Analysis of Adult Medical Observation Unit Admission Process
Final Report

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EXECUTIVE SUMMARY

The Adult Medical Observation Unit (AMOU) at the University of Michigan Hospital treats patients who require observation for approximately 24 hours. The AMOU Medical Director reported that it takes an average of 90 minutes to admit a patient from the Emergency Department (ED) to the AMOU, which is not acceptable, and believes this process can be significantly more efficient. An IOE 481 student group from the University of Michigan, Team 6, was asked to reengineer the current admission process to reduce its length and determine a realistic and reproducible expected length of an admission. In addition, the Medical Director requested Team 6 determine which activities of the admission process need to occur within the ED and which can wait until the patient is in the AMOU.

Background

The AMOU is an 18-bed unit located next to the ED intended for patients of short stay status. All patients are tracked using a whiteboard within the unit and an electronic medical records system, which was recently updated to MiChart. The majority of patients admitted to the AMOU come from the ED, which has created a close relationship between the two departments. In July 2015, an additional observation location with 22 beds will open to help cover the high volume of observation status patients in the University of Michigan Health System. The current AMOU will be renamed the Medical Short Stay Unit (MSSU) North, and the new location will be named the Medical Short Stay Unit (MSSU) South. The ED has requested that, after expansion, observation patients leave for one of the MSSUs within 30 minutes. The current plan is to have an H&P team stationed in the ED to complete H&Ps before patients are transferred to one of the MSSUs. The goal of this future state is to have observation patients leave the ED as soon as possible and create an environment where admitting Providers are not interrupted for tasks unrelated to admissions.

AMOU Providers – who are Medical Doctors (MDs), Nurse Practitioners (NPs), and Physicians Assistants (PAs) – complete admissions. MDs are also referred to as Attendings. The AMOU Medical Director reported that admissions take an average of 90 minutes, which is not acceptable. The current admission process involves four main steps:

1. The ED contacts the AMOU Attending with a patient identified for observation.
2. An AMOU Provider is assigned to the admission.
3. The admitting Provider completes a History and Physical (H&P).
4. The admitting Provider writes the orders and documents the H&P in the department’s electronic medical records, MiChart.

Team 6 developed recommendations to reduce the length of an admission as well as determine a realistic and reproducible expected length of an admission. These recommendations identify inefficiencies in the current process and can be applied to the future state process after expansion.
Methodology
To reengineer the current admission process to reduce its length, determine a realistic and reproducible expected length of an admission, and identify where admission process steps need to occur, the team performed eight types of tasks:

(1) Researched past IOE 481 projects: Three past IOE 481 teams have had projects involving the AMOU admission process. The teams’ reports gave Team 6 a better idea of the admission process and past recommendations.
(2) Conducted a literature search of systems similar to the AMOU admission process: The team used one article titled “Improving Service Quality by Understanding Emergency Department Flow: A White Paper and Position Statement Prepared for the American Academy of Emergency Medicine” to support certain recommendations.
(3) Performed initial observations: The team observed three admissions on an evening shift to gain a better understanding of the current AMOU admission process and where to target data collection.
(4) Implemented a time collection log in the AMOU: The time log was created to collect time stamps for specific patients throughout the admission process. Admitting Providers completed the time collection logs, and completed 38 logs over a two-week collection period.
(5) Collected data to supplement the time collection logs: The Medical Director collected additional patient data including age and presenting complaint for each patient with a completed time collection log.
(6) Surveyed AMOU providers: The survey included 10 questions to gauge provider opinion on certain recommendations. The team collected 14 completed surveys out of 20 providers.
(7) Analyzed all data: The team analyzed the time collection logs, additional MiChart data, and provider survey results using Microsoft Excel and Minitab.
(8) Developed recommendations

Findings and Conclusions
The data collection and analysis led to the following key findings:

(1) The team determined that the average admission length of 90 minutes, reported by the Medical Director, was information gathered from a previous IOE 481 study.
(2) Past projects showed that Providers spent an average of 16 minutes per admission on interruptions.
(3) The article explained that creating critical pathways based on patient type can reduce the treatment time for individual patients as well as the entire system.
(4) There are multiple paths for patients to be admitted from the ED to the AMOU.
(5) The average time to complete an admission is 138.39 minutes with a standard deviation of 49.64 minutes.
(6) The longest process step is documentation, which takes an average of 46.68 minutes to complete.
(7) The average time to complete an H&P is 64.37 minutes with a standard deviation of 36.93 minutes.
(8) 71% of admissions experience one or more interruptions, and these interruptions increase orders and documentation by 12.72 and 13.35 minutes respectively.
(9) Admission and H&P lengths vary based on presenting complaint and patient age.
(10) 61% of initial physical exams occur in the ED and these admissions are 12.80 minutes shorter on average.
(11) 77% of Providers surveyed believe initial patient research should take 15 minutes or less and 64% believe patient research is lengthened due to interruptions or distractions.

Based on these findings, the team determined that admissions are taking 48.39 minutes longer than the Medical Director initially reported. The team believes this increase in average admission length could be due to differences between this project’s time collection method and those of previous projects or the recent implementation of MiChart. The high standard deviation of admission length shows that the process is not standard, and admission lengths are heavily influenced by the specific patient and admitting Provider. The team concluded that with an average H&P length of 64.58 minutes, the ED’s 30-minute expectation is unrealistic. In addition, the team found that interruptions and distractions throughout the admission process are still a problem.

Through observations and meetings with the Medical Director, the team also determined that certain process steps – discussion with the attending, writing orders, and documenting the H&P – are required and cannot be changed. These requirements and the project time constraint made it impractical to completely reengineer the admission process; however, the team has identified which steps require the most time, small inefficiencies within the process, and ways to reduce the average admission length.

**Recommendations**

The team recommends the following changes within the current admission process to reduce admission length:

1. Set a standard for patient research time
2. Implement the new H&P team in the ED
3. Create a new note-taking form for Providers

In addition to these changes, the team recommends that Providers wait to document if there is a backlog of admissions that need to be completed. The team believes these actions will reduce average admission length by 45.88 minutes. This reduction is the result of standardizing the process and implementing the new H&P team in the ED. Standardizing the process will also make the process less dependent on each Provider. The team also recommends that the process be further analyzed to create critical pathways to streamline patients, develop a future state simulation and pilot, and utilize the time before ED Handoff in the future state.
INTRODUCTION

The Adult Medical Observation Unit (AMOU), part of the University of Michigan Health System (UMHS), is an area of the hospital meant for patients who require a hospital stay of approximately 24 hours. These patients are not complex enough for inpatient care, but require a longer stay than the Emergency Department (ED). The AMOU Medical Director reported that it takes an average of 90 minutes to admit a patient from the ED to the AMOU. The admission process begins when the ED contacts the AMOU Attending with a patient and ends once documentation in the electronic medical records system, MiChart, is complete. The process includes completing a history and physical (H&P) and writing orders. The Medical Director in the AMOU believes an average admission time of 90 minutes is not acceptable and thinks the admission process could be significantly more efficient.

The AMOU Medical Director asked an IOE 481 student group from the University of Michigan, Team 6, to reengineer the current admission process to reduce its length, determine a realistic and reproducible expected length of an admission, and identify which admission steps should occur in the ED and which can occur in the AMOU. The team broke down the process, analyzed each step to identify waste, and has recommended ways to streamline and standardize admissions. The purpose of this report is to present the team’s process for collecting and analyzing data and to present the findings, conclusions, and recommendations to reduce the length of admissions.

BACKGROUND

The AMOU is an 18-bed unit located next to the ED intended for patients of short stay status. The AMOU Medical Director reports that 10-15% of ED hospital admissions, or an average of 12 patients per day, are admitted to the AMOU. In addition, 80-90% of admissions to the AMOU are from the ED. The AMOU’s high demand has led to a planned expansion to increase the number of observation beds. In July 2015, a new 22-bed observation location will be opened to make 40 total observation beds in two locations. The current AMOU will be renamed to the Medical Short Stay Unit (MSSU) North, and the new location will be named the Medical Short Stay Unit (MSSU) South.

Currently, ED staff identifies observation patients and contacts the AMOU to begin the admission process. An AMOU Provider is assigned to the admission and then completes the patient’s History and Physical (H&P). Providers are Medical Doctors (MDs), Nurse Practitioners (NPs), and Physicians Assistants (PAs). MDs are also referred to as Attendings. The assigned AMOU Provider either walks to the ED to complete the H&P or waits until the patient is transported to the AMOU before completing the H&P. An H&P involves a physical exam, the medication reconciliation, and a discussion about the patient’s medical history and current problem with the patient and his/her family. Next, the AMOU provider writes the orders and documents the patient information into the recently implemented electronic medical records system, MiChart. Between steps, the admitting provider and Attending take time to discuss the case and develop an action plan. The Medical Director reported that this admission process takes an average of 90
minutes per patient and believes this average time is too long. Figure 1 illustrates a high-level process map of this current admission process. The transport of the patient to the AMOU is not shown in the process map because it can occur any time after the ED calls the AMOU.

![Process Map](image)

**Figure 1: High-Level Current Admission Process**

The future state process, post expansion, will include an H&P team stationed in the ED to perform the H&P immediately after a patient is identified for observation. The goal of the H&P team is to have observation patients leave the ED as soon as possible for one of the MSSUs and to set up the ideal environment for admitting patients to the MSSUs. This environment is ideal because Providers will only perform admissions, and therefore will not be interrupted for non-admission related problems. Patients will be transferred to an observation unit, MSSU North or MSSU South, once the H&P is complete. In this future state, the ED has requested that patients leave the ED for an MSSU 30 minutes after being identified as needing observation. The ED staff set the 30-minute expectation for the MSSU staff to open beds faster for ED care and reduce patient wait times. The AMOU Medical Director is unsure if this request is realistic, which is why the team was asked to determine which tasks that need to occur in the ED and which can wait until the patient has been transferred. The actual steps needed to complete an admission will be the same; however, the location where they occur and the Provider who performs them would change due to the ED H&P team. Therefore, a process currently taking an average of 90 minutes per patient needs to be completed in 30 minutes. The AMOU Medical Director has asked Team 6 to reengineer the current admission process to reduce its length and determine a realistic and reproducible expected length of an admission.

Previous IOE 481 project teams analyzed the AMOU admission process to identify inefficiencies and enabled the Medical Director to set expectations for the expanded observation service. Team 6 used the previous projects to understand the current situation and the inefficiencies past teams have identified. In addition, the current team researched articles about similar processes to gain a deeper understanding of the AMOU’s problems.

**GOALS AND OBJECTIVES**

The primary goal of the project is to reengineer the current admission process to reduce its length, determine a realistic and reproducible expected length of an admission, and identify which admission steps should occur in the ED and which can occur in the AMOU. To achieve this goal, the team:

- Observed admissions and established a time collection log to understand the details of the current admission process
• Surveyed AMOU Providers to further understand the process, problems, and expectations of the admission process
• Identified waste in the admission process and steps in the process that require the most time

With this information, the team developed recommendations to:
• Reduce the time it takes for an ED patient to be admitted to the AMOU
• Determine a realistic expectation of the time it takes to complete an admission
• Identify which process steps need to occur in the ED and which can occur in the AMOU

KEY ISSUES

The following key issues were driving the need for this project:
• The AMOU admission process currently takes an average of 90 minutes per patient, which is too long
• The AMOU Medical Director believes the admission process contains inefficiencies and could be streamlined
• The ED has set the expectation that patients identified for observation leave the ED for one of the MSSUs within 30 minutes
• An H&P team will be placed in the ED after expansion

PROJECT SCOPE

This project includes only the admission process from the ED to the AMOU. There are three high level steps in the AMOU admission process. First, the AMOU is contacted about a patient identified for observation in the ED. Next, a provider conducts the H&P and orders are entered. Finally, the H&P is documented and the admission is complete. The team examined the entire admission process for this project.

Any tasks not connected to the AMOU admission process were not included in this project. Specifically, transport time from the ED to the AMOU is not included in the 30-minute expectation and was not analyzed. Additionally, the team did not study activities that occur before the AMOU is called. All other ED patients and processes were not included in this project. This project does not include a staffing analysis. Recommendations are directed only towards the AMOU admission process.

METHODS

To reengineer the current admission process to reduce its length, determine a realistic and reproducible expected length of an admission, and identify where admission process steps need to occur, the team performed the following eight tasks: Researching past projects, conducting a literature search, performing initial observations, implementing a time
collection log, collecting data to supplement the time collection logs, surveying AMOU Providers, analyzing data, and developing recommendations.

**Past Projects**
Multiple previous IOE 481 teams have studied the AMOU admission process. Team 6 was given full access to the previous reports as a source of baseline information. Two reports the team used to better understand the admission process were from Winter and Fall 2013.

The IOE 481 team in Winter 2013 assessed the AMOU Clerk Patient Time Log to produce a distribution of patient arrivals from the ED to the AMOU over the 24 hours in a day. These arrivals correspond to the patients admitted to the AMOU from the ED. The IOE 481 team in Fall 2013 calculated the average admission length and broke down admissions into value added time and time spent on interruptions.

**Literature Search**
In addition to researching past projects, the team conducted a literature search for related processes and applicable tested recommendations. The most beneficial report the team found was, “Improving Service Quality by Understanding Emergency Department Flow: A White Paper and Position Statement Prepared For the American Academy of Emergency Medicine” by Dave R. Eitel, MD, MBA, Scott E. Rudkin, MD, MBA, M. Albert Malvehy, MD, James P. Killeen, MD, and Jesse M. Pines, MD, MBA, MSCE. [1]

The team found the article on Google Scholar and used it to better understand hospital processes that require attention to detail and timely action to help develop and support recommendations for the AMOU.

**Initial Observations**
The team observed three admissions in the AMOU on Wednesday October 1st from 7:00 to 9:30 PM. The Medical Director explained this observation period was slower than usual for a Wednesday evening; therefore, no patient was forced to wait while a provider finished a separate admission. The main purpose of the observation was for the team to gain a better understanding of the AMOU admission process. The Medical Director provided an in-depth description of the admission process and explained the documentation steps in MiChart.

**Time Collection Logs**
The time collection log’s purpose was to collect different times throughout an admission to help the team determine the length of each step in the process. The specific times collected were:

- Time received by assigned Provider
- Start of patient research
- Start and end of first patient contact
- Start and end of discussion with attending
- Orders complete
- Documentation complete
The time collection log also tracked the following qualitative information throughout each admission:

- Patient location (ED or AMOU)
- Number of Provider interruptions and reasons
- Number of times Provider waits and reasons
- Number of times Provider is frustrated and reasons

The time collection logs were implemented Monday October 20th and were completed for patients admitted to the AMOU until Sunday November 2nd. The original plan was to have Providers complete a time collection log for each patient admitted from the ED to the AMOU during one week. Based on a past project team’s conclusion that AMOU admissions vary by day and hour rather than by season, the team determined that having Providers complete logs for one full week would eliminate bias. After the first week, the team realized Providers were not completing the log for every patient, and therefore extended the collection period to two weeks. Over the two-week collection period, the team received 38 completed time collection logs. The team observed Providers complete the time collection logs to validate the data. In total, the team validated six admissions. One team member observed Monday October 20th at 7:00 PM, one observed Wednesday October 22nd at 4:30 PM, and the third observed Friday October 24th at 11:00 AM. The validation showed that Providers were completing the time collection logs accurately, and allowed the team to be confident in the results and conclusions developed from the time collection logs. A copy of the time collection log can be found in Appendix B.

Data Collection to Supplement Time Logs
The team used patient identifiers, such as name and Medical Record Number, to track other patient characteristics. The Medical Director used the patient identifiers to pull the additional characteristics for all 38 patients with completed time collection logs from MiChart. The additional patient characteristics collected were presenting complaint, date of birth, gender, if the patient was readmitted within 30 days, and admitting Attending. However, the team only analyzed the effect of presenting complaint and age had on admission length.

Surveys
After data analysis, the team developed a 10-question online survey with the help of the Medical Director. The surveys were distributed to all AMOU Providers, and the team received responses from 14 out of 20 Providers. The questions were used to develop a better sense of how Providers would react to potential changes in the process and validate the time collection logs. Potential changes in the process reflected the results of the team’s data analysis and observations. The survey can be found in Appendix C.

FINDINGS AND CONCLUSIONS

Each method led to key findings that allowed the team to make conclusions about the current admission process. The findings and conclusions were used to reengineer the current admission process to reduce its length, determine a realistic and reproducible
expected length of an admission, and identify where admission process steps need to occur.

**Past Projects**
Team 6 used past project reports from Winter 2013 and Fall 2013 to gain a better understanding of the AMOU admission process and identify past recommendations. The main findings from this method were that most arrivals occur after 11:00 AM, and an admission takes 90 minutes on average to complete. These findings led to the conclusions that the team should observe in the evening shift and that the Medical Director’s information for average admission length came from these past projects. All Figures discussed below can be found in Appendix A.

**Winter 2013**
The past IOE 481 team in Winter 2013 assessed the AMOU Clerk Patient Time Log to produce a distribution of patient arrivals from the ED to the AMOU over the 24 hours in a day. These arrivals correspond to the patients admitted to the AMOU from the ED. The distribution, Figure 1 in Appendix A, shows that most arrivals occur after 11:00 AM with the peak number of arrivals occurring around 12:00 PM and steadily declining thereafter. From this data, the team concluded that observations during the evening shift would allow the team to see the most admissions.

**Fall 2013**
The past IOE 481 team in Fall 2013 calculated the average admission length and broke down admissions into value added time and time spent on interruptions. The analysis, Figure 2 in Appendix A, shows that the average admission length was 90 minutes long. An average of 16 minutes were spent on interruptions, and the other 74 minutes were classified as value added time. The past team’s analysis also shows the perceived average admission time to be 66 minutes, which is far lower than the observed average. The Fall 2013 team broke down an admission into multiple steps and calculated the time required for each individual step, shown in Figure 3 in Appendix A, and determined the longest steps are patient research and documentation. The analysis shows that eliminating interruptions and medications from the process would reduce the average admission time by 30%, reducing the average admission length from 90 minutes to 60 minutes. From the Fall 2013 findings, team 6 concluded that the Medical Director’s information of average admission length was primarily from this project. In addition, team 6 concluded that interruptions were a large problem, and reexamined if interruptions are still a problem within admissions.

**Literature Search**
From the literature search, the team found that creating critical pathways in an admission process impacts the length of the entire system. The specific article discussed the differences between manufacturing and service environment, but the most applicable section discussed critical pathways. Critical pathways are unique paths created for patients based on certain characteristics. The article specifically mentions the impact of critical pathways based on illness. The goal of critical pathways is to reduce variability in care and standardize how care is received. The article argues, “By reducing the variability of care for a given condition, the treatment time for a given patient, as well as for the
entire system, can be reduced.” [1] From this, the team concluded that critical pathways
could be an effective way for the AMOU to reduce its average admission length and
standardize the process.

Initial Observations
The team observed three admissions, but only collected quantitative data for two, and
used these observations to gain a better understanding of the current admission process
and begin to identify the process’s problems. The key findings involved average
admission length and other process details. These findings led to the conclusions that the
process is not standard and admissions are taking longer than the Medical Director
initially reported.

Findings
Initial observations led to the following key findings: The admissions took 63 minutes
and the 90 minutes, there are multiple paths for a patient to be admitted from the ED to
the AMOU, and each Provider admits patients differently. The Medical Director believed
admissions taking 63 and 90 minutes were very long for a slow evening with no backlog.
The team observed two different ways the Attending was notified of an observation
patient in the ED. In one case, the ED paged the Attending. In the other, an ED staff
member told the Attending about a potential observation patient while he was in the ED
examining a different patient. In addition, the team observed that each Provider has a
unique way of admitting patients. Each Provider spent a different amount of time
researching the patient before completing the H&P, had different ways of taking notes
while completing the H&P, and documented differently. Specifically, some dictated notes
while others typed directly into MiChart.

In addition to these findings, the Medical Director reported that a typical evening shift
(3:00 PM to 11:00 PM) admits 6-8 patients and a typical night shift (11:00 PM to 7:00
AM) admits approximately 4 patients.

Conclusions
The first key conclusion from the initial observations was that the AMOU admission
process from the ED is not standard. The admission process has specific steps that must
be completed; however, these steps have no specific order in which they need to occur. In
addition, each Provider admitting a patient differently creates variety within the process.
The second key conclusion is that the admission process is taking longer than the Medical
Director first reported. The admissions observed took 63 and 90 minutes on a slow night,
making it hard to have any admissions take significantly less time on any other day.

Time Collection Logs
The team analyzed the 38 completed time collection logs in four different ways: by each
admission as a whole, by process step, by physical contact location, and by applying the
data to the future state. These analysis methods led to several key findings that allowed
the team to make conclusions about the current admission process and predictions about
the admission process after expansion.
Findings: Each Admission as a Whole
Analysis of the time collection logs by each admission led to three key findings: The current average admission length is 138.39 minutes, the admission process has a standard deviation of 49.64 minutes, and Providers are interrupted during 71% of admissions. Figure 2 shows the distribution of AMOU admission length in a histogram. Using Minitab, the team ran a normality test to confirm that the admission lengths follow a normal distribution.

Figure 2: Histogram of Admission Length, Sample Size = 38

Figure 2 shows that the average admission length is 138.4 minutes, and that most admissions are completed within 150 minutes. The graph also shows that there are three outlier admissions which took approximately 250 minutes and increase the average admission length. Eliminating the three highest admission lengths of 245, 250, and 270 minutes reduces the average admission length to 128.26 minutes and the standard deviation to 36.5 minutes. Table 1 shows a cumulative breakdown of admissions completed within 120, 90, and 60 minutes.

Table 1: Admission Length Breakdown, Sample Size = 38

<table>
<thead>
<tr>
<th>Measure</th>
<th>Admissions Complete in 120 minutes</th>
<th>Admissions Complete in 90 minutes</th>
<th>Admissions Complete in 60 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Instances</td>
<td>13</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Percent Completed</td>
<td>34%</td>
<td>18%</td>
<td>3%</td>
</tr>
</tbody>
</table>

The percent completed within each time frame are based on a total number of 38 completed time collection logs. The data shows that only 34% of admissions are
completed in 120 minutes, meaning 66% of observed admissions take longer than 120 minutes to be completed.

The time collection logs also had a qualitative section for Providers to note interruptions throughout an individual admission. In total, Providers were interrupted 27 out of the 38 admissions, which is equal to 71% of the time. In addition, 57% of admissions experienced more than one interruption. Table 2 shows the impact of interruptions on the length of an admission.

<table>
<thead>
<tr>
<th>Admission Type</th>
<th>Average Admission Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Interruptions</td>
<td>147.74</td>
</tr>
<tr>
<td>Without Interruptions</td>
<td>115.45</td>
</tr>
</tbody>
</table>

The data in Table 2 shows that interruptions have a significant impact on admission length. Admissions with interruptions are 32.29 minutes longer on average than admissions without interruptions.

Findings: Process Steps
Analysis of the time collection logs by process step led to three key findings: AMOU admission process steps have high standard deviations, documentation is the most time consuming step of the process, and interruptions increase the time needed to write orders and complete documentation by 14.21 and 13.35 minutes respectively. In this analysis, the process begins when the Provider receives the admission and ends when documentation is complete. Table 3 shows the breakdown of admissions by process step and gives the average length and standard deviation for each individual step.

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Average Length (mins)</th>
<th>Std Deviation (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider Receive to Start Research</td>
<td>17.24</td>
<td>27.20</td>
</tr>
<tr>
<td>Initial Research</td>
<td>25.18</td>
<td>20.91</td>
</tr>
<tr>
<td>Initial Physical Contact</td>
<td>22.16</td>
<td>12.14</td>
</tr>
<tr>
<td>Discussion with Attending</td>
<td>4.74</td>
<td>2.13</td>
</tr>
<tr>
<td>Orders</td>
<td>28.18</td>
<td>30.49</td>
</tr>
<tr>
<td>Documentation</td>
<td>46.68</td>
<td>27.16</td>
</tr>
<tr>
<td>Total Admission</td>
<td>138.39</td>
<td>49.64</td>
</tr>
</tbody>
</table>

From Table 3 you can see that documentation is the longest individual step, taking 46.68 minutes on average, which is 34% of the total admission time. Orders is the next most
time-consuming step, taking 28.18 minutes on average, which is 20% of the total admission time. In addition, the standard deviations for each process step, except for initial physical contact and discussion with Attending, are fairly high.

Next, the team looked at the effect of interruptions on two process steps: Orders and Documentation. Figure 3 compares the length of each step for admissions with and without interruptions.

![Figure 3: Effect of Interruptions on Orders and Documentation, Sample Size = 38](image)

Interruptions increase the time needed to complete orders and documentation to increase by 14.21 and 13.35 minutes respectively.

**Findings: Physical Contact Location**

Analysis of the time collection logs by physical contact location led to one key finding: Admissions where initial physical contact occurs in the ED are shorter on average than admissions where physical contact occurs in the AMOU. Completed time collection logs showed that initial contact occurs in the ED for 61% of admissions, and initial contact occurs in the AMOU for 39% of admissions. Table 4 shows the average contact length and admission length based on physical contact location.

<table>
<thead>
<tr>
<th>Location of Contact</th>
<th>Average Contact Length (min)</th>
<th>Average Admission Length (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMOU</td>
<td>22.53</td>
<td>146.13</td>
</tr>
<tr>
<td>ED</td>
<td>21.91</td>
<td>133.35</td>
</tr>
<tr>
<td>Overall</td>
<td>22.16</td>
<td>138.39</td>
</tr>
</tbody>
</table>

The data shows that Contact length is only .62 minutes longer when contact occurs in the AMOU; however, the entire admission is 12.80 minutes longer when contact occurs in the AMOU.
Findings: Applications to Future State
Analysis of the time collection logs by applying the data to the future state led to one key finding: The H&P process takes an average of 64.58 minutes and has a standard deviation of 36.93 minutes. In the future state, an H&P team will be placed in the ED to admit observation patients. The H&P team will need to receive the admission, complete initial research, and perform a physical exam before the patient can leave for one of the MSSUs. Table 5 shows the breakdown of times for the future state process:

<table>
<thead>
<tr>
<th>Step</th>
<th>Average Length (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H&amp;P (performed in ED)</td>
<td>64.58</td>
</tr>
<tr>
<td>Orders and Documentation</td>
<td>73.82</td>
</tr>
</tbody>
</table>

The data shows that, based on the current state, this new H&P team would need 64.58 minutes before a patient can leave the ED. In addition, each Provider would need an average of 73.82 minutes to write the orders and document for each patient. Figure 4 shows the cumulative percents of H&Ps completed within 90, 60, 45, and 30 minutes.

Over 70% of admissions are complete within 90 minutes, over 50% are completed within 60 minutes, approximately 40% are complete within 45 minutes, and only over 10% are completed within 30 minutes. Similar to the entire admission process, H&Ps have a high standard deviation of 36.93 minutes. The reality that a patient could have an H&P that takes over 90 minutes and another patient could have an H&P that takes less than 30 minutes exemplifies the issue of processes with high standard deviations.
Conclusions: Each Admission as a Whole
The findings from analyzing the data by each admission allowed the team to draw three key conclusions: The AMOU admission process is too long, the process is not standard, and interruptions are still an issue. The Medical Director initially reported that the time it takes to admit a patient on average is 90 minutes, which he believed to be too long. The actual observed average length of an admission is 138.39 minutes, which is 48.39 minutes longer than the original time reported. This increase reaffirms that admissions are too long with respect to the Medical Director’s expectation. The high standard deviation of admission lengths reaffirms the initial observations conclusion that the process is not standard. Each patient admitted from the ED to the AMOU could experience a very different admission length. The high standard deviation also makes it hard to predict a realistic expected admission length because each individual admission is very different. The time collection logs also showed that interruptions occur during 71% of all admissions, which supports the conclusion that interruptions are still a problem within the process. The data in Table 2 supports the conclusion that eliminating interruptions would reduce the overall admission length by at least 32.39 minutes.

Conclusions: Process Steps
The findings from analyzing the data by process step allowed the team to draw three key conclusions: Each process step within the admission is not standard, documentation is very Provider and patient dependent, making it a hard step to impact, and reducing interruptions would decrease admission lengths. Looking at each process step individually allowed the team to conclude that no one step within the process makes admissions not standard. The team could not focus on one standardizing one specific step to make a large impact. Provider received to start research, research, orders, and documentation all had high standard deviations, meaning each step is not standard on its own. In addition, the finding that documentation is the longest step allowed the team to conclude that Providers and specific patients have a large impact on admission length. Each provider documents differently, and each patient requires a different amount of documentation. There is no standard way of taking notes during research time or the physical contact, which makes each provider approach documentation with a different amount of easily accessible information. Moreover, extremely complicated patients might require more time for documentation than simple patients with a short medical history.

Conclusions: Physical Contact Location
The finding from analyzing the data by physical contact location allowed the team to draw one key conclusion: The new H&P team in the ED will reduce the length of admissions. The time collection logs showed that admissions are 12.80 minutes shorter on average when the physical contact occurs in the ED and in the future state, all physical exams will occur in the ED by the new H&P team.

Conclusions: Applications to Future State
The finding from analyzing the data by applying it to the future state allowed the team to draw one key conclusion: The ED’s 30-minute expectation is unrealistic. The ED’s expectation would require Providers to receive an admission, complete initial research, and physically examine the patient within 30 minutes. Based on the time collection logs,
the time required to complete these steps is 64.58 minutes on average, which is significantly higher than 30 minutes.

**Additional MiChart Data**
The additional MiChart data was used to analyze how other patient characteristics may affect admission length. Specifically, the team analyzed admission and H&P length by presenting complaint and patient age.

**Findings**
The supplemental MiChart data led to two key findings: Admission and H&P lengths vary by presenting complaint, and Admission and H&P lengths vary by age. First, the team analyzed the data by presenting complaint. The completed time collection logs included patients with 16 different presenting complaints. Figure 5 shows the distribution of admission length by presenting complaint and Figure 6 shows the distribution of H&P length by presenting complaint.

![Average Admission Length by Presenting Complaint](chart.png)

**Figure 5**: Distribution of Admission Length by Presenting Complaint, Sample Size = 38

The graph shows that the presenting complaints acute renal failure and IR procedure have the longest average admissions of approximately 270 minutes and 190 minutes respectively. In contrast, diarrhea and feeding tube are the only presenting complaints with average admission lengths under 100 minutes.
Figure 6 shows that acute renal failure and IR procedure are the presenting complaints with the longest average H&Ps of 90 minutes and 110 minutes respectively. This observation is expected because the same presenting complaints have the longest average admissions lengths. Back pain, diarrhea, feeding tube infection, and headache are the only presenting complaints with H&P lengths under 40 minutes. Comparing Figure 4 and Figure 5, the H&P lengths seem to be more variable than the admission lengths for each presenting complaint.

Next, the team analyzed admission and H&P length based on patient age. The team grouped patients into 5 different age groupings: 19-35, 35-45, 45-55, 55-65, and 65+. The team used these specific groups to maximize the sample size of each group. Figure 7 shows the variation in admission length by patient age, and Figure 8 shows the variation in H&P length by patient age.
The graph shows that patients older than age 65 take the longest to admit on average. This is expected because older patients tend to have more complicated medical histories or longer lists of current medications. In contrast, patients from age 55 to age 65 take the shortest time to admit on average.

Figure 8 shows that, on average, patients from age 45 to age 55 require the most time to complete an H&P, and patients from age 55 to age 65 require the least time. Comparing
Figure 6 and Figure 7, it again seems that H&P length varies more by age than overall admission length.

Conclusions
The team was able to develop findings from the additional MiChart data; however, the team determined no conclusions could be made. The total sample size was only 38 patients, making the sample sizes for each presenting complaint and age group were too small to conclude what specific effects either presenting complaint or patient age have on admission and H&P lengths. No presenting complaint had a sample size greater than 7 admissions and no age group had a sample size greater than 10 admissions. Instead of developing specific conclusions and recommendations from the additional MiChart data, the team used these findings to support recommendations for future work in the AMOU.

Provider Surveys
The key findings from the Provider surveys were that 77% of Providers believe initial patient research should take 15 minutes or less, and 64% believe patient research is lengthened due to interruptions or distractions. These findings allowed the team to conclude that 15 minutes is enough time for Providers to research a patient’s medical history before performing the physical exam. The findings also confirm the previous project team’s conclusion that interruptions are an issue and further support implementing the new H&P team in the ED after expansion. In addition, the team found that most providers agreed in how they defined “Documentation Complete” while completing the time collection logs. This result allowed the team to be confident in the times collected through the time collection logs.

RECOMMENDATIONS

Set a Standard for Patient Research Time
Based on conclusions from initial observations and Provider Surveys, the team recommends that the Medical Director set a standard research time of 15 minutes on average. The team recognized this step in the process to be an opportunity where the average time could be reduced. Observations showed the team that each provider went about patient research differently. In addition, research was dependent on the patient’s past medical history. The provider surveys indicated that 69% of the providers believed patient research could be completed in 15 minutes or less, which supports the team’s recommendation. The goal of this recommendation is to begin standardizing the admission process, thus impacting the overall length of an admission.

Implement H&P Team in the ED
Based on the findings and conclusions, the team recommends that the Medical Director implements the new H&P in the ED. Admissions in which the physical exam occur in the ED are shorter on average than admissions in which the physical contact occurs in the AMOU. In addition, the only task of the new H&P team would be completing admissions, thus eliminating interruptions for other AMOU matters. The conclusions support that reducing interruptions would significantly reduce the average admission length.
Create New Note-Taking Form for Providers
When conducting an H&P, the admitting Provider used a standard sheet to collect relevant patient information. The Provider then uses the information from this sheet as a reference during the documentation step. Time Collection Logs indicated that documentation is currently taking too long; therefore, the team recommends a new note-taking form for the Providers to fill out during the H&P. If the note-taking form were formatted to prompt for the same information that goes into documentation and in the same order, Providers could save time during documentation by simply reading off this sheet.

Wait to Document if Backlogged
Time Collection Logs showed that documentation is the longest step in the admission process. Additionally, the team observed that it is not necessary to complete documentation for the patient to be transported from the ED to the AMOU. Therefore, in order to get patients out of the ED as fast as possible, the team recommends that Providers wait to document if there is another patient waiting to be admitted. The Providers should complete documentation once no patients are waiting to be admitted or before their shift ends. Implementing the new H&P note-taking sheet would make it easier to document after a delay and document multiple patients at a time, when necessary. Dictated notes do not appear in MiChart until the following day, so delaying documentation a few hours is insignificant comparatively.

EXPECTED IMPACT
By performing the steps outlined in the methods, the team provided recommendations to reengineer the current admission process to reduce its length and determine a realistic and reproducible expected length of an admission. Specifically, the team believes these recommendations will result in:

- A new AMOU admission process with an average admission time of 92.52 minutes per patient.
- The implementation of the H&P team, thus allowing patients to leave the ED within 37.16 minutes on average if only the H&P is completed and 55.25 minutes on average if both the H&P and orders are complete.

Figure 9 shows the expected reduction in admission length based on each individual step. In the future state, there should be no time between the time a Provider receives an admission and the time that Provider begins patient research because they are in the ED. In addition, the new H&P team will not experience any interruptions or distractions because their only task will be to complete admissions. The implementation of the new H&P team in the ED and the other recommendations will reduce the average admission length by 45.88 minutes, shown in Figure 9.
FUTURE WORK

The team believes the AMOU could perform future work to complete the following three tasks and further improve the admission process: Create critical pathways to streamline patients, develop a future state simulation and pilot, and utilize the time before ED handoff in the future state.

Create Critical Pathways to Streamline Patients
Based on the results from analyzing the effect of presenting complaint and patient age, the team recommends that the Medical Director further explore these correlations with a larger sample size of patient. This analysis could help the Medical Director create critical pathways based on either characteristic, thus reducing the time to admit these patients. This future work is also supported by the findings from the literature search.

Develop a Future State Simulation and Pilot
The team recommends that the AMOU simulate the future state using a simulation software before the expansion. Arrival times and patient lengths of stay could be used in the simulation to understand how the future state would look. In addition, the AMOU could test the team’s recommendations. The Medical Director could then develop a pilot to test the simulation results and gauge the staff’s reactions to the future state.

Utilize the Time Before ED Handoff in the Future State
Lastly, the team recommends that the Medical Director explore how to utilize the time before the ED handoff, but after a patient has been identified for observation. The “time 0” for the ED’s 30-minute expectation is the handoff time. If the new H&P team in the ED could utilize the time before the handoff, it may be possible to have patients leave the ED within 30 minutes. One possibility is that able patients use this time to complete an H&P form, thus making it easier for the admitting provider to complete the H&P. Another possibility is that the admitting provider use this time to begin patient research.
REFERENCES

APPENDIX A: Past Projects’ Figures

Figure 1: AMOU Admissions by Hour 7/1/2012 - 2/28/2013
(Source: AMOU Clerk Patient Care Time Logs; Data Collection Period: 7/1/2012 – 2/28/2013; Sample Size: 2814)

Figure 2: Average admission times differ between observed and perceived (by mid-levels)
(Source: IOE 481 Team 11 Student AMOU Observations; Data Collection Period: 10/1/13-11/15/13; Sample Size: 25)
Figure 3: Process time reduction of 26 minutes from current process to future process.
(Source: IOE 481 Team 11 Student AMOU Observations; Data Collection Period:
10/1/13-11/15/13; Sample Size: 25)
## APPENDIX B: Time Collection Log

**PATIENT STICKER**

**TIME COLLECTION**

- Received by Admitting Provider: __________
- Start Patient Research: __________
- First Patient Contact: __________
  - Location: ED AMOU
- End of First Patient Contact: __________
- Discuss Case With Attending:
  - Start: __________
  - End: __________
- Orders Complete: __________
- Documentation Complete: __________
- At Completion, where is Patient?
  - ED AMOU OTHER __________

**DELAYS**

- Interruptions:  
  - ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
  - Reasons:
    - ____________________________________________

- Waiting:  
  - ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  
  - Reasons:
    - ____________________________________________

- Frustration:  
  - ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  
  - Reasons:
    - ____________________________________________

**ADDITIONAL COMMENTS:**

- ____________________________________________
- ____________________________________________
- ____________________________________________
APPENDIX C : Provider Survey

1. What do you think is the ideal time to spend on patient research (before seeing patient)?
2. What are possible barriers to completing the research within this time?
3. How long do you think you would spend admitting a patient (from provider assignment to documentation complete in an ideal state (no interruptions or other tasks))?
   1. Average, min, and max
4. How long do you normally spend with the patient at the bedside completing the H&P?
5. How long do you think you would spend at the bedside completing the H&P in an ideal state (no interruptions or other tasks)?
   1. Average, min, and max
6. What patient characteristics, if any, make an admission take longer?
7. Is there anything that you think would make the AMOU admission process faster?
8. How many times per week on an evening or night shift do you think you are completing multiple admissions at the same time?
9. How did you define “Documentation Complete” when filling out the admission time study?
10. Has Michart made the admission process (check all that apply):
    1. shorter, faster, less difficult, more difficult, other______