed slightly right with four out of five samples having a total lead time less than 30 minutes. It is important to note, however, that the sample size is small.

Percent of Time with Bed Slip by Staff Member
As recorded in observations and shown in the value stream maps, the bed slip passes through the hands of three different types of employees: Charge RNs, Primary RNs, and Technicians. The percentage of time the bed slip spent with each staff member was analyzed for patients being admitted to General Care. Figure 7 shows the distribution of time usage for the 84 samples collected by the team and staff.
As seen in the pie chart above, the majority of the time a bed slip is being processed is between when the tech is informed to when the patient leaves. According to the data, 53% of the total process time is spent in this stage.

Figure 8 shows the distribution of time for patients going to the AMOU.

For the AMOU most of the time that a bed slip is active is spent with the Charge RN (55%). This is different than the General Care units where the majority of the time is spent with the Tech. Once again though, as noted in the chart, the sample size of data for the AMOU is small.
Data Analysis Stratification by Reasons for Delay

There were 27 samples collected by team and staff that listed reasons for delay. For the staff data collection, staff members were asked to indicate a reason for delay if the admissions process exceeded 30 minutes for a particular patient. The reasons for delay that were indicated include:

- Additional Care
- Additional Medication
- Attending team doing assessment in ED
- Competing Priorities-Nurse
- No ‘A’ Icon
- Other

Other reasons that were indicated include:

- Bed dirty, re-paged when done
- Change bed type
- Charge Nurse handling other bed slips
- ED Charge never received page
- New Nurse
- No page-bed was ready
- Patient being transported from NUC med to 5C
- To OR
- Transport

Figure 9 shows the occurrence percentage for each reason for delay from the staff data collection.

![Figure 9: Reasons for delay in the admissions process by category, with most delays due to other reasons as indicated by ED staff. There were 27 samples available.](image.png)

From the other reasons indicated, transport was the only reason written in multiple times. Out of the 27 samples with delays, 5 were patients going to transport pilots units. Transport was indicated as a delay 3 times out of these 5 samples. Thus the longer lead time for the pilot floors
in the General Care process could be attributed to the transport. A list of the individual reasons reported under “Other” can be found in Appendix E.

Despite the small sample size, certain reasons for delay that were expected to be common were not found, such as competing priorities- tech and patient unavailable when bed slip arrived.

Work-Task Breakdown

Figure 10 below shows the tasks for each process: AMOU, Pilot General Care and Non-Pilot General Care. The bars are color coded red or green depending if they are value or non-value added activities.

Figure 10: Stacked chart of Value/Non-Value added tasks by destination unit.

From Figure 10, value added is defined as any part of the process where direct work is being done for the admission such as completing paperwork or taking vitals. Non-value added is defined as any part of the process where no work is being done for the admission such as handing off the bed slip or waiting for transportation to arrive.
The majority of time for all three admission routes is spent on non-value tasks. It is our goal to reduce the time spent on non-value tasks.

Conclusions

Based on the findings, the team was able to draw the following conclusions:

- Lead time was greater for the transportation pilot than the non-pilot patients
- Majority of lead time comes between when the tech is informed to when the patient leaves
- Average time between paging the unit and the patient leaving is not the expected 15 minutes
- The longer lead time for the pilot in the General Care value stream map could be attributed to the transport as a reason for delay
- The Charge RN receiving the ‘Bed Ready’ page adds to the overall process lead time.
- Admissions into the AMOU typically have a shorter lead time than admissions into General Care units
- There isn’t a consistent reason for why the process exceeds 30 minutes

Recommendations

The team developed three immediate recommendations as well as four future recommendations. If the immediate recommendations are implemented the ED admission lead time will potentially go from 30 minutes to 26 minutes.

Eliminate Charge RN Tasks

In the current state of the ED Admission Process, the task intervals that involve the Charge RN average a total lead time of 5.9 minutes and 10.0 minutes for General Care and AMOU, respectively. To reduce the total lead time of the General Care and AMOU ED Admission Processes, the team recommends removing the tasks of the Charge RN in both process flows.

Table 4, below, shows the wait times and process times for General Care with the removal of the tasks of the Charge RN, and it can be seen that the average total lead time is 26.6 minutes. By removing the tasks of the Charge RN, the average total lead time is reduced by 6.7 minutes.
Table 4. Analysis of predicted wait and process times for General Care removing the tasks of Charge RN.

Table 5, below, shows the wait times and process times for AMOU with the removal of the tasks of the Charge RN, and it can be seen that the average total lead time is 10.8 minutes. By removing the tasks of the Charge RN, the average total lead time is reduced by 7.6 minutes.

Table 5. Analysis of predicted wait and process times for AMOU removing the tasks of Charge RN.
Table 6, below, summarizes the lead time saved with the elimination of the tasks of the Charge RN in both the General Care and AMOU processes. It can be seen that 67% of the samples recorded had a total lead time less than 30 minutes for the General Care process flow, and 80% of the samples recorded had a total lead time less than 30 minutes for the AMOU process flow.

<table>
<thead>
<tr>
<th>Comparative Statistics - Lead Time Saved Without Tasks of Charge Nurse</th>
<th>General Care</th>
<th>AMOU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average (min)</td>
<td>6.7</td>
<td>7.6</td>
</tr>
<tr>
<td>Median (min)</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>St Dev (min)</td>
<td>6.2</td>
<td>6.0</td>
</tr>
<tr>
<td>80th Percentile (min)</td>
<td>7.0</td>
<td>9.2</td>
</tr>
<tr>
<td>Max (min)</td>
<td>34.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Number recorded</td>
<td>49</td>
<td>5.0</td>
</tr>
<tr>
<td>percent &lt;= 30 mins:</td>
<td>67%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Table 6. Minutes of lead time saved by removing tasks of the Charge RN

Figure 11: Histogram of total lead time with removal of tasks of the Charge RN for General Care

The histogram in Figure 11 shows that with the removal of the tasks of the Charge RN from the General Care process, 80% of the samples have a total lead time less than or equal to 34.8 minutes.
The histogram in Figure 12 shows that with the removal of the tasks of the Charge RN from the AMOU process, 80% of the samples have a total lead time less than or equal to 28.0 minutes.

Based on findings from the process times in the value stream maps, the team found that by eliminating the tasks performed by the ED Charge RN from the process the team will reduce wasted time. A mean of 5.9 minutes and a potential maximum of 47 minutes can be eliminated from the General Care process while a mean of 10 minutes and a maximum of 18 min can be eliminated for AMOU. This removal of tasks will also eliminate the potential delays in the process of Charge RNs competing priorities.

- Implementation would require an infrastructure where the bed ready page is sent directly to the Primary RN in the ED. Then, the bed slip would no longer be printed to the Main ED Clerk station but would need to be printed by the Primary RN to be given to the tech/transport.

**Update Paperwork in Patient Room**
The time from end vitals to start paperwork is currently taking 5 minutes. If the Primary RN needs to update the patient’s vitals, they do so in their room and then walk back to their computer to chart the vitals in the computer and to start their paperwork. The wait time between ending vitals to starting paperwork currently has a median 5 minutes based on a sample size of 5 data points. Having the Primary RN chart vitals and update paperwork in the patient’s room will potentially eliminate this 5 minute wait time.
**Change Communication between Primary RN and Tech**
Currently the inpatient floors require a 15 minute lead time to prepare the paper work and get the room ready for the patient. The Primary RN in the ED tells the Tech to arrive in 15 minutes to begin prepping the patient. It takes the Tech a median time of 4 minutes to prep the patient before leaving the ED. The team recommends that the Primary RN informs the tech to arrive in 10 minutes and then continues with their 4 minute prep. This way the patient will be ready to go up to their inpatient floor directly after the 15 minute lead time rather than waiting an additional 4 minutes for the Tech to prep before exiting the ED. Currently 48% this process is taking 15 minutes or less. By implementing this recommendation, the team hopes to increase this percentage for the Emergency Department.

**Future Group Work**
The team recommends further projects to continue to improve the ED admission process. These projects include:

- Analyze transport efficiency
- Analyze impact of removing Charge RN tasks
- Investigate the tasks of the unit floors to reduce 15 minute lead time
- Investigate the difference between collected data and historical data

**Expected Impact**
Based on the project goals, a detailed value stream map of the admission process for both General Care and AMOU, and the identification of waste within this process would lead to a decrease in lead time. Furthermore, an improvement in the efficiency of the admission process will be made.

The recommendations provided by the Team are expected to result in:
- Decreased lead time of ED admission process
- Improved efficiency and consistency of communication between ED staff including Techs, RNs, MPs, and Clerks.
- Minimized waste within the admission process
- Standardized sub processes within the admission process
### Appendix A - Team Data Collection Sheet

#### Data Collection Sheets for Observations

<table>
<thead>
<tr>
<th></th>
<th>Page from ABC to ED charge nurse</th>
<th>Start of bed slip</th>
<th>Finish of bed slip</th>
<th>Hand off to primary nurse</th>
<th>Vitals update</th>
<th>Start paperwork</th>
<th>Finish paperwork</th>
<th>Page unit charge nurse</th>
<th>Inform tech (if necessary)</th>
<th>Transport/Tech arrives</th>
<th>Patient leaves</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>Patient 2</td>
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<td>Patient 3</td>
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<td>Patient 4</td>
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<td>Patient 5</td>
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<td>Patient 6</td>
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<td>Patient 7</td>
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<tr>
<td>Patient 8</td>
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</tr>
</tbody>
</table>

**Directions:** Fill in times for all patient activities. Write notes as needed.
Data Collection Sheets for IOE 481 ED Admit

Date: __________/________/2012
Patient Initials: __________
Primary Nurse: __________

Please use military time for all recordings

<table>
<thead>
<tr>
<th>Task</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed ready page to ED Charge Nurse</td>
<td>:</td>
<td></td>
</tr>
<tr>
<td>Bed Slip to primary nurse</td>
<td>:</td>
<td></td>
</tr>
<tr>
<td>Vitals update</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Check if vitals need to be updated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paperwork (Chart update and printing)</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Page Unit Charge Nurse</td>
<td>:</td>
<td></td>
</tr>
<tr>
<td>Inform tech (if necessary)</td>
<td>:</td>
<td></td>
</tr>
<tr>
<td>Patient leaves the room</td>
<td>:</td>
<td></td>
</tr>
</tbody>
</table>

Please fill out below if total time exceeds 30 minutes.

Reasons for delay (please check all that apply)

- 'A' icon not present on the board
- Additional care needed
- Additional medication needed
- Admitting team doing assessment in ED
- Competing priorities - nurse
- Competing priorities - tech
- Patient was unavailable when bed slip arrived
- Other (please list): ________________________
Appendix C – Staff Script

Script for the staff that is printed on the back of the data sheets.

- These sheets will be used to track times for the ED admission from bed ready to patient left
- They will be attached to the bed slips
- Write down the patient's initials and the primary nurse
- Circle where the patient is being admitted to (AMOU, ICU, or other)
- Write down the time for each task during the admission process
- At the end of the process write down the overall process time
- If the overall process time is greater than 30 minutes check the box next to the reason for delay or write in the reason if it is not already on the sheet
Appendix D - Literature Search Summary

Title: “Hospitalists and an Innovative Emergency Department Admission Process

Health System: Johns Hopkins Bayview Medical Center

Year Published: 2004

URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1492152/pdf/jgi_30431.pdf

Summary: Paper about redesigning the "admission process so ED physicians admit patients directly to the general medical unit after a telephone consultation with a hospitalist (…) to reduce admission cycle time, hospital LOS, and in-hospital mortality rates"

Title: Rapid Admission Protocol for Emergency Department Patients Reduces Boarding Time

Health System: Parkland Health & Hospital

Year Published: 2007

URL: http://www.innovations.ahrq.gov/content.aspx?id=2926

Summary: Developed a new "protocol (that) reassigns certain admitting process steps from the emergency department physician to an internist working in the emergency department. The protocol allows the internist or the emergency department physician (rather than the physician on the admitting unit) to write transitional admission orders for clinically stable patients (...) and allows for transfer to the unit before diagnostic testing has been completed." This reduced boarding time.
Appendix E

Reason for delay listed under “Other”

- Bed dirty, re-paged when done
- Change bed type
- Charge RN handing out other bed slips
- ED Charge RN never received page
- New nurse
- No page- bed was ready
- Patient being transported from NUC
- To OR