University of Michigan Comprehensive Stroke Center

Improving the Discharge and Post-Discharge Process Flow

Final Report

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EXECUTIVE SUMMARY

Background
The Comprehensive Stroke Center, in total, receives approximately 800 patients a year, with patients discharged to one of five different pathways: home with outpatient rehab, home with home care skilled needs, acute rehab, subacute rehab, or long term acute care. The scope of this project is to focus on two specific pathways from Unit 4A: to home with outpatient rehab, and to the Inpatient Rehabilitation Facility (IRF). Problems with patients that are discharged home with outpatient rehabilitation often include ensuring the patients are taking their medications, and following up with doctors. The team from IOE 481 examined the current state process for the discharge of stroke patients, and make recommendations for an improved process.

Methodology
This section details the methods used throughout the scope of the project.

1. Literature Search: The team conducted literature searches to understand methodologies used for improving the discharge process at many hospitals, including an implementation of Six Sigma Methodology.

2. Interviews and Observations: The team interviewed twenty-four stakeholders including physicians, nurses and administrators; each interview went through the same questions, which are in Appendix A.

3. Historical Data Collection and Analysis: The team received two data sets, one regarding the discharge to home process and the other regarding the discharge to the IRF. For each data set, the team picked three time metrics to analyze with ANOVA and Statistical Process Control (SPC) charts. Specifically, the team analyzed time from discharge to follow-up appointments, time from discharge order to discharge, and time to write a discharge note for the discharge to home process and time from most recent PM&R consult to IRF admission, discharge order to discharge, and medical clearance and admission for the discharge to IRF process.

4. Flowcharts: From interviews, a complete current state flowchart illustrating the flow from patient arrival to the 3-month follow-up appointment at the Stroke Clinic for both home with outpatient rehab and inpatient rehab discharge dispositions were developed.

5. A3 Report and A3 Picture Story: The team created an A3 report to further detail and succinctly visualize the problems occurring throughout the discharge process from Unit 4A/4AS. The team created the A3 report by incorporating qualitative and quantitative data gained from earlier phases of the project.

Findings and Conclusions
This section describes the findings and conclusions derived from the methods.

1. Literature Search Findings Not Currently Applicable: After recommendations are made by the IOE 481 student team and the process approaches a more standard design, a Six Sigma Analysis could then be applied to quantify the discharge process and improve discharge timings.

2. Need for additional data: Both historical data on 7 day follow up phone calls and IRF admissions have sample sizes of larger than 100. While the data is adequate for assessing the current state of the process since it is still larger than 30 so normality can be assumed,
it is not comprehensive enough to accurately analyze trends and causes of problems.

3. **Opportunities for Standard Workflows:** From interviews, the team discovered steps (such as in the transition to IRF and the involvement of Social Work) in the discharge process that lack a standard workflow.

   - **Transition to the Inpatient Rehabilitation Facility (IRF) on Unit IRF:** From interviews and observations the team noted three key steps where the transition to the IRF is nonstandard: (1) the process of when the IRF Admissions Coordinator should begin looking for a bed at St. Joseph Mercy Ann Arbor (SJMAA), (2) the process of notifying the IRF Admissions Coordinator that a bed is needed by a patient who is discharging from Units 4A/4AS, and (3) the process and timing of insurance clearance and medical clearance.

   - **Social Work Involvement After Screening:** Social workers initially screen all patients but only pick up those that need their services. From interviews, the team determined that in the current process, the social workers are not consistently involved in the process in a standardized way after screening, leaving the social workers, Unit 4A/4AS physicians, and Unit 4A/4AS nurses confused on how social work fits into the overall discharge plan for the patient.

4. **Unresolved Discharge Process Issues are Discovered at 7-day Phone Call:** Based on interviews and observations, the team determined many issues discovered at the 7-day phone call could likely be handled prior to discharge while the patient is still in the hospital. This includes questions about appointments, questions regarding nursing advice, a need for consultation, a need for a referral, or sending the patient to the emergency room given their current symptoms.

5. **Key staff roles do not have cross-coverage:** Based on interviews, the team determined that two staff members that play key roles in the discharge process where there is no process for covering their role when they are out of the hospital. These two roles are the Resident Assistant on Units 4A/4AS and the IRF Admissions Coordinator.

6. **Handoffs Leading to Confusion:** After creating the flowchart, the team identified six necessary roles for discharge to home and five for discharge to IRF; however, handoffs between roles often happen multiple times during the process and can be unclear to those involved.

7. **Gaps in Continuity of Patient Care:** Providing stroke education resources is often a rushed step at the end of the discharge process. Patients are given a folder which has generic information detailing the signs and symptoms of stroke and how to move on post-stroke. Additionally, continuity of patient care occurs for patients discharged to home with outpatient rehabilitation is a gap.

8. **Communication and Transparency Gaps:** Currently the Unit 4A team and the IRF teams both attend stroke rounds, however the attendance is not standardized or regular and does not always include administration and care management. In addition, the underutilization of MiChart to update discharge dates and the organization of information within MiChart is an obstacle to communication between units as well.

9. **Data Findings for the Discharge to Home Process:** Overall, the process of discharging to home from Unit 4A appears to be meeting its goals, with respect to the time from discharge to follow-up appointments, time from discharge order to discharge, and time to write a discharge note. After removing points with assignable causes all the SPC charts
were in control, and the means were relatively on target. The process should continue to be monitored, as the small sample size may have skewed the data.

10. **Data Findings for the Discharge to IRF Process**: Overall, the discharge from Unit 4A to the IRF appears to be in control. Despite being in control, the discharge process has a significant mean shift, resulting in process steps taking much longer than they should. An ANOVA analysis also revealed that Unit 4A and Unit 4AS are not the only units struggling with this off target issue. More data needs to be collected in order to evaluate the situation with a higher degree of confidence.

**Recommendations**

The following items are recommended to address the previously described findings in order to address the primary goal of improving the discharge process.

1. **Collect Data**: Sample sizes need to be. Information on date and time of discharge order, discharge summary, and discharge time should be continued to be gathered from MiChart for patients in both data sets in order to have a better picture of critical time metrics.

2. **Delineate Patient Ownership During the Follow-up Process**: The lack of clear ownership of the patient during the time between discharge and follow-up leaves confusion over where the patient should be sent with their questions. Therefore, the team recommends that the Comprehensive Stroke Center clearly delineate patient ownership during the follow-up process with a triage algorithm and response time goals.

3. **Cross-train Staff on Roles that are Key to the Discharge Process**: To address the finding that key staff roles do not have cross-training, the team recommends that cross-training be implemented to ensure adequate coverage of these key steps when the necessary staff member is absent from work.

4. **Incorporate Standardized Communication between Unit 4A and the IRF Consult Team**: The 4A team and the IRF consult team should have regular huddles where administration and care management would attend, in order to have a standard time where both units can update one another and provide more details on why certain dispositions change, or why some logistical obstacles may be causing delays to transitions. Furthermore, the team recommends that the discharge date recorded in MiChart be updated after each huddle, to ensure this information stays up to date.

5. **Make Stroke Education Resources More Robust and Accessible**: To address the findings of too many discharge process issues being found at the 7-day phone call and gaps in the continuity of patient care, the team recommends that stroke education resources be made more robust and accessible. The current folder that patients are given during discharge should be made available electronically on the Stroke website and through the patient portal.

6. **Communicate Roles and Responsibilities Document**: The lack of process knowledge can cause frustration and slow downs. Sharing the flowchart created with those involved would be beneficial for increasing process awareness.

7. **Conduct Full Six Sigma Analysis**: A full six sigma analysis would be helpful in providing quantitative improvements in the discharge process, once the current discharge process is standardized.
INTRODUCTION

The Operations Director of the Comprehensive Stroke Center at the University of Michigan Hospital Center has expressed concern regarding the discharge process for ischemic stroke patients and the communication gaps between the discharge and the follow-up appointment with the clinic. The Stroke Coordinator reports several discrepancies between the instructions from the physician and the understanding of the patients regarding their post-discharge care plan (medications, referrals, at-home equipment, and follow-up appointments). These discrepancies influence the continuity of care for the patients, and can lead to confusion and dissatisfaction for the patient and/or the caregiver. The Operations Director would like to know how to improve the current discharge process from the inpatient stroke center on Unit 4A, for two discharge dispositions (either to home with outpatient rehabilitation or to the Inpatient Rehabilitation Facility (IRF)), to streamline the discharge and follow-up processes. She has asked the student team from IOE 481 to examine the current state process for the discharge of stroke patients, and create future state workflows that improve the process. The following report details the background, goals and objectives, methods, findings, conclusions and recommendations for streamlining the discharge and post discharge follow-up processes.

BACKGROUND

The ideal discharge process involves coordination of referrals, diagnostic orders/labs, medications, follow-up appointments, at home equipment, support and resources. Currently the Stroke Coordinator will call the patients within 7 days of discharge to home. The Stroke Coordinator will reconcile medications, verify follow-up appointments, verify care services (if required), and provide resources and support to the patient. It is through this process that the Stroke Coordinator was made aware of the communication gaps between physician and nurse instructions and the patient's understanding. This causes a potential delay in patient care. Between November 1, 2016 and January 28, 2016, the stroke center had 81 patients, with 79% of the follow-up calls flagged with issues. The most common issue found was nursing advice, which further emphasizes this communication gap between nurse instructions and patient understanding. The remaining issues found included stroke appointments, neurology appointments, unable to reach, and physician consultation. In addition to the follow-up process, there are many other key issues involving communication gaps between unit 4A and IRF, and a lack of standardized workflows.

The Comprehensive Stroke Center, in total, receives approximately 800 patients a year, with patients discharged to one of five different pathways: home with outpatient rehab, home with home care skilled needs, in-patient rehab, subacute rehab, or long term acute care. The scope of this project is to focus on two specific pathways: home with outpatient rehab, and inpatient rehab. Problems with patients that are discharged home with outpatient rehab often include ensuring the patients are taking their medications and following up with doctors. When patients are discharged to acute rehab, there are logistical issues involving the transition from the
Inpatient Stroke Treatment Center (Unit 4A and Unit 4AS) to Inpatient Rehabilitation Facility (IRF), involving bed capacity and communication between neurology team and Physical Medicine and Rehabilitation (PMR) team. Strokes are a particularly time sensitive medical issue and the previously stated issues are impeding patient care.

GOALS AND OBJECTIVES
The main goal of the project is improving the discharge process of stroke patients at the Comprehensive Stroke Clinic by streamlining the steps involved in the discharge and follow-up processes. The project objectives are as follows:

- Create current state workflow
- Analyze and identify barriers and waste in stroke patient discharge process that leaves gaps in care and communication until the follow-up clinic appointment
- Provide an A3 picture story to summarize and visualize improvement opportunities
- Provide a summary of improvement opportunities utilizing a benefit/effort matrix to prioritize

KEY ISSUES
The following key issues, noted by the Operating Director of the Stroke Center, are driving the need for this project:

- Key information is not being gathered from Patients and Caregivers before discharge:
  - Patient and caregiver phone numbers are not verified during their inpatient stay making it difficult for the Stroke Coordinator to contact patients for follow-up
  - Correct pharmacy information is not gathered from patients prior to discharge, leading to delays and confusion in the prescription process
  - Patient’s primary care physician (PCP) information is not collected during inpatient stay, making communication between the Comprehensive Stroke Center and patients’ PCP difficult
- Discrepancies (differences between patient perception and hospital perception of key healthcare-important information) when the Stroke Coordinator follows up with patients are causing significant rework and redundancies
- Discrepancies lead to confusion between patient/caregiver and their providers causing setbacks in rehabilitation of up to one week
- Transition of patient from Unit 4A (or Unit 4AS) to the Inpatient Rehabilitation Facility (IRF)

METHODS
The following methods used include a literature search, interviews and observations, historical data collection and analysis, a flowchart, an A3, and an A3 picture story.
**Literature Search**
The team conducted literature searches in order to understand methodologies used for improving the discharge process at many hospitals, including an implementation of Six Sigma Methodology. This study included a pre- and post- intervention quantitative study over a 10-month period at the Emergency Department at the American University of Beirut Medical Center. The outcomes included a discharge time (discharge order to patient leaving the room), percent of patients whose discharge order was written before noon, percent of patients leaving the room by noon, hospital length of stay and length of stay of patients admitted to emergency department, which will be discussed more in detail in the Findings [1].

**Interviews and Observations**
The team completed a total of twenty-four interviews, each interview went through the same questions which can be referenced in Appendix A. A variety of care providers and administrators, including physicians, nursing, care managers, physical and occupational therapy, and administrators, from Inpatient Stroke Treatment Center (4A), Acute Rehabilitation (IRF), and the Stroke Clinic were interviewed. The purpose of the interviews was to gather an in depth understanding of the requirements of the discharge process. From the interviews three key problems were reiterated including (1) the importance of maintaining positive relationships and communications between Unit 4A and IRF, (2) a need for robust and standard stroke education resources, and (3) challenges consistently using EMR/MiChart.

Two types of observations were performed, rounds and priority discharge. Rounds take place in 4A and involve stakeholders from PT/OT, neurology, and PMR discussing the state of patients and discharge statuses. This allowed the team to observe who was consulted in discharge decisions including physicians from both 4A and IRF, administrators, nursing and PT/OT. Additionally, factors that were observed to slow down the process included insurance, discrepancies between different stakeholder’s recommendations, and bed availability. This confirmed statements that were made during interviews.

**Historical Data Collection and Analysis**
Historical data was gathered in order to develop a picture of the current state of the process including two previously completed flows. Data from the Comprehensive Stroke Center include baseline discharge data, phone intervention data, and two flows on transitions of care showing all types of discharges and one on inpatient to home. The baseline discharge data shows the timing between initial discharge orders and actual discharge. The phone intervention data marks problems that occurred in each 7-day follow up phone conversation the Stroke Coordinator performs. Problems include remittance, having to schedule appointments, and coordinating consultations. Both sets cover from November 1, 2016 to January 28, 2017 and include 81 data points.
Data from the Inpatient Rehabilitation Facility (IRF) included baseline admissions data, and an IRF admissions flow. Admissions data showed the timing between the time the admissions coordinator is notified and the patient is admitted. Data covers the time period from January 3, 2016 to February 28, 2017 and include 75 data points.

The team began to analyze the data as soon as it was received. Several statistical analysis methods were used, including: interval plots, ANOVA, and statistical process control (SPC) charts. Each data set was analyzed to gain insight into how long critical portions of the discharge process take. Specifically, for Unit 4A the analysis focused on the length of time between discharge and follow-up appointments, discharge order and discharge, and the length of time to write a discharge note. For IRF the analysis focused on the length of time between: most recent PM&R consult and admission to IRF, discharge order and discharge, and medical clearance and admission. Additionally, the team drilled down on the IRF admissions data such that only patients entering the IRF from Unit 4A and Unit 4AS were considered. The drill down included an analysis of the same critical time metrics as was conducted with the entire IRF data set.

Flowcharts
After completing interviews and observations as well as gathering already completed information on the process flow, the team developed a complete current state flowchart illustrating the flow from patient arrival to the 3-month follow-up appointment at the Stroke Clinic for both home with outpatient rehab and inpatient rehab discharge dispositions. Each flow was broken down into swim lanes. For the discharge to home flow that includes 4A/4AS roles of physicians, care management, physical and occupational therapy, nursing, and stroke coordinator. For the discharge to IRF that includes 4A/4AS roles of physician, nursing, and occupational and physical therapy, as well as the IRF roles of administration, and physician.

The flowcharts are attached in Appendix B. The purpose of the charts is to ensure that everyone involved in the discharge process can be made aware of responsibilities and patient care can maintain a consistently high level of quality. Understanding the steps is necessary to see waste and improvement opportunities.

A3 Report and A3 Picture Story
After completing a literature search, interviews, observations, and historical data analysis, the team created an A3 report to further detail and succinctly visualize the problems occurring throughout the discharge process from Units 4A and 4AS. The A3 report was created by incorporating qualitative and quantitative data gained from earlier phases of the project with particularly valuable information coming from interview findings and observations. The report can be found in Appendix C. The report is a “left-sided” A3 report as the project scope did not include implementing the team’s recommendations, thus leaving the Future State Plan and Follow-Up Sections blank to be completed by the client going forward.
Creating an A3 report served two purposes, (1) as detailed above, the report allowed the team to summarize the data collection efforts and provided a holistic overview of the process for determining potential recommendations, and (2) the report serves as a summary deliverable for the client to disseminate the results of the project.

Additionally, the team created an A3 picture story report, which can be found in Appendix C. This was requested by the client to help stakeholders in the process more quickly and easily visualize the state of the project and the key issues involved in the discharge process. The picture story was based on the A3 report and thus shares the same content, just in a more visual, “snap-shot” manner.

FINDINGS AND CONCLUSIONS
The team discovered the following findings based on the methods detailed above. In many cases, multiple methods lead to each finding indicating the pervasive nature of the given finding. These findings are current hindrances to a streamlined discharge process that should be addressed to achieve the primary goal of improving the overall discharge process.

Literature Search Findings Not Currently Applicable
The team conducted literature searches to understand methodologies used for improving the discharge process at many hospitals, however applying these methodologies to the Comprehensive Stroke Center would take place once this ongoing project is complete. As the scope of this project is to outline the current state and provide recommendations based on the current process, implementing Six Sigma methods could be applied in future phases of the project. The research conducted in Beirut maintains that institutions aspiring to tackle delays in the discharge process should be adopting the core principles of Six Sigma. Their team was able to reduce discharge time by 22.7% and reduced length of stay of patients from 3.4 days to 3.1 days post-intervention [1]. Using this analytical method is effective in generating interventions for improving discharge timings, however for this specific project regarding the discharge process for ischemic stroke patients, the process is not yet standardized enough to perform Six Sigma analysis. After recommendations are made by the IOE 481 student team and the process approaches a more standard design, this method could then be applied to quantify the discharge process.

Need for Additional Data
Throughout interviews and during the search for accurate historical data the team determined that there were inadequate methods of data collection happening for the most comprehensive statistical analysis to take place. However, both data on 7 day follow up phone calls and IRF admissions have sample sizes of fewer than 100. While the data is adequate for assessing the current state of the process since it is still larger than 30 so normality can be assumed, it is not
comprehensive enough to accurately analyze trends and causes of problems. With the assumption of 5% margin of error, 95% confidence interval, and a population size of greater than 20,000 a sample size of 377 is needed. While much of the information needed for analysis is within MiChart this is not sufficient as it cannot be aggregated within the program. Information on the 7 day phone calls, insurance clearance times, and more accurate information on how long a patient has been waiting to move to IRF have been identified of initial areas of work.

**Opportunities for Standard Workflows**

From interviews, the team discovered that steps (such as in the transition to IRF and the involvement of Social Work) in the discharge process lack a standard workflow. The unorganized process leaves involved stakeholders (such as IRF Admissions Coordinator, social workers, and physicians) to rely on intuitions and experiences, rather than a standard, best practice, for handling each individual patient situation.

**Transition to the Inpatient Rehabilitation Facility (IRF)**

The patient’s transition from the Inpatient Stroke Unit on Units 4A and 4AS to the Inpatient Rehabilitation Facility (IRF) involves integrated steps by multiple stakeholders. These steps include insurance clearance, medical clearance, physical therapy consultation, bed availability checks, and patient transport where each step is performed by various stakeholders including the 4A Case Manager, 4A physicians, the IRF Admissions Coordinator, IRF physicians, physical therapists, and 4A nurses.

From interviews and observations, the team noted three key steps where the transition to the IRF is nonstandard and thus is limiting the ability of the Stroke Center to provide the highest quality care.

The first key step lacking standardization is the process of when the IRF Admissions Coordinator should begin looking for a bed at an outside rehabilitation facility such as St. Joseph Mercy Ann Arbor (SJMAA). Currently the IRF Admissions Coordinator will use her intuitions and experiences to determine if a patient will be waiting “too long” for a bed at the IRF. This determination of “too long” is currently not well defined. The team asked Unit 4A/4AS physicians for their opinion on the length of time that is appropriate for a patient to wait for admission to IRF and the consensus was approximately two days. Further investigation should be conducted to determine precisely how to standardize the workflow with a focus on including input from all involved stakeholders, namely Unit 4A/4AS physicians, the Unit 4A Case Manager, the IRF physicians, and the IRF Admissions Coordinator. In addition to eliciting stakeholder opinion, this investigation should rely on data that quantifies the patient wait time for a bed as getting the patient into a rehabilitation program as quickly as possible should be the primary goal.
The second key step lacking standardization is the process of notifying the IRF Admissions Coordinator that a bed is needed by a patient discharging from Unit 4A/4AS. Interviews with Unit 4A/4AS physicians indicated that each physician has a distinct process for notifying the IRF that a bed is needed causing confusion for the IRF Admissions Coordinator (determined from interviews with the IRF Admissions Coordinator) thus delaying the patient’s transfer to the IRF. Additionally, there is no method in place for the IRF Admissions Coordinator to record when a bed request was made for a given patient making it significantly more likely that a patient will not be transferred in a timely manner or in the proper priority order. As stated above, valuable data is not being tracked thus making it more difficult to track if improvement efforts are effective.

The third key step lacking standardization in the transition to the IRF is the process and timing of insurance clearance and medical clearance. In order for a patient to be discharged to the IRF, he or she must first be medically cleared, then insurance must approve the transfer. Interviews with Unit 4A/4AS physicians revealed that each physician has a different method for accomplishing medical clearance and insurance clearance. More experienced physicians, such as attendings and senior residents, indicated that they get a “feeling” of when a patient will be medically cleared and will start the insurance clearance process earlier to try to have medical clearance complete at the same time insurance clearance completes. The desire to have the patient transferred as soon as possible once being medically ready motivates this decision to “jump start” the insurance clearance process. This may be a decision motivated out of the patient’s best interest, but the method is not well documented and leaves physicians who less familiar with the discharge process to rely on their less-informed intuitions. Furthermore, there are cases when the physician starts the insurance clearance process too soon and the patient is not medically ready for discharge. Then the insurance process must be repeated causing wasted time and rework. A standard process would mitigate these issues and make it clear for all involved physicians and program coordinators the proper steps to follow.

Social Work Involvement After Screening
Throughout the discharge process some patients require the support of social workers to arrange financial services, communicate with their family, provide mental health information and support. From interviews, the team determined that in the current process, social worker involvement is standard because they initially screen all patients. However, not all patients are picked up by the social work team meaning that, beyond the initial screening, social work involvement is nonstandard. Since the social work is not consistently involved in the process beyond the initial screening, the social workers, Unit 4A/4AS physicians, and Unit 4A/4AS nurses are not aware of how social work fits into the overall discharge plan for the patient. This confusion leads to delays in communication between the Unit 4A/4AS stakeholders and therefore can delay patient discharge if questions are not caught and addressed prior to discharge initiation.
Unresolved Discharge Process Issues are Discovered at the 7-Day Phone Call

From interviews and analysis of Unit 4A historical data, the team found many issues are discovered at the 7-day phone call that indicate gaps in the discharge process. The phone call process itself follows a standard workflow (see Appendix B) to ensure all patient issues are addressed. However, many unresolved issues could likely be handled prior to discharge while the patient is still in the hospital. Some of these issues that surface at the 7-day phone call include questions about appointments, questions regarding nursing advice (i.e., advice that does not require the input of a physician and can be answered by the Stroke Coordinator making the phone call), a need for consultation, a need for a referral, or sending the patient to the emergency room given their current symptoms (see Figure 1). These unresolved issues discovered at the 7-day phone call are caused by multiple gaps in the discharge process (see Appendix C for a Fishbone Diagram detailing root causes).

Additionally, 5.4% of the time the Stroke Coordinator is not able to reach the patient due to a wrong number being recorded in the patient’s chart. With a more robust and standardized discharge process that integrates patient education and confirmation of medication and patient information, the number of issues discovered at the 7-day phone call could likely be reduced.

Furthermore, the Stroke Coordinator is working to ensure that the patients have all necessary appointments scheduled, but this may lie outside of her job scope. The Stroke Coordinator is picking up this additional work because there is a gap left by other portions of the discharge process as the majority (84.8%) of all 7-day phone calls require some form of follow-up or
additional work by the Stroke Coordinator. As viewed in Figure 1 above, appointments are the largest portion of issues that surface at the 7-day phone call. Breaking down the general appointments category further, the majority (52.4%) of needed appointments are for stroke follow-up (see Figure 2). According to interviews conducted with the Resident Assistant, stroke follow-up appointments should be scheduled prior to the patient’s discharge. The fact that the major issue discovered at the 7-day phone call is a need to schedule stroke follow-up appointments indicate a gap in the scheduling process prior to patient discharging from the hospital.

![Figure 2: Pareto Chart of Appointment Issues at the 7-day Phone Call that Indicate Gaps in Stroke Follow-up Appointment Scheduling (n = 81 patients)](image)

The final issue the team discovered surrounding the 7-day phone call is that the Stroke Coordinator is often doing tasks that are out of the scope of her role description. From interviews, the team determined that the Stroke Coordinator is often double checking with each department to ensure that appointments and referrals are in place for the patient. This extra step is in effort to provide the highest quality of care to patients, but creates significant redundancy and rework as these appointments and referrals may already be in a work queue for a given department. However, there are cases where the Stroke Coordinator catches an appointment or referral that has been missed and had not been added to a work queue and therefore times when this double-checking improves patient care. Further data should be collected on the percentage of time that missed appointments and referrals are caught due to the Stroke Programs Coordinator’s double-check to see if this check is a valuable use of time.

**Key staff roles do not have cross-coverage**
From interviews, the team determined that there are two staff members that play key roles in the discharge process where there is no process for covering their role when they are out of the
hospital. These two roles are the Resident Assistant on Units 4A/4AS and IRF Admissions Coordinator.

The Resident Assistant is a key role because she schedules the patients’ follow-up appointments and make sure the patients’ ACT monitors are ordered and applied before the patient leaves the hospital (see the flowchart in Appendix B for more details on this role). Interviews revealed that when this staff member is sick or on vacation, patients do not get their appointments scheduled or ACT monitors ordered and applied prior to discharge. This leads to patient confusion and delay in patient care because steps that should have been completed in-person prior to discharge are now forced to take place via a phone call.

The IRF Admissions Coordinator is a key role because she manages bed availability of the IRF. This role includes monitoring the patient admission list, rearranging patient rooms so that genders will match in shared rooms, and determining when to send a patient to St. Joseph Mercy Ann Arbor (see the flowchart in Appendix B for more details on this role). From interviews, the team learned that when the IRF Admissions Coordinator is absent, these tasks are left unhandled and patient admission to the IRF is often slowed.

Handoffs Leading to Confusion
The flowcharts (see Appendix B) illustrates the seven handoffs between different roles for each discharge process. As discussed previously, the team identified six necessary roles for discharge to home and five for discharge to IRF, however handoffs between roles often happen multiple times during the process and can be unclear to those involved. While the number of handoffs is not an issue lack of standardization and checklists cause confusion during them. For instance, in the IRF flow, for a patient to be discharged the 4A physician must medically them and the IRF admissions coordinator must confirm bed availability and insurance clearance, however for the IRF coordinator to begin this process the patient must be added to their list by the IRF consult team. When the coordinator’s tasks are complete the hand the task back to 4A team, however they notify over 40 people with the page and email sent out (reference chart 2 in Appendix B).

Through interviews it was apparent that instances such as this blur responsibilities and contribute to the lack of standard work processes. Additionally, these handoffs can cause times during or after a patient's stay where the hospital personnel are unsure whose responsibility they are causing non-continuous patient care.

Gaps in Continuity of Patient Care
Interviews, observations, and the flowchart made clear that two notable gaps in the continuity of patient care throughout the discharge process are present.

The first gap is stroke education resources. Based on interviews and observations, the team noted
that providing educational resources is often a rushed step at the end of the discharge process. Patients are given a folder which has generic information detailing the signs and symptoms of stroke and how to move on post-stroke. Additionally, for patients discharged to home with outpatient rehabilitation, the nurses give the patients a printout of their medications and walk them through how and when to take each one. This education process is lacking because patients have just suffered from a stroke. Often, they are not fully back to baseline levels on cognition and therefore cannot understand complex resources available. Furthermore, from Unit 4A data analysis, the team noted that the average length of stay (LOS) is approximately 4.25 days (minimum LOS was 0.58 days, maximum LOS was 20 days) indicating that there may not be enough time for robust and thorough patient education to occur during the inpatient hospital stay. Interviews and observations revealed that patients also tend to lose the stroke education folder and there is not a clear location for them to find the same information online or through their patient portal. Finally, for the patients who are discharged to the IRF, even less emphasis is placed on stroke education resources because a belief that education is not as needed since the patient is only being transferred within the hospital. The folder often is lost or misplaced during the patient transport to the IRF. This leads to confusion and frustration between Units 4A/4AS and the IRF about which unit is in charge of education patients with stroke-specific information.

The second gap in continuity of patient care occurs for patients discharged to home with outpatient rehabilitation. Between the time a patient is discharged from the hospital and their follow-up appointment in stroke clinic, there is confusion over who has responsibility for the patient: the inpatient team on 4A/4AS or the outpatient team at the Stroke Clinic. This leads to confusion over where to direct questions the patient has and thus causes significant issues to be discovered at the 7-day phone call and beyond (as mentioned earlier). Neither the inpatient team nor the outpatient team have official responsibility for the patient during this gap as the inpatient team believes they should no longer officially be responsible because the patient is no longer physically in the hospital, and the outpatient team believes they should not officially be responsible as they have never seen the patient before. However, a decision needs to be made and communicated to both parties so that patients may receive the best care during this time.

**Communication and Transparency Gaps**

Interviews, observations, and the flowchart made clear that the majority of the frustration between the transitions from 4A to IRF is due to communication and transparency gaps. There are multidisciplinary stroke rounds where both the 4A physicians and the IRF physicians attend and discuss potential patients transitioning to IRF, however attendance from both units is not standardized. In addition, administration and care management are not always involved in these rounds and standardizing their involvement would be helpful in providing the full picture on the patient’s logistical goals and needs.

One specific tool that provides a hurdle to communication is the utilization of MiChart and other
Electronic Medical Records. Different units update information for patients in different areas, such as adding information into the “Notes” rather than their respective fields. This causes extra work as other physicians or nurses looking into that patient need to search for the information they are looking for. In addition, the discharge date on MiChart is not updated every time the date changes through discussions at rounds and the progress the patients make. This too adds extra work as nurses must verify the discharge dates rather than relying on the information in MiChart.

Data Findings for the Discharge to Home Process
The data provided to the team allowed three time metrics to be studied: The time between discharge and follow-up appointments, time from discharge order to discharge, and the time to write a discharge note. The analysis conducted by the team on the baseline discharge data from Unit 4A consisted of three main steps: analyzing the variance of each time metric, analyzing variance based on day of the week, and analyzing the mean value of the time metrics. Ideal values for each time metric were determined from interviewing physicians and nurses involved with the discharge process. For time from discharge to follow-up appointments the ideal time is 35 days. The ideal time from discharge order to discharge is 60 to 90 minutes. Finally, the ideal time for writing a discharge note is 45 minutes.

Time Metric Variance Analysis:
In order to study the variance of each of the time metrics the team utilized Individual Moving Range (IMR) charts. Of the three time metrics the team was analyzing, the team only noted 5 points that were out of control on their respective individual value charts, and 6 points out of control on the moving range charts. Figures 3, 4, and 5 show the IMR charts, which include out of control points, as well as the current average for each time metric analyzed.
Figure 4: IMR Chart of Hours Between Discharge Order and Discharge

Figure 5: IMR Chart of Days Between Discharge and Follow-Up Appointment

Once the team noticed out of control points, the team checked for any assignable causes. By checking the patient notes from MiChart the team realized that most of these out of control points had assignable causes, and thus could be removed from consideration. With few to no out of control points remaining, the team determined the process does seem to be in statistical control. However, the small sample size makes it difficult to conclude this with a high degree of certainty.

Day of the Week Variance Analysis:
In addition to analyzing the data points with IMR charts, the team also decided to see if any of
the critical time metrics varied based on the day of the week. The team conducted an ANOVA study to see if any day of the week resulted in significantly longer or shorter lengths of time for each time metric. The results can be seen in Figures 6, 7, and 8 below.

Figure 6: ANOVA of Hours to Write a Discharge Note

Figure 7: ANOVA of Hours Between Discharge Order and Discharge
None of the ANOVA interval plots showed a significant difference based on the day of the week. Thus, the day to day variance of the critical time metrics appears to be minimal. This is the expected result; the process should not vary by day.

**Mean Analysis:**
After noticing that the variance of the process seemed to be in relative control, the team checked to see if the means were on target for these critical lengths of time. The ideal time for writing a discharge note is 45 minutes, but the average determined from the baseline data was 6.7 hours. The ideal time between discharge order and discharge is 60 to 90 minutes, but the average of the data was about 106 minutes. The ideal time between discharge and follow-up appointment is 35 days, and the average of the data was 39 days. The only time metric that is significantly different from its target value is the time to write a discharge note.

Overall, the process of discharging to home from Unit 4A appears to be meeting its goals, with respect to the three key metrics the team analyzed. The only time metric that has a significant mean issue is the time to write a discharge note, however this difference could be the result of the small data sample size. Despite meeting most of the ideal goals, the process should continue to be monitored, as the small sample size may have skewed the data.

**Data Findings for the Discharge to IRF Process**
The data provided to the team allowed three time metrics to be studied: time from most recent PM&R consult to IRF admission, discharge order to discharge, and medical clearance to admission. The analysis conducted by the team on the baseline admissions data from the IRF consisted of three main steps: analyzing the variance of each time metric, analyzing the mean value of the time metrics, and analyzing variance based on unit admitting patients. Ideal values
for each time metric were determined from interviewing physicians and nurses involved with the discharge process. For time from most recent PM&R consult to IRF admission the ideal time is no more than 48 hours. The ideal time from discharge order to discharge is 60 to 90 minutes. Finally, the ideal time from medical clearance to admission is less than 24 hours.

**Time Metric Variance Analysis:**
To study the variance of each of the time metrics the team again utilized Individual Moving Range charts. Of the three time metrics the team was analyzing, the team only noted 7 points that were out of control on their respective individual value charts, and 21 points out of control on the moving range charts. Figures 9, 10, and 11 show the IMR charts, which include out of control points, as well as the current average for each time metric analyzed.

![IMR Chart of Hours Between Most Recent Consult and Admission](image)
After noting the out of control points in the above chart, the team checked to see if there were any assignable causes that would allow us to remove these points from consideration. Rather than find these causes, the team instead noticed that the data set provided information on admissions from more units than just Unit 4A and Unit 4AS. Since the team is only interested in these particular units, the team decided to redo the IMR charts with only points from Unit 4A and 4AS. Figures 12, 13, and 14 show these revised charts.
Figure 12: IMR Chart Hours Between Most Recent Consult and Admission (Filtered Data)

Figure 13: IMR Chart of Hours Between Discharge Order and Discharge (Filtered Data)
The filtered data set only has 1 out of control point among all three critical timing metrics, showing that the process is very much in statistical control. However, the team realizes that this data set is very small, and may not be entirely representative of the process.

**Mean Analysis:**
Since the variance of the admissions process was in control, the team checked to see if the means were on target for these critical lengths of time. The ideal time between a patient's consult and their admission to the IRF is no more than 48 hours, but the average determined from the baseline data was approximately 70 hours. The ideal time between discharge order and discharge is 60 to 90 minutes, but the average of the data was about 160 minutes. The ideal time between medical clearance and admission to the IRF is less than 24 hours, and the average of the data was 16 hours. The only time that matches the ideal situation is the time between medical clearance and admission to the IRF, the other two critical time metrics were far larger than the ideal value.

**Variance Analysis Based on Discharging Unit:**
After noting that there was a pretty significant mean off target problem with two of the critical time metrics, the team performed an ANOVA study to see if these problems were unique to discharges from Unit 4A. The results can be found in Figures 15, 16, and 17 below.
Figure 15: ANOVA Chart Hours Between Most Recent Consult and Admission

Figure 16: ANOVA of Hours Between Discharge Order to Discharge
Figure 17: ANOVA of Hours Between Medical Clearance and Admission

Based on the ANOVA results, Unit 4A and 4AS appear to be very similar to most other units. This suggests that the problem with the process is not unique to just Unit 4A admissions. However, the sample size for this study was very small, with only a few points per unit, so it is difficult to determine a problem with certainty.

Overall, the discharge from Unit 4A to the IRF appears to be in control. Despite being in control, the process has significant mean shifts, resulting in two out of three timing metrics taking much longer than the ideal situation. The data also revealed that Unit 4A and Unit 4AS are not the only ones struggling with this off target issue. More data needs to be collected in order to evaluate the situation with a higher degree of confidence.

Summary of Findings and Conclusions

In summary, the team discovered many findings related to insufficient data, communication gaps, and nonstandard workflows:

- Literature Search Findings
- Need for Additional Data
- Opportunities for Standard Workflow
  - Transition to IRF
  - Post-Screening Social Work Involvement
- Unresolved Discharge Process Issues Discovered at 7-day Phone Call
- Key Staff Roles Do Not Have Cross Coverage
- Gaps in Continuity of Patient Care
- Data Findings for Discharge to Home Process
- Data Findings for Discharge to the IRF Process
RECOMMENDATIONS
The following recommendations include collect data, delineate patient ownership during the follow-up process, cross-train staff on roles that are key to the discharge process, incorporate standardized communication between 4A and IRF consult team, make stroke education resources more robust and accessible, communicate roles and responsibilities workflow, and conduct full six sigma analysis. The team developed these recommendations to achieve the primary goal of streamlining and improving the discharge process.

Collect Additional Data
As previously stated, sample sizes need to be larger across the board. Information on date and time of discharge order, discharge summary, and discharge time should be continued to be pulled from MiChart for patients in both data sets in order to have a better picture of critical time metrics. Table 1 shows the metrics that should also be recorded into excel sheet.
Table 1: Needed Data Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Purpose</th>
<th>Current State</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow up phone call date</td>
<td>Continue collecting data for larger sample size</td>
<td>Insufficient Sample Size</td>
<td>Stroke Coordinator</td>
</tr>
<tr>
<td>Follow up phone call issues</td>
<td>Continue collecting data for larger sample size</td>
<td>Insufficient Sample Size</td>
<td>Stroke Coordinator</td>
</tr>
<tr>
<td>Re-admittance Date</td>
<td>Determine correlation between discharge timing, phone call issues and re-admittance.</td>
<td>Insufficient Sample Size</td>
<td>Stroke Coordinator</td>
</tr>
<tr>
<td>Insurance Clearing Time</td>
<td>Determine if any insurances that are bottlenecking the discharge to IRF process</td>
<td>Unmeasured</td>
<td>IRF Admissions Coordinator</td>
</tr>
<tr>
<td>Time on IRF Admissions List</td>
<td>Gather a more accurate data on how long patients wait from being medically cleared to being moved to IRF</td>
<td>Unmeasured</td>
<td>IRF Admissions Coordinator</td>
</tr>
<tr>
<td>Time to Outside Facility</td>
<td>Time it takes to arrange discharge to an outside facility (e.g., Saint Joseph Mercy Ann Arbor)</td>
<td>Unmeasured</td>
<td>IRF Admissions Coordinator</td>
</tr>
</tbody>
</table>

Once information of a sufficient sample size (377) is obtained for both populations the Quality Department should perform from further analysis. Additionally, data should be collected clearly and consistently.

**Delineate Patient Ownership during the Follow-up Process**

The team recommends that the Comprehensive Stroke Center clearly delineate patient ownership during the follow-up process to address the findings of too many issues being found at the 7-day phone call and gaps in the continuity of patient care. As indicated previously, the lack of clear ownership of the patient during the time between discharge and follow-up leaves confusion over where the patient should be sent with their questions. After conducting interviews with the Stroke Clinic (the location of patient follow-up appointments), the team believes the Stroke
Clinic should take ownership of the patient in this interim time between discharge and follow-up. However, further analysis and interviews should be conducted to determine the proper team for owning the patient in this interim time.

To ensure the Stroke Clinic physician has accurate knowledge of the patient, the team recommends that an effort be made for the Stroke Clinic physician to visit the patient while they are still in the hospital. The Stroke Clinic team should reach out to the inpatient team with questions about a specific patient. Overall the two teams (Inpatient stroke care and the Stroke Clinic) should work to become a more integrated team, through huddles and communication, so that patient care may be handed off seamlessly. Further investigation should be made into the feasibility and specific details of this recommendation but this project has illuminated the need from a continuity of care perspective.

The team also recommends that the Stroke Center create a triage algorithm so that care team members receiving calls and questions from the patient will know where to direct each category of question. Along with a triage algorithm, the Stroke Center should develop and inform the team of response time goals for various acuities of patient issues. This will ensure that all care team members know where to send a given question, and with what urgency this question should be answered.

Additionally, the team recommends that there be a person dedicated to confirming patient information prior to discharge. This will address the other issues being discovered at the 7-day phone call such as not being able to reach a patient due to a wrong number. Having a dedicated role for this task will reduce the rework required at the 7-day phone call by ensuring correct patient contact information, pharmacy contact information, and properly scheduled appointments prior to the patient being discharged from Units 4A/4AS.

**Cross-train Staff on Roles that are Key to the Discharge Process**

To address the finding that key staff roles do not have cross-training, the team recommends that cross-training be implemented to ensure adequate coverage of these key steps when the necessary staff member is absent from work. This low-effort recommendation can have large impact as in the current flow, patient care is being delayed when these two roles are absent. Additionally, having the Resident Assistant and IRF Admissions Coordinator evaluate their workflow and learn to teach someone else these key steps will help them to better understand their roles and streamline the process as redundancies are revealed.

**Incorporate Standardized Communication between Unit 4A and the IRF Consultation Team**

To address the finding that there is a communication gaps and transparency between 4A and IRF, the team recommends that 4A and the IRF consult team have regular huddles where
administration and care management would attend, to have a standard time where both units can update one another and provide more details on why certain dispositions change, or why some logistical obstacles may be causing delays to transitions. Furthermore, the team recommends that the discharge date recorded in MiChart be updated after each of these huddles, to ensure this information stays up to date.

Also, currently, there is a daily table highlighting potential discharges and beds available in IRF for stroke patients that IRF admissions sends out to select physicians and nurses. The team also recommends that this table be sent out to all the 4A physicians to provide transparency to ease frustration on logistical delays.

**Make Stroke Education Resources More Robust and Accessible**

To address the findings of too many issues being found at the 7-day phone call and gaps in the continuity of patient care, the team recommends that stroke education resources be made more robust and accessible. The stroke education folder that patients are given during discharge should be made available electronically on the Stroke website (for generic information) and through the patient portal (for patient specific information). Patients should still be given the stroke education folder upon discharge for those patients that prefer a hard copy of the information, but making an electronic version available will make it easier for patients to seek out information when they are more cognitively able as they recover further from their stroke. Additionally, an electronic version of the information will make it easier for patients discharged to the IRF to access information as they may have lost their stroke education folder during the discharge process to the IRF.

Another possible way to address patient education is by using the HeartCare Channel. This educational resource is compiled by the American Heart Association/American Stroke Association in conjunction with The Wellness Network [2]. HeartCare Channel gives patients a comprehensive education source for updated stroke knowledge that they or their family members can access 24/7. Additionally, providers can assign “learning modules” to patients to help patients learn information or tasks related to their specific disease. Based on the information the team obtained from interviews and observations, HeartCare Channel could significantly increase the accessibility of resources, making it less likely that patients will have educational concerns at the 7-day phone call or throughout the gap between discharge and their follow-up appointment.

**Communicate Roles and Responsibilities Document**

While many of the stroke center and rehabilitation personnel are frustrated when the discharge process does not move as quickly as they expect, few have knowledge of the overall process and focus only on their roles. The lack of process knowledge in combination with the communication difficulties between units and frequent handoffs can cause frustration and slow downs. In order to combat this the team recommends sharing the flowchart created with those involved. By
reviewing the process on a more aggregate level they can see the need for standardization of their role and communications and have realistic expectation of others. For instance, when 4A staff fail to update MiChart appropriately those in other roles fail to be notified on time. Just looking at their role it may not seem necessary since they can verbally communicate with many care providers, but then are frustrated when admissions take a long time. Additionally, it is recommended that checklists are kept to maintain high quality throughout discharge. Allowing insight into other’s roles can help everyone adjust their communication.

**Conduct Full Six Sigma Analysis**

In line with the findings from the literature search conducted, the team recommends that in the long-run, a full six sigma analysis would be helpful in providing quantitative improvements in the discharge process, once the current discharge process is standardized. Ideally significant improvements in discharge timings would result, as they did at the American University of Beirut Medical Center.

**EXPECTED IMPACT**

The team believes the recommendations will be able to improve the efficiency and reliability of the discharge process. Specifically, the recommendations will result in:

- Improved communication between the hospital team and patients
- Less rework and redundancies
- Streamline patient transition from Unit 4A to the IRF
- Improve the data collection process
- Improve the staff’s understanding of the process and its stakeholders
- Enable future process monitoring and analysis
REFERENCES


Appendix A: Interview Questions

- **Introduction**
  - What is your role within the stroke center
  - What interactions do you have with patients?
- **Go over your role in process (draw out a flowchart with them)**
  - Go Step By Step through their role
  - Get Time frame for each step
- **Go over current state process map**
  - What steps are missing?
    - What are your roles in these steps?
  - Is there anything that is not accurately reflected?
  - What notes do you have on current process steps?
- **What are potential improvements you would make to the current process?**
  - What are significant bottlenecks to patient care?
- **How do you know that a patient is going to be discharged? (alternatively) how do you know you have something to do?**
- **If alerted via EMR/MiChart/pager, ask to see what that looks like. Observe the number of clicks/screens needed to get there.**
- **When you are notified/alerted/emailed/told that a patient is being discharged, what is the first thing you do?**
- **When do you do this task? Immediately upon notification, when you find time, after a “batch” is ready to be worked on, around 2pm because….?**
- **What do you need in order to do this task? A computer, a phone, access to MiChart/patient’s record, a printer?**
  - If via EMR/MiChart, ask to see what that looks like.
  - If a supply or equipment is needed and it’s stored somewhere, ask where this is kept and go see (observe if this place seems “far”)
- **Where do you do this work? A personal office, shared space, at the patient’s bedside?**
- **What happens if there are issues?**
- **When is this task considered complete? What happens next?**
- **When do you consider your part complete? Do you hand off to a next person or does the patient/paperwork go into a queue/basket?**
Appendix B: Flowchart

The attached electronic PDF file (Patient Flows.pdf) provides the full size flowcharts for two types of discharge (1) to home with outpatient rehabilitation and (2) to the Inpatient Rehabilitation Facility (IRF). A sample screenshot is included here but, due to size limitations of the chart, please refer to the PDF document for a full resolution version.

Figure B-1: Discharge to Home with Outpatient Therapy Flowchart

Figure B-2: Discharge to IRF Flowchart
Appendix C: Fishbone Diagram
Appendix D: A3 Report and A3 Picture Story

The attached electronic PDF file (StrokeCenter_A3Report+PictureStory.pdf) provides the full size A3 report and A3 Picture Story. A sample screenshot is included here but, due to size limitations of the report, please refer to the PDF document for a full resolution version.

Figure D-1: A3 Report

Figure D-2: A3 Picture Story