LEAN PROCESS IMPROVEMENT AT ST. VINCENT HOSPITAL

A Major Qualifying Project Report:

submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

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Degree of Bachelor of Science by

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Approved:

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Abstract

In this project, the team applied lean process improvement techniques to create recommendations for reducing non-valued added work in the nuclear medicine, transportation, and pharmacy departments at St. Vincent's Hospital in Worcester, MA. The techniques used included process mapping, root cause analysis, and data analysis. The goal was to improve quality and processes, in conjunction with the staff and our sponsor in each department. Implementation of proposed recommendations is expected to create time and costs savings for the departments.

Acknowledgements

Without the support of the staff at St. Vincent Hospital and our advisors, our project would not have been feasible. We would especially like to thank our advisors Sharon Johnson and Kim Walker for guidance, support, and help. We would also like to thank all of the wonderful staff at St. Vincent for allowing us to observe and learn so much from them. In particular we would like to recognize Brian Trinque, Mark Corbin, and Paul Paladino, without whose support we would not have been able to complete our project.

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1. Introduction and Project Goals

St. Vincent was founded 125 years ago by the Sisters of Providence, and served as the Catholic community hospital (Saint Vincent Hospital 2013). The hospital has grown consistently over time, and is now run by Tenet Healthcare Corporation, which continues to promote the importance of community. In 2000 the Hospital moved into a new state of the art building. The new building has allowed for a variety of procedures and departmental growth thus the opportunity to improve patient care and satisfaction. Our sponsor and project leader was Kim Walker, a member of the Kaizen office at St. Vincent.

Lean implementation is fairly new to hospitals, but is quickly growing in popularity. There are hospitals all around the nation such as Virginia Mason, ThedaCare, and Cleveland Clinic, which are offering higher levels of care through lean implementation. Hospitals have always put the patient's quality of care first, which is why implementing lean is the next step in improving patient care.

Our group used the tools of lean to achieve increased patient care in the NucMed and the pharmacy departments at St. Vincent. The first area that the team focused on was patient care and safety. No matter what implementations and improvements were made, patient safety could not be lessened or sacrificed. Another principle was time efficiency, which was either applied to patients getting through the system more quickly or getting an employee's job done faster. The last principle that was considered was elimination of waste. Elimination of waste means taking out inefficiencies in processes, like extra steps or extra supplies. All of these goals were taken into consideration and applied to every aspect of the project and any new problems that arose.

The report is organized as follows. In Chapter 2, lean processing and its place in hospitals is reviewed. Chapter 3 describes the lean methodology, and which principles the team

utilized. Chapter 4 then details the sub-projects completed during our time at St. Vincent. The report concludes with the results of the sub-projects in Chapter 5 and the reflections on the overall project in Chapter 6.

2. Literature Review and Background

The literature review and background section of the paper covers the research done to better understand lean processing. The section gives a general description of lean process improvement and its methods. Three case studies of hospitals using lean process improvement are examined to better understand the place of lean in hospitals of the whole. The methods used at St Vincent are then reviewed before an in depth look at how St Vincent uses those methods.

2.1 Lean Process Improvement

Lean process improvement is a systematic approach that focuses on creating customer value by eliminating wastes from the process. The basic methodology of lean is a cycle of: identifying value, mapping the value stream, creating flow, establishing pull, and seeking perfection (Lean Enterprise Institute 2009). The lean cycle repeats continuously to ensure the constant improvement to the system. Root cause problem solving is a key component to any lean process. The basis of root cause problem solving is to keep asking "why" until the true source of the problem is located (Process Excellence Network 2014). The purpose of asking "why" is to discover the source of the problem rather than treating symptoms. Once the source is found an action plan is made so that the problem never occurs again. Lean is a powerful tool especially when combined with six sigma principles. Lean six sigma is the ability to achieve and maintain high throughput and quality of service (Ultimus Enterprise Solutions 2014). Six sigma also uses a systematic approach to problem solving called DMAIC. DMAIC stands for design, measure, analyze, improve, and control, and is the basis for many six sigma projects (Ultimus Enterprise Solutions 2014).

GEMBA is the practice of going to the place where waste and problems occur (Casewell 1998). It is a Japanese term to find value added activities where they occur. The GEMBA

process begins by asking departments to come up with measurable problems that they have. An example is the number of times that someone forgets to file a document or to record a needed update. Key performance indicators (KPIs) are set by departments and posted on a board for everyone to see (Flinchbaugh n.d.). The board also contains a day by day status that indicates whether the department has met the goals for each problem identified. The problems are also broken up into different types, ranging from quality to financial. If a goal was not met for the day then the reason is also recorded on the board for quality and pattern tracking. Having a board with all of the information on it allows everyone in the department to be on the same page.

Another ingenious aspect of the GEMBA approach is that the department is responsible for the problem and collecting the metrics to solve it. It is the responsibility of the quality department or lean leader to facilitate a problem statement and monitor the boards to ensure that the different departments are staying on task. The way the lean leaders check that the departments are on task is through a GEMBA walk. The walk happens once a day to all the GEMBA boards. The department is responsible for the boards, so they present the status at each location, rather than the person on the walk just checking the metrics themselves for updates.

2.2 Quality in Healthcare

The healthcare system in America has started to move towards a more quality based outlook. The lean approach to business now not only applies to factories, but people related businesses like healthcare. Moving towards lean means keeping the patient as the focus while incorporating quality into care and increasing the information flow throughout the entire hospital system (Committee on Quality of Health Care in America 2001). There are major cost benefits to applying a quality approach to health care. If the hospital is using fewer resources then it can provide the same level of care while saving both the hospital and the patient money (Chmel and

Sloan 1991).If a hospital is also able to save time or even completely remove a process or step it can also increase hospital profit by allowing the doctors to work more efficiently, and thereby allowing doctors and nurses to see and treat more patients a day.

2.3 Case Studies

The next sub-section is the reviews three case studies; ThedaCare, Virginia Mason, and the Cleveland Clinic. For each case the team reviewed the approach toward lean being used and why it was beneficial.

2.3.1 ThedaCare

ThedaCare is a system of health care facilities located in Northeast Wisconsin. They deal with a variety of different treatments and types of patients. Every department is connected by their commitment to leaner healthcare. Their devotion can clearly be seen in their vision statement which says, "Our vision is to transform the healthcare industry to deliver higher value through experiments, collaboration and education that integrates the three interdependent components and spreads learning and accelerates improvement" (Thedacare n.d.)ThedaCare has committed to providing better patient hospital experience through continuous improvement on a company wide scale.

One way that ThedaCare practiced lean implementation was by doing value stream mapping coupled with rapid improvement events (Gerard n.d.). The data from these events allowed ThedaCare to observe locations and real time events that improved patient care while improving efficiency. To a hospital such as ThedaCare value is defined as that which is of value to the patient. Thus when the hospital eliminates waste in the system they are getting rid of anything that is not directly beneficial or value added, to the patient. The result is that ThedaCare is able to remove patients through the system faster, while still giving the best care that

ThedaCare has to offer. One of ThedaCare's most important lessons when teaching their system for lean improvements is that there is no special formula that will work for all healthcare institutions. It is important for all healthcare systems to keep innovating and keep improving until they find the improvements that work best in their individual situation. Once improvements are made to a process it is important to practice continuous improvement, because that enables checking and adjusting of the process. These tools have worked for ThedaCare as well as many other hospitals.

2.3.2 Virginia Mason

Virginia Mason Medical Center is a hospital located in Seattle, Washington. Virginia Mason is known for their application of lean methods using the simple principles as in the Toyota Production System. The overall goal is to improve patient safety and quality, and do so by making improvements across the entire system. Their core philosophy is the hospital with the highest quality is the one that is the safest. Virginia Mason therefore sets its goal to be zero defects. In order to achieve zero defects they have implemented a 'Culture of Safety.' To create a 'Culture of Safety' means to change the way people think, such that defects are not to be expected and are avoidable (Virginia Mason 2013). Virginia Mason creates an atmosphere where incidents that cause or nearly cause harm are reported without fear of negative effects. The focus is on improvements not punishments. The staff has been trained in giving feedback so that substantive improvements can be made, and there are constant checks to improve the culture (Virginia Mason 2013). Virginia Mason strives to find the solution to the problem at the source, and that is the key to a deficit free system. One result of the deficit free system is the enactment of the 'Patient Safety Alerts' (PSA) system (Virginia Mason 2013). When a PSA is called everyone involved stops what they are doing, and a response team is called in to help. The team

reviews the problem, and attempts to resolve the issue to prevent it from being passed on. The end result is a quick solution and fresh eyes to look at the problem. A consequence of the PSA is that it reassures the patient they are receiving quality care. The goal is more PSAs, because more PSAs are more problems that are being solved. Even the patient is seen as being able to contribute and give helpful feedback that improves the system. All so Virginia Mason provides a safe place and quality care for patients.

2.3.3 Cleveland Clinic

The Cleveland Clinic focuses on reestablishing the relationship between Patient safety and clinical care. Cleveland uses various improvement techniques such as lean process improvement, 5S philosophy, and Fastrac© (Cleveland Clinic 2013). The 5S philosophy is about improving the work area to create better employee morale and good first impressions with customers. The 5S's are sort, straighten, shine, standardize, and sustain (American Society for Quality 2004). Fastrac© is a tool designed to use a team approach to solve problems quickly (Cleveland Clinic 2013). By having a variety of methods the Clinic can use the correct tool for the problem in order to create the best space for patient care. When selecting projects the clinic focuses first on the needs of patients and their families. Cleveland wants to know how to improve their experience. Once again the focus is to continuously improve quality of care and patient safety.

2.4 Lean at St. Vincent Hospital

St. Vincent Hospital employs GEMBA in almost all of its departments. The GEMBA walks occur every morning in every department that participates. Most of the major departments, ranging from surgery to maintenance, have a GEMBA board with metrics and goals the department has set up with the help of the Kaizen department. When our group went on a

GEMBA walk with them, we were able to see some of the benefits of using this process. Each department accepted suggestions from the staff and then the department voted on which goals were added to the board. Once problems are on the board, they cannot come down unless the goal metric has been met for thirty straight days. If a department was struggling to meet their goal, they do a 5 why exercise, which is used to get to the root cause of a problem. These exercises are run by the Kaizen office to help the departments determine why they are not reaching success for target goals, and to brainstorm a few actions that they can implement to help them get to their thirty days. The Kaizen department assists if a department is having trouble collecting data and determining the metrics for their problem. If a board loses momentum and the employees no longer buy in, it loses some of its effectiveness. It is important for the employees at St. Vincent to either be reminded of their goals or to make new goals that they care more about and can get behind as a whole.

The Kaizen department also does a GEMBA on the GEMBA process. After every GEMBA walk the Kaizen department fills out their own board on the effectiveness and proficiency of the GEMBA process. Their GEMBA includes topics such as whether they got to every department on time, were the appropriate managers there for the walk, and is there any follow up needed by the Kaizen team to help with the goals set by other departments. The overall GEMBA is an important step in the process because at St. Vincent there are two GEMBA routes carried out by two different groups of people, and the board at the end gives them a chance to catch up and judge how the hospital is doing as a whole and if there are any problems that need to be addressed as a team.

3. Methodology

The methodology section of our paper describes the different steps the group took to achieve our final goal of lean implementation within specific departments at St. Vincent Hospital. The departments that we applied lean methods to were the Nuclear Medicine Department and the Pharmacy Department. For each of these departmental sub-projects, the methods that we used were rapid improvement sheets to understand the goals and the constraints of the projects, observation of the different processes that the group wanted to improved, recommendations to the staff, and implementation of agreed upon recommendations. Our sponsor, Kim Walker, assisted with project selection based on timing and feasibility.

3.1 Rapid Improvement Event Sheets

A Rapid Improvement Event (RIE) sheet is used by all employees at St. Vincent to plan and track projects. The sheet was filled out at the start of each sub-project to help gain an understanding of what it would take to complete each project and what type of goals should be the focus. To fill out the sheet our group first had to decide what goals and benchmarks we wanted to meet to complete our project. Once the goals were decided a timeline was put in place to move the project forward at a timely pace.

3.2 Observation

A majority of each sub-project was spent observing and understanding aspects of the processes in the department studied. The observation time allowed us to develop an understanding of how the department was run. During the observation period data was also collected and used to create a process map. The initial data was used to create goals and metrics. Once the goals were established, a deeper more focused level of observation ensued where evidentiary data was collected to find trends, figure out the level of issues within the department,

and support future recommendations. From the data root cause analysis, using the 5-why technique, was applied to figure out what were the key variables or factors that were causing the problems stated in the rapid improvement sheet. If it was possible root causes were examined with additional metrics to affirm that they were truly the cause of the problems. Additionally, staff was interviewed and consulted throughout the observation period to get insight on additional problems or potential solutions.

3.3 Recommendations

Once the root causes of a problem were found, potential solutions were generated. They were then either tested or presented to the staff. The suggested improvements were provided in two different forms. The first was a power point presentation that went over the both the scope of the problem as well as the suggested improvements. The second method was a report that was delivered to the head of departments. After the recommendations were presented to the relevant heads of department, another meeting was set up with the department staff. From here recommendations were revised to fit within the parameter and scope of what was achievable.

3.4 Implementation

After all recommendations were considered, a few were chosen for implementation. Improvements were chosen based on ability of the group to make or set up a process in the limited time available for the project, as well as items that could actually be directly affected and influenced more heavily by the group rather than the staff. After the department heads approved implementation, additional time was spent in the departments gathering more information and making improvements. A procedure and method was also created for the department to practice continuous improvement even after our group left the hospital. The plan was created to ensure the success of the improvements as well as shift improvements from the team over to the

employees. The recommendations that were not implemented due to time constraints, but were considered positive and feasible changes, will be carried out by the department with the support of the different department heads.

St. Vincent Lean Projects and Results

The following section presents the sub-projects we completed at St. Vincent Hospital. The first sub-project was in Nuclear Medicine (NucMed), where the group worked both alongside the NucMed department as well the transportation department to analyze if a transporter needed to be assigned to the NucMed department on the weekend. The group found several opportunities for improvement in the NucMed process, but adding a transporter assigned to the department on the weekend was not recommended by the team. The second sub-project the group worked on was general efficiency improvement in the pharmacy department. The group focused on three different areas: the code cart, the AcuDose runs, and pharmacy phone calls. The completion of the pharmacy sub-project resulted in a wide variety improvements implemented, with all other recommendations taken under consideration.

4.1 Nuclear Medicine Sub-Project

Nuclear Medicine provides an inexpensive, efficient, and noninvasive way for doctors to gain information about their patient's conditions. The basic process is to use radioactive materials in small amounts that are coded to attach to a certain organ or tissue. After the isotopes are fully dispersed throughout the body multiple images are taken using a special machine. The images are then analyzed by the technician and sent off to the doctors. The NucMed department at St. Vincent works with the transportation department, which moves patients from all different locations all around the hospital to and from NucMed. Specifically they move patients about every half hour to and from the NucMed department. The team was tasked with observing the process during the weekend and finding improvements during the specified time period.

4.1.1 NucMed Background

The first step in the project was to shadow and map the process of NucMed over the weekend. Figure 1 is a visual representation of the entire process from the patients' point of view. Each step will be explained further in the NucMed methodology.

Figure 1: Patient Flow Chart

The Nuclear Medicine testing process starts before the patients arrive. The night before a patient comes, the technicians order isotope capsules. Since the isotopes decay they have to be ordered and approved on a daily basis.

When the first technician comes in for the day he or she is in charge of calibrating the dosage measuring machine and subsequently measuring out the appropriate doses for all patients being seen that day. All of the prep work is done in conjunction with making sure there are enough supplies on hand, such as saline and syringes. The next step is for the technician to turn on all the machines that are going to be used for that day. During setup technicians also do a basic quality check on the equipment. On the weekend the clinic only sees four patients per day, so only one of the machines needs to be turned on, but during the week NucMed receives 20-30 patients per day so all three machines must be calibrated. Once everything is in place and ready, the patients are called down using the Teletracker system. Teletracker is the transportation information system that the hospital uses to signal that patients or goods need to be picked up from different locations.

On the weekend the first patient is called down at 8:00 am, and the second thirty minutes later. The 30-minute staggering is used, because after administration, the isotope needs 30

minutes to spread before the patient can be scanned. The scan takes 20 minutes so a technician working alone can administer an isotope and care for a patient, put the first patient in the scanner and at the same time administer the isotopes to the next patient waiting.

The results from the scan take between 5 to 10 minutes to process, so patients can be efficiently scanned and replaced with the next patient. While the second patient is getting a scan, the first is picked up to do a physical stress test in another room or sent back to their room for an hour and a half. Patients need to receive two scans, so the effects of the isotopes in the system can be measured over time. A second picture is taken after a longer time period has passed.

A large portion of the technicians' time is spent monitoring the patient. Patients generally do not get left alone, so even though the patient is lying on a bed or in the scanner the technician is responsible for their welfare. Technicians may have twenty to thirty minutes of non-productive time waiting for isotopes to take effect, a scan to complete, or a transporter to arrive.

The system runs smoothly except when the patients refuse treatment, or take a while to be picked up or dropped off. Certain types of scans have longer isotope reaction times. For instance bone scans take twenty four hours for the isotopes to be effective, so that patient would be allowed to go home. The patient would not need a transport to wheel them in or out and both scans would be taken at once instead of staggered.

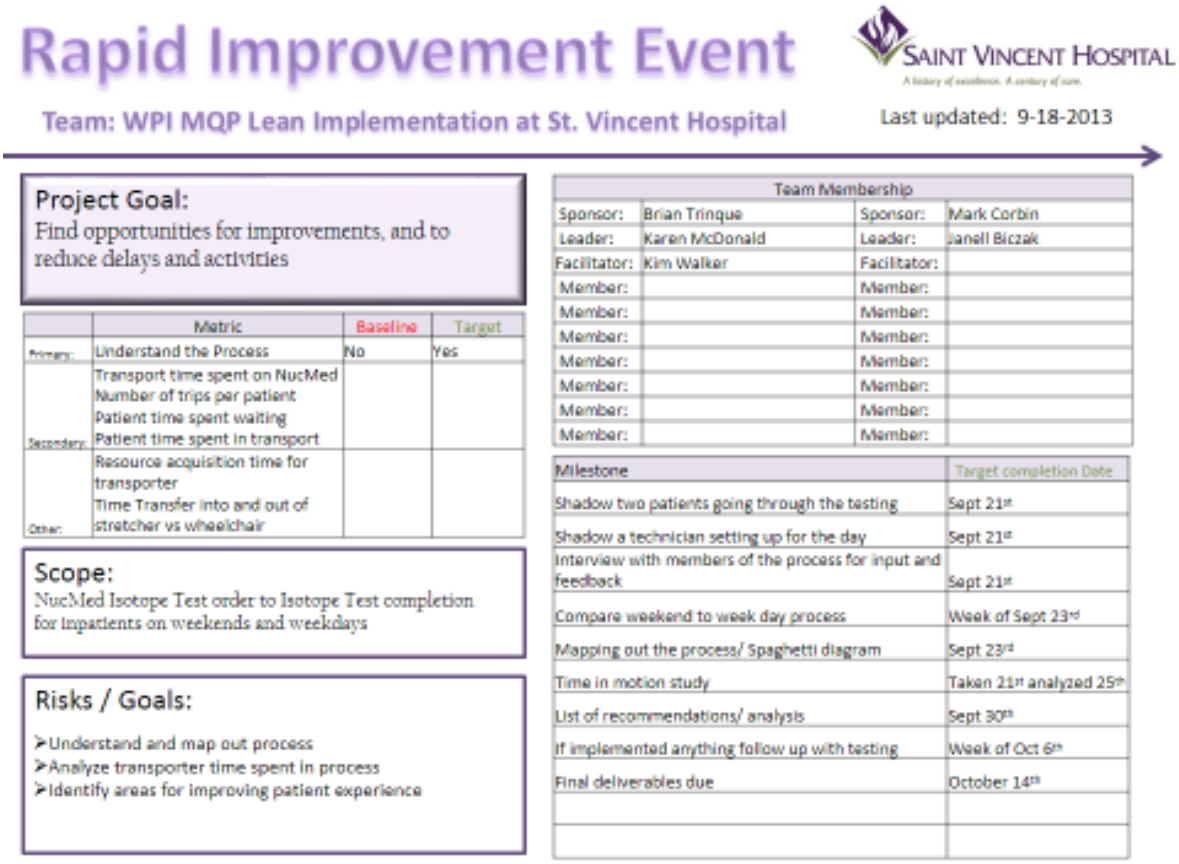
The process also should be looked at from the transporter point of view. A patient is called and entered into the Teletracker first thing in the morning and in the midafternoon, once for each scan. Patient urgency is rated as the second lowest in hospital activities, so the order is only filled when there are almost no other jobs waiting for transport. It takes fifteen minutes once the call is accepted to get the patient ready and down to NucMed. If it is busy or during the change of shift at 3pm, it can take up to an hour to pick up or drop off low urgency patients.

Once a patient is dropped off, the transporter needs to come back for that same patient in an hour. Due to the fact there are almost always two patients in NucMed, the transporter is called to pick up or drop off a patient approximately every thirty minutes on the weekend. On weekdays, the number increases dramatically since the number of patients jumps from four to twenty one. Even if a transporter does not need to be dedicated to NucMed on the weekend, it would be very beneficial on the weekday.

4.1.2 NucMed Overall Goals and Methodology

The RIE for the NucMed Project, shown in Figure 2, was created to refine the goals and metrics for the project. The overall project goal was to find opportunities for improvements in the transportation process and to reduce delays and activates. The secondary goals were based on the metrics that were most important in determining if the process is efficient or not. The four secondary goals were: transport time spent on NucMed, number of trips per patient, patient time spent waiting, and patient time spent in transport. These goals line up with what the hospital is most concerned about, which is patient safety and experience. Patients should get where they need to go without wasting their time and causing them undue discomfort with multiple unnecessary trips to and from NucMed.

Benchmarks were set up to aid in accomplishing our main objectives. Since we were mostly concerned with process, our methodology focused on observation and information gathering. The group talked to technicians and observed both the NucMed isotope testing process as well as joined a transporter to familiarize ourselves with the transportation schedule and routes. The last step of our methodology was to analyze the data in order to determine if there improvements that could be made.



Rapid Improvement Event

SAINT VINCENT HOSPITAL

Team: WPI MQP Lean Implementation at St. Vincent Hospital

Last updated: 9-18-2013

Project Goal:
Find opportunities for improvements, and to reduce delays and activities

	Metric	Baseline	Target
Primary:	Understand the Process	No	Yes
Secondary:	Transport time spent on NucMed Number of trips per patient Patient time spent waiting Patient time spent in transport		
Other:	Resource acquisition time for transporter Time Transfer into and out of stretcher vs wheelchair		

Scope:
NucMed Isotope Test order to Isotope Test completion for inpatients on weekends and weekdays

Risks / Goals:
- Understand and map out process
- Analyze transporter time spent in process
- Identify areas for improving patient experience

Team Membership			
Sponsor:	Brian Trinque	Sponsor:	Mark Corbin
Leader:	Karen McDonald	Leader:	Janell Biczak
Facilitator:	Kim Walker	Facilitator:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
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Milestone	Target completion Date
Shadow two patients going through the testing	Sept 21st
Shadow a technician setting up for the day	Sept 21st
Interview with members of the process for input and feedback	Sept 21st
Compare weekend to week day process	Week of Sept 23rd
Mapping out the process/ Spaghetti diagram	Sept 23rd
Time in motion study	Taken 21st analyzed 25th
List of recommendations/ analysis	Sept 30th
If implemented anything follow up with testing	Week of Oct 6th
Final deliverables due	October 14th

Figure 2: Rapid Improvement Tracking Sheet for NucMed

4.1.3 Process Mapping

From our observations we conducted time and motion studies on both patients and technician process steps. The study showed how the technician and patients time was being utilized over the course of the day, shown in Figure 3 and Figure 4. Once we had a complete picture of the process, we were able differentiate how much time was value-added for a patient and how much was non value-added. What we found is that a majority of the time is spent monitoring patients either while they are waiting for the isotopes to take effect, or while the scan is in process.

Nuclear Med	7:20	7:25	7:30	7:35	7:40	7:45	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00
Pierre		1P Called	Calibrated Machines and measured Isotopes			2P Called			1P Isotope				2P Isotope				1P Scan		3P and 4P Called and Trans for 1P		
1P								Arrived	Isotope Administerd								Start Scan				Scan Complete
2P												Arrived	Isotope Administered								
3P																					
4P																					

Sat 1	7:20	7:25	7:30	7:35	7:40	7:45	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00
Pierre						1P Isotope								1P Scan							
1P			Arrived			Isotope Administered								Start Scan				Scan Complete			

Figure 3: Process Map of the NucMed Testing Process

Time	7:20	7:25	7:30	7:35	7:40	7:45	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00
Utilization																					
Pierre																					
1P																					
2P																					
3P																					
4P																					

Key			
	Time spent with Patient or With TeleTracker		Patient Receiving 1 on 1 care
	Monitoring Patients		Waiting for Isotopes to become effective or Scan to complete
	Waiting without Patient		Waiting uncessarily
	Break		

Figure 4: NucMed Time Utilization on the Weekend

We also observed the transporters during a weekend to examine their level of utilization. Figures 5 through 8 show the transporter activity in the form of a timeline. The purpose of these timelines is to show when tasks are started and the time necessary to reach the next task. Figure 5 shows the beginning of the day before appointments have begun. The transporters spend the early hours preparing the Emergency Department for the rest for the day by staging stretchers in an easy access hallway. Figures 6 through 8 begin with the downtime that exists between most weekend jobs. In Figure 6 the transport was for a specific test where the transporter waits and then returns the patient to their room. These timelines helped to provide a clear view of the time between tasks and created a clear visual representation of the transported tasks that are going on in NucMed, which are caused out with conjunction to the other transport tasks.

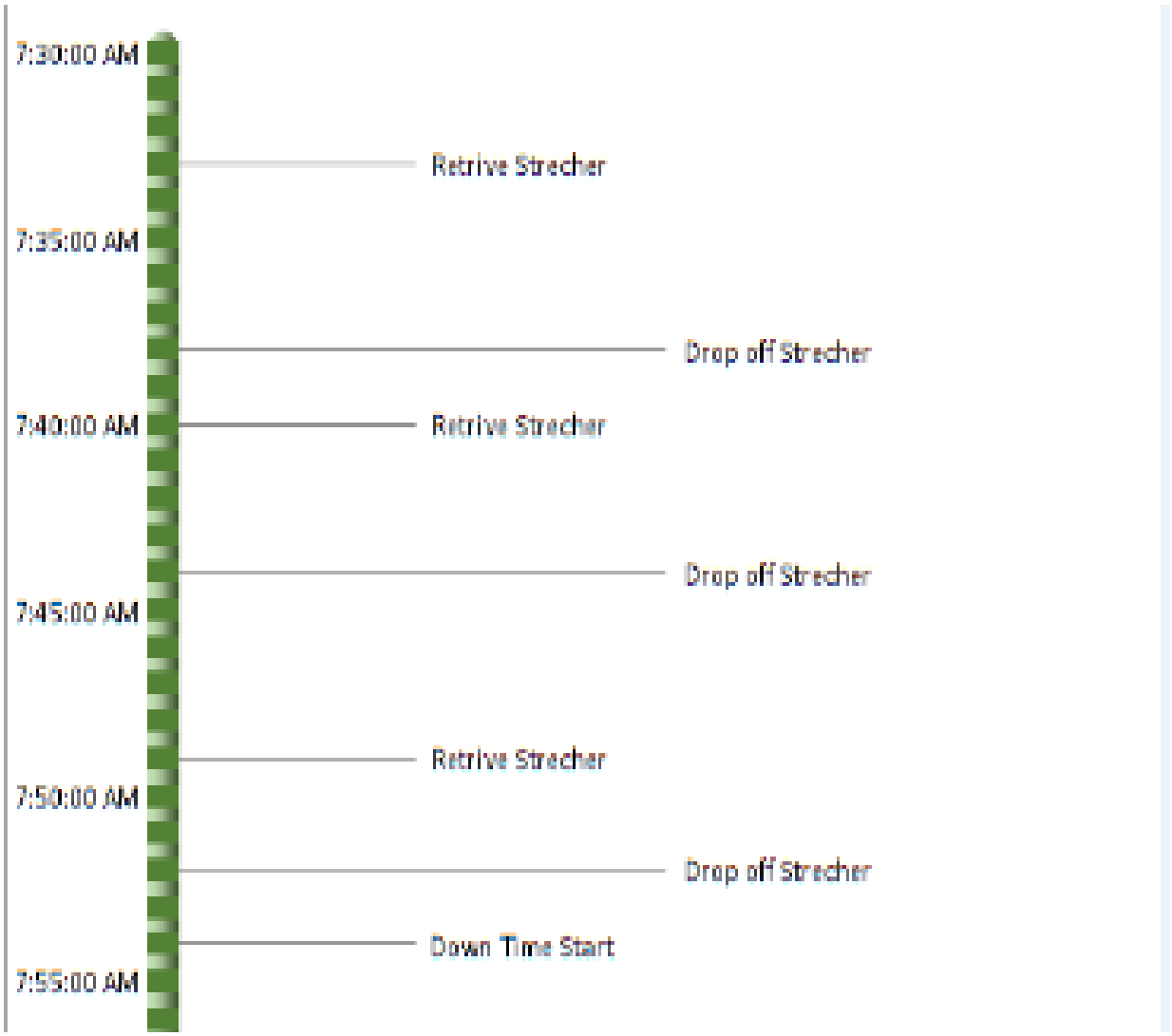


Figure 5: Patient One Transportation

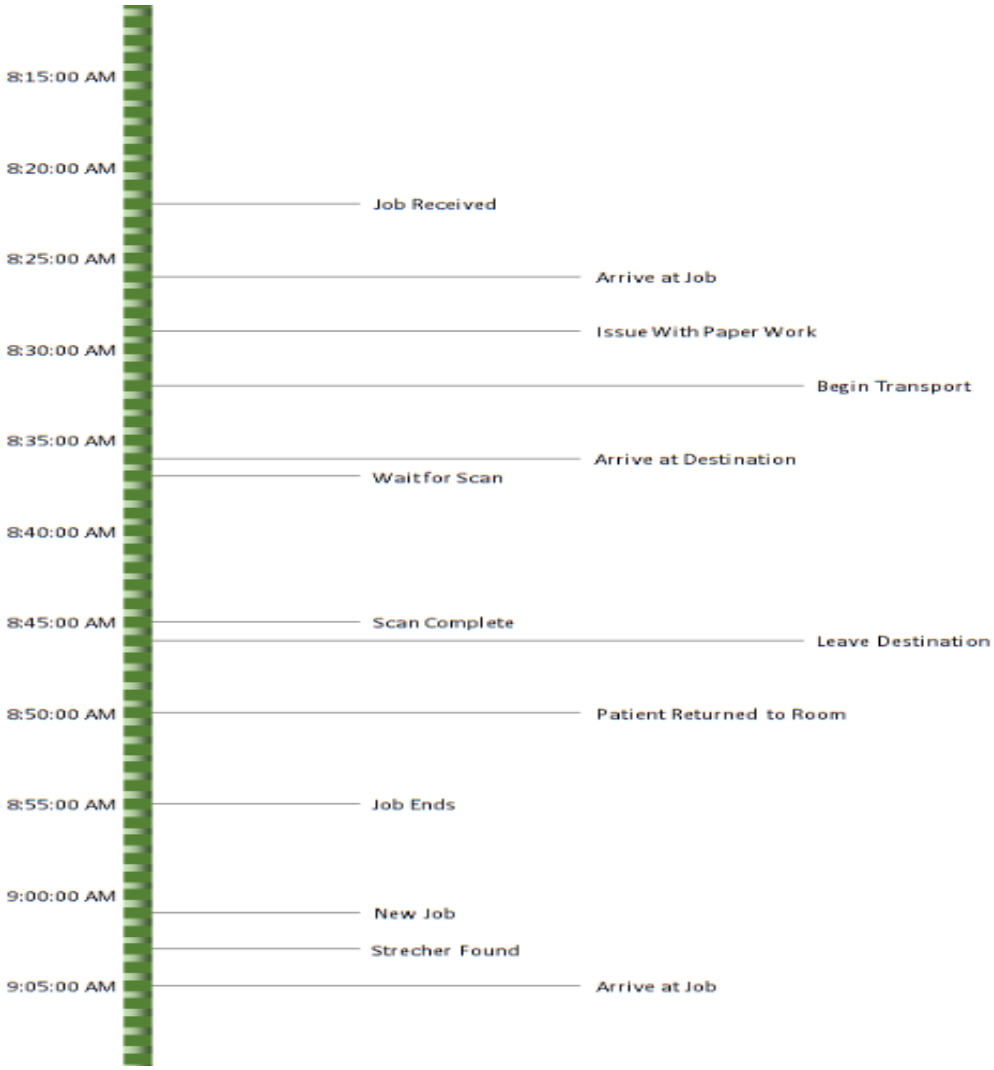


Figure 6: Patient Two Transportation

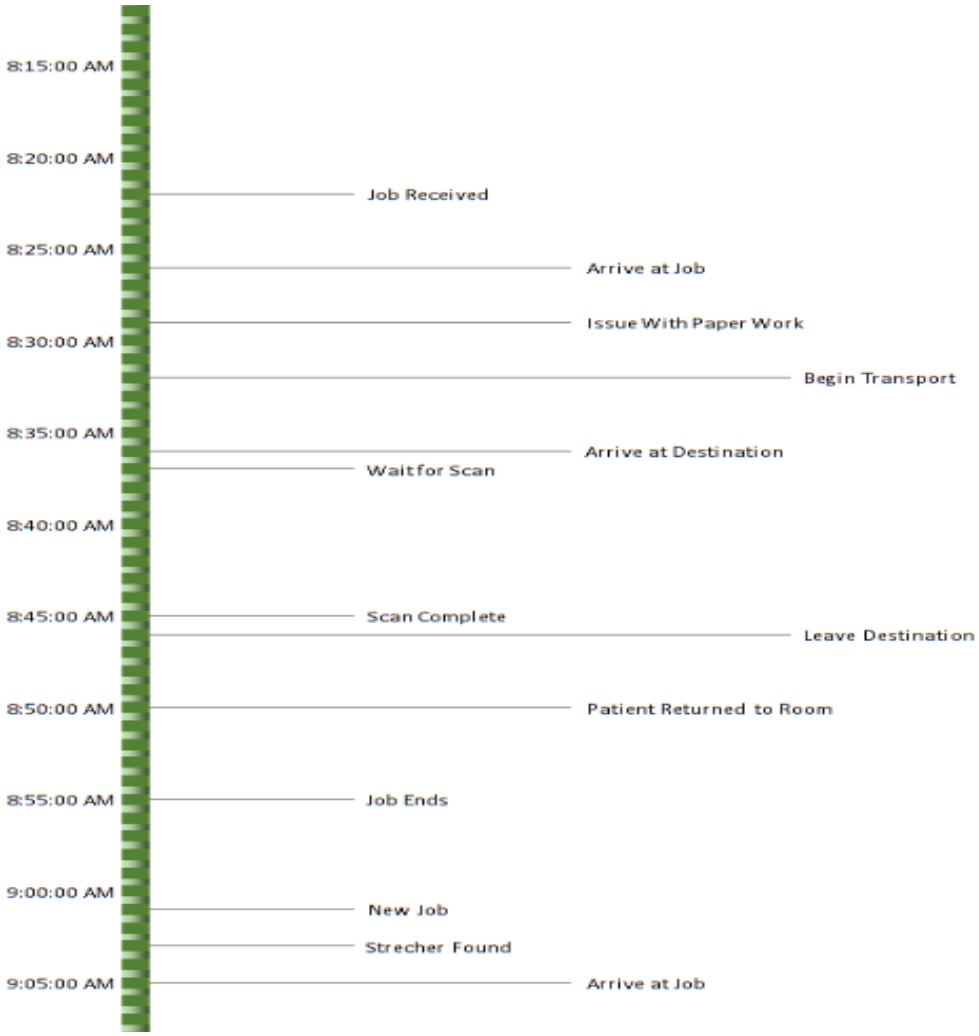


Figure 7: Patient Three Transportation

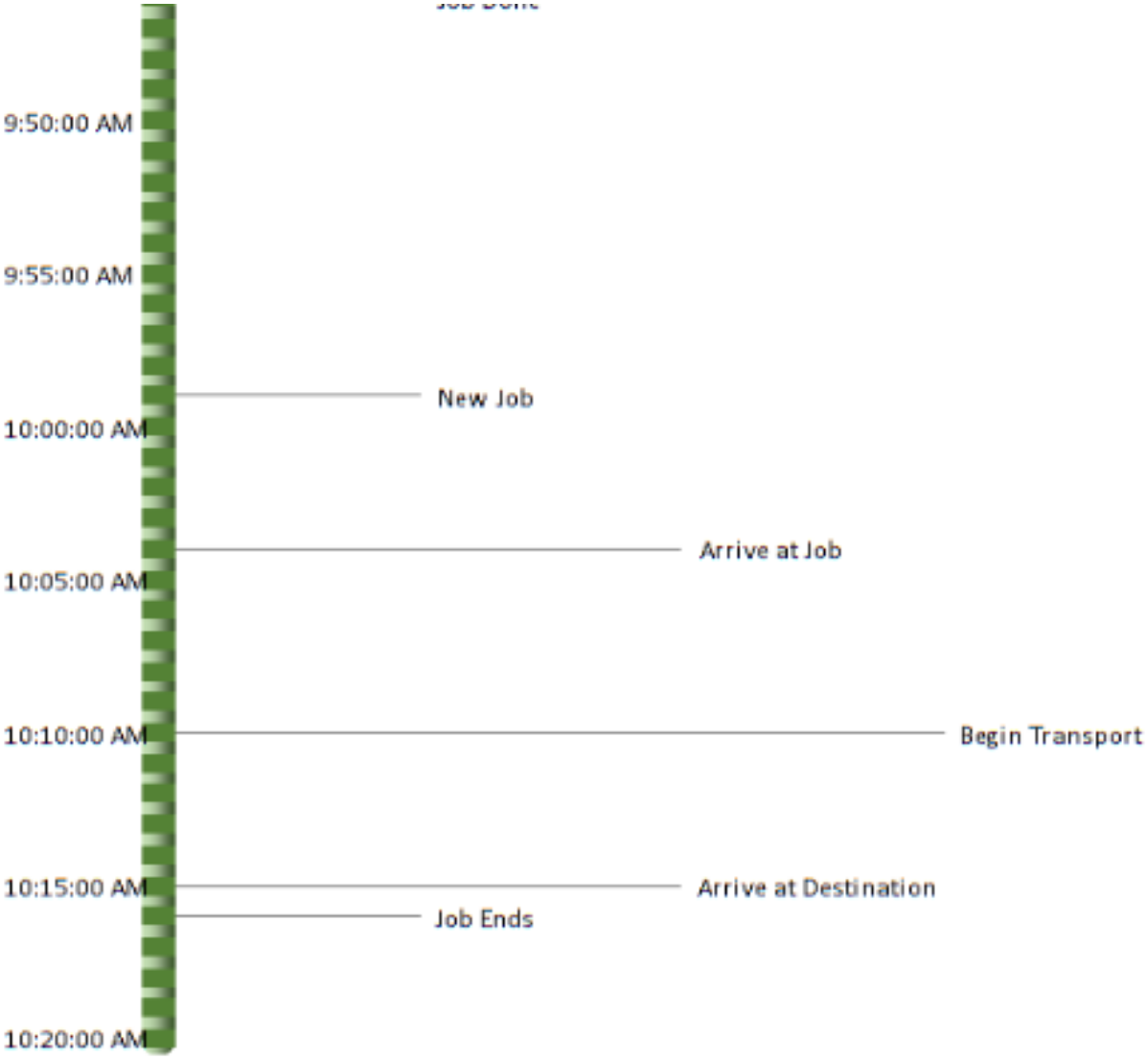


Figure 8: Patient Four Transportation

Figure 9 represents the time utilization by a transport, based on shadowing one of the transports on the weekend. The down time represents time spent waiting for a call to come in. The transporter spends their time in the break room or monitoring the floors that might need a transport. The blue sections of Figure 9 represent the time that the transporter spends after the call, and is then waiting outside the patients' room. A majority of the waiting is related to the nurse on duty preparing the patient for transport. The transporter is not qualified to help the patient, so when they arrive at the wing the transporter must find the nurse who is in charge of the particular patient. Part of the project was also looking at the amount of down time the transporters had on the weekend versus a weekday to see if transport could spare a transporter in the NucMed department. The data collected on time utilization can be seen in Figure 10: Saturday vs. Thursday Transporter Utilization and Figure 11: Weekday Transportation Utilization. These two figure hi-light the increased utilization of transporters both on weekdays and towards the end of the day.

Another part of the transporter's duty is to get the patient chart ready. It is important that these charts are only handled by the transporters. The transporters take full responsibility for the information on the chart, and incorrect information can cause rework. While observing the process firsthand the importance of the transporter preparing the chart was addressed by the transporter. The transporter explained that if there is a chart mix up it could cause safety issues for patients. The transporters always double check to ensure that the correct chart is filled out and with the correct patient before leaving any location.

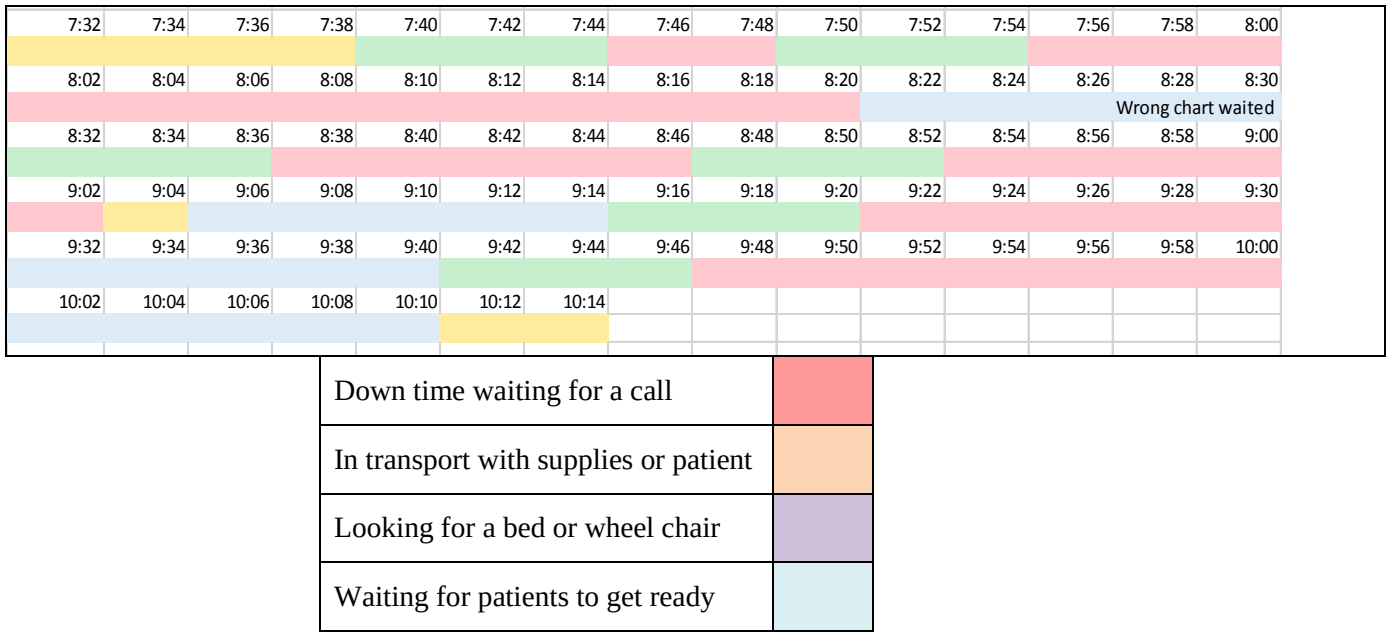


Figure 9: Transporter Utilization on the Weekend

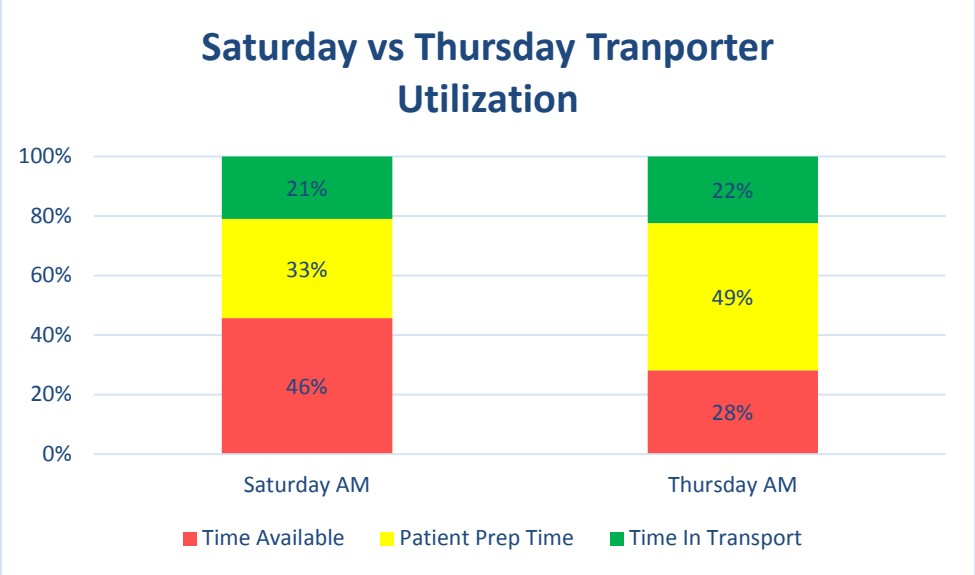


Figure 10: Saturday vs. Thursday Transporter Utilization

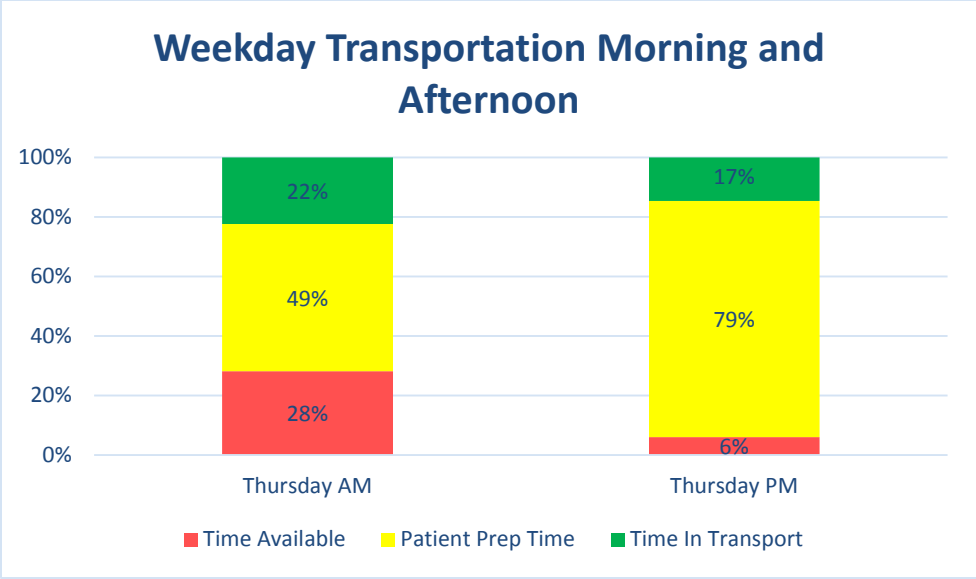


Figure 11: Weekday Transportation Utilization

4.1.4 Results

Based on the data collected NucMed, the team generated the following recommendations. Stretchers should be used for transporting patients to NucMed. A stretcher provides patient comfort while isotopes are being absorbed, not all patients could use a wheelchair, and wheelchairs are not as readily available as stretchers. NucMed would benefit from upgrading the third machine to be able to do cardiac tests. NucMed would also benefit from having one person dedicated to watching patients. Ideally the person would be a technician, so they are able to administer isotopes while the other technicians focus on scanning.

Transportation could potentially improve transportation wait time and worker utilization through implementing the following recommendations. To help with the increase in work at shift change, one or two transporters would arrive for a shift between 2:00pm and 4:00pm. Another option would be to have the shifts overlap an hour, so that the morning shift ends at 3:00pm and the evening shift begins at 2:00pm. The extra workforce at that time would lessen the transportation backlog that routinely occurs at 3:00pm, as seen in Figure 11: Weekday

Transportation Utilization. An improvement involving NucMed and Transportation specifically would be if a transporter was assigned to NucMed during the week and not the weekend.

4.1.5 NucMed Implementation Chart

The group presented the results in Table 1: NucMed Recommendations to both the NucMed and Transportation department. Some of the recommendations were implemented, while the rest of the recommendations were either taken into advisement or not feasible. Table 1: NucMed Recommendations also summarizes the results.

Table 1: NucMed Recommendations

Recommendation	Summary	Result
Upgrade testing machine	All machines in NucMed can perform the cardiac test	The NucMed Department has ordered a new machine
One person in charge of watching patients	Patients need to be monitored at all times, the best choice is a Technician so they can also administer isotopes	Not possible because of personnel constraints
Stretchers used for all patients	For patient comfort and safety stretchers should be used over wheelchairs	Transporters are only using stretchers to transport patients to NucMed
Have 1-2 transporters come in early	Helps to alleviate shift changes happening at peak times	Not possible because of personnel constraints
Assign a transporter to NucMed during the week	There is enough traffic in NucMed to warrant a transporter during the week	Not possible because of personnel constraints

4.2 Pharmacy Sub-Project

St. Vincent Hospital's Pharmacy Department strives to give the best care to patients, and accomplishes the goal by ensuring the proper medicine is available when the patient needs it. The pharmacy sub-project was used to examined three areas for potential improvement; the code cart, the AcuDose System, and the pharmacists verifying orders.

4.2.1 Overall Goals

The overall goal of the sub-project was to increase the efficiency of the Pharmacy. The methods for achieving the goal were observing the Pharmacy's operations, data collection, and identifying areas for improvement. The final steps of the project were to present recommendations for improvements and to set up a basis to implement recommendations.

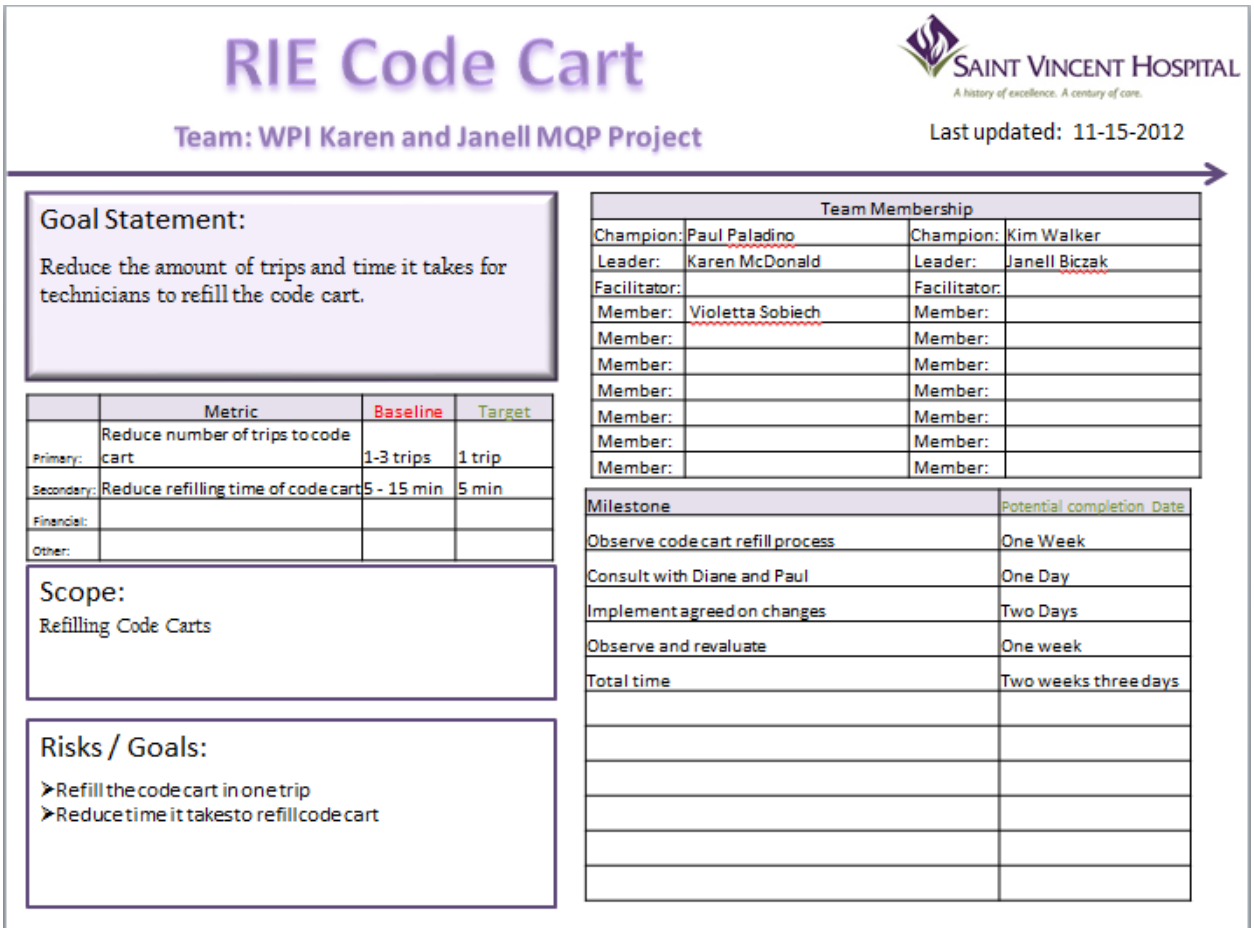
4.2.2 Code Cart

The code cart is the emergency supply of medication and supplies used when a patient crashes unexpectedly. The cart is checked periodically for expired medications and supplies. When supplies are used, it is the Pharmacy's job to refill the cart. The cart is taken from the emergency department, filled in the pharmacy and then returned fully stocked.

4.2.2a Goals

The goals for the code cart project were reducing the number of trips and time taken for technicians to refill the code cart. In order to complete these goals the group considered two different metrics. The first metric was the number of trips that the technician takes to refill the used medications in the code cart. The second was reducing the total time it takes to complete the whole process. To complete these goals the group observed the code cart process and looked for improvements. Next steps the team presented analysis and suggestions to the department heads

to decide on and implement improvements. The final step was to observe the effectiveness of the improvements and reevaluate to see if the improvements worked or if new improvements needed to be made. Our group laid out these steps and the complete plan below in Figure 12: RIE for the Code Cart.



RIE Code Cart

SAINT VINCENT HOSPITAL
A history of excellence. A century of care.

Team: WPI Karen and Janell MQP Project

Last updated: 11-15-2012

Goal Statement:

Reduce the amount of trips and time it takes for technicians to refill the code cart.

	Metric	Baseline	Target
Primary:	Reduce number of trips to code cart	1-3 trips	1 trip
Secondary:	Reduce refilling time of code cart	5 - 15 min	5 min
Financial:			
Other:			

Scope:

Refilling Code Carts

Risks / Goals:

- Refill the code cart in one trip
- Reduce time it takes to refill code cart

Team Membership			
Champion:	Paul Paladino	Champion:	Kim Walker
Leader:	Karen McDonald	Leader:	Janell Biczak
Facilitator:		Facilitator:	
Member:	Violetta Sobiech	Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	

Milestone	Potential completion Date
Observe code cart refill process	One Week
Consult with Diane and Paul	One Day
Implement agreed on changes	Two Days
Observe and revaluate	One week
Total time	Two weeks three days

Figure 12: RIE for the Code Cart

4.2.2b Process

The process for the code cart has four steps. The first step is for the technician to retrieve the code cart from the ambulance center down the hall. Once the cart is retrieved, the technicians open up the cart to see if any of the medications have been used, or if any medications are

expired. If medications have been used the technicians go through the list of medications to determine how many need to be replaced. Those medications are then gathered from the medication room and restocked in the code cart. The medications' expiration dates are recorded and the whole set is bagged up.

4.2.2c Analysis

The third step in the code cart process is to refill any missing medications. Refilling the medications took between one and three trips to gather the necessary medications, based on our four days of observation. These trips are an issue because every additional trip takes up valuable technician time.

4.2.2d Recommendations

Based on our observations one recommendation was that the number of medications that need to be refilled exceeds ten then the technicians should bring along a basket. The technician can then fill the order all at once and only make one trip to the code cart to fill the order.

Another recommendation is to bring the code cart over to the medication area. The change would cut down on the travel time, and because the code cart is on wheels it would not require any extra time and minimal effort for the technicians. The recommendation is limited by the space in the medication area, so there might not always be enough room to refill the code cart in that area.

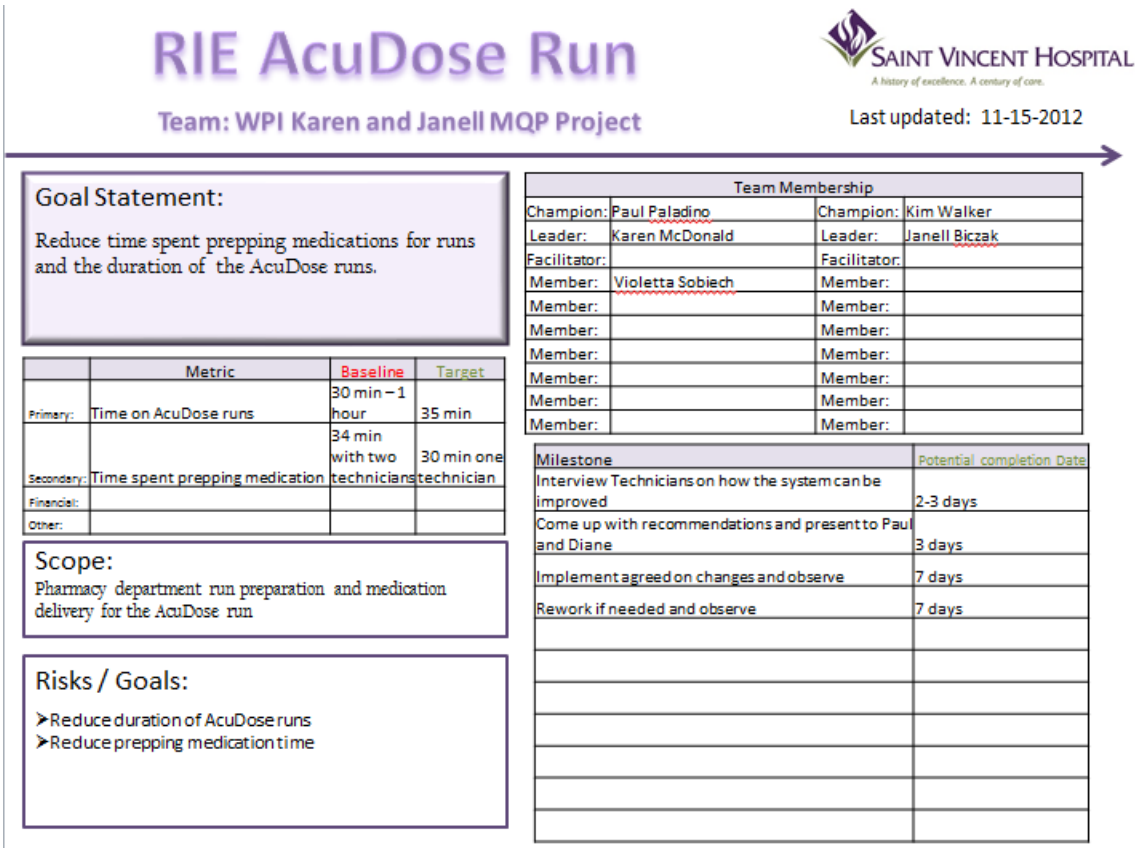
4.2.3 AcuDose Runs

AcuDose is the name of the automated system that dispenses the medications to nurses to deliver to patients. AcuDose runs are rounds that technicians make to deliver medicine to the different departments' systems. The AcuDose system is automated and lets the pharmacy know

when a new medication is prescribed as well as when the medications that are already in the system get low. These runs take place every two hours and last approximately thirty minutes.

4.2.3a Goals

The goals for the AcuDose runs project were reducing the time spent prepping medications for AcuDose runs as well as the total duration of the run. The measured metrics were the time spent prepping and the time spent on the run, which are directly linked to the goals. The first step to complete the goals was interviewing technicians on how they think the process can be improved. The team interviewed ten technicians and pharmacists and got important feedback, as it came from people who know the process and its' difficulties the best. The next step was to develop and organize proposed recommendations and present them to both the head of the Pharmacy as well as the head of technicians. From the meetings, the team determined which suggestions would be implemented. The final step would be to take new metrics and observe if further actions needed to be implemented. The steps are summarized in Figure 13: RIE for AcuDose Runs.



RIE AcuDose Run

Team: WPI Karen and Janell MQP Project

Saint Vincent Hospital
A history of excellence. A century of care.

Last updated: 11-15-2012

Goal Statement:

Reduce time spent prepping medications for runs and the duration of the AcuDose runs.

	Metric	Baseline	Target
Primary:	Time on AcuDose runs	30 min – 1 hour	35 min
Secondary:	Time spent prepping medication	34 min with two technicians	30 min one technician
Financial:			
Other:			

Scope:

Pharmacy department run preparation and medication delivery for the AcuDose run

Risks / Goals:

- Reduce duration of AcuDose runs
- Reduce prepping medication time

Team Membership			
Champion:	Paul Paladino	Champion:	Kim Walker
Leader:	Karen McDonald	Leader:	Janell Biczak
Facilitator:		Facilitator:	
Member:	Violetta Sobiech	Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	

Milestone	Potential completion Date
Interview Technicians on how the system can be improved	2-3 days
Come up with recommendations and present to Paul and Diane	3 days
Implement agreed on changes and observe	7 days
Rework if needed and observe	7 days

Figure 13: RIE for AcuDose Runs

4.2.3b Process Map

A process map for the AcuDose refill system was created in order to better understand the process (Figure 14: AcuDose Process Map). The medication refilling process starts when an order comes from a nurse or doctor to the pharmacy department. The pharmacist verifies in the system that the dosage and medication is correct. If the information is correct two possible actions can occur. One possibility is that the patient needs the medication before the next AcuDose run. When that occurs a medication label is printed to be filled. Once the label is printed the technician picks up the label and takes it to the medication room to be filled. Once filled the technician brings it to the pharmacist to be checked and then sends the medication out via tube.

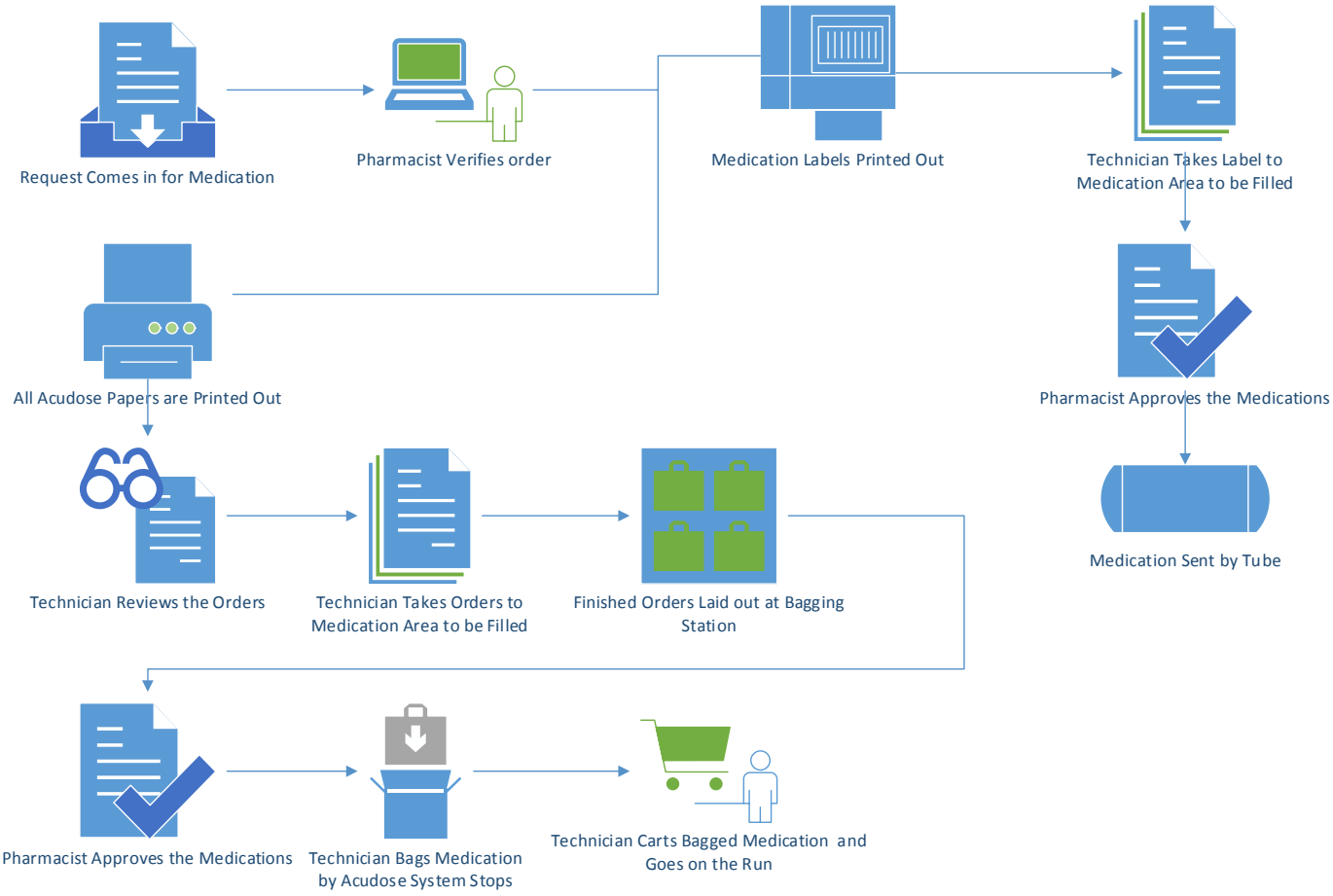


Figure 144: AcuDose Process Map

The second option is that the medication can wait until the AcuDose run. All the medications needed for the next two hours are printed out and organized by the technician. The technician reviews the orders and takes them over to the medication room to be filled. Once all the medications are gathered with their respective orders, they are taken over to the bagging area to be approved. Once a pharmacist comes over and approves the orders, the technician bags the medications by department and loads them in a basket. The technician is then ready to go on the AcuDose run.

4.2.3c Data Collection and Analysis

In the pharmacy sub-project two different forms of data collection were utilized. The first was observational. The team went on AcuDose runs with the technicians to get a baseline for AcuDose run duration. Figure 15: AcuDose Run Times and Figure 16: AcuDose Run Times are examples of the data the team collected. The team noted the number of stops and the amount of time spent refilling medication. The team also noted any special requirements that would cause any deviation from the typical routine of entering medication in the AcuDose system.

The second form of data collection that the group used from system records of tubed medications and phone calls to and from the pharmacy department. The analysis from the data can be seen in Figure 17 through Figure 20. These figures are different charts and graphs that aided in the understanding of what opportunities existed for improvement in the pharmacy department.

Stop	Minutes
1	2
2	1
3	3
4	1
5	1
6	2
7	1
8	1
9	2
10	1
11	1
Total	16 min
Actual Time	30 min

Stop	Minutes	Additional Information
1	2	
2	1	
3	1	
4	1	
5	2	
6	4	clean room needed gown
7	1	
8	2	
9	1	
10	3	clean room needed gown
11	2	
12	1	
13	1	
14	1	
15	1	
16	1	
Total	25	
Actual Time	62	

Figure 15: AcuDose Run Times Day 1

Stops	Minutes		Stops	Minutes	
1	2		1	2	
2	3		2	3	
3	4		3	4	
4	7	Narcotics	4	7	Narcotics
5	2		5	2	
6	3		6	3	
7	8		7	8	
8	6		8	6	
9	5		9	5	
10	3		10	3	
11	5		11	5	
12	3		12	3	
13	2		13	2	
14	4		14	4	
15	2		15	2	
Total	59	New Tech	Total	59	New Tech

Figure 16: AcuDose Run Times Day 2

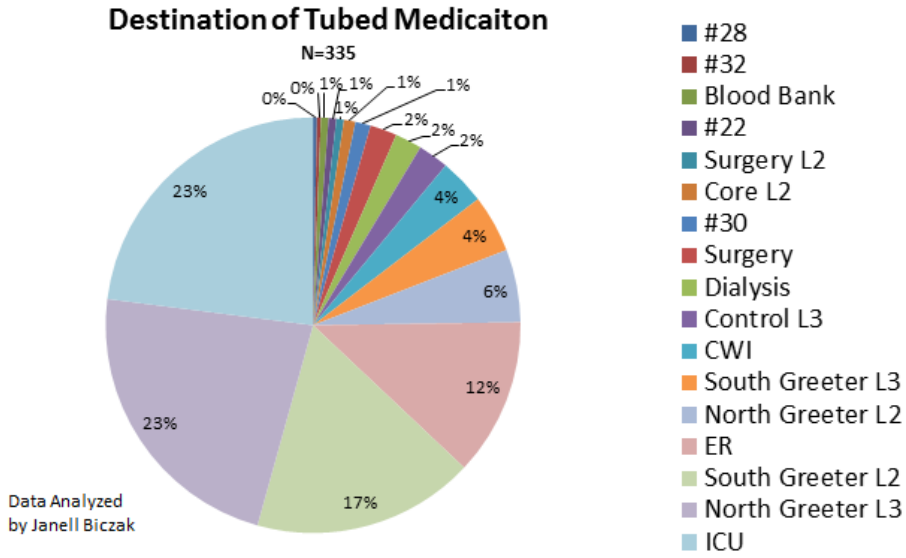


Figure 17: Destination of Tubed Medication

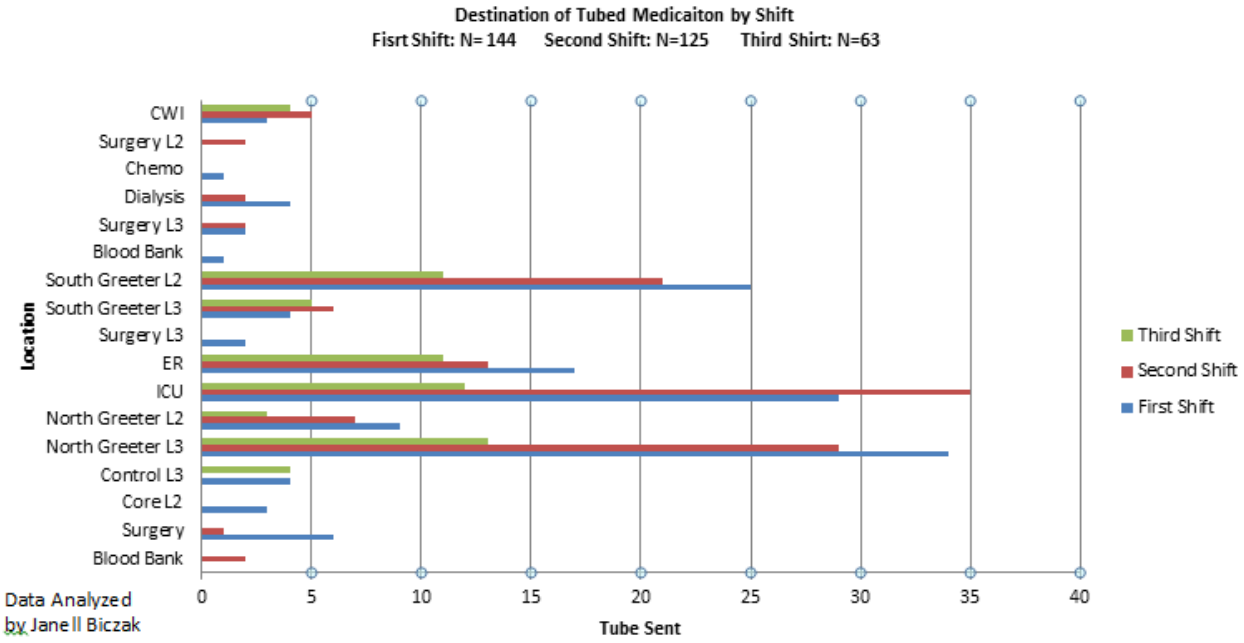


Figure 18: Destination of Tubed Medication by Shift

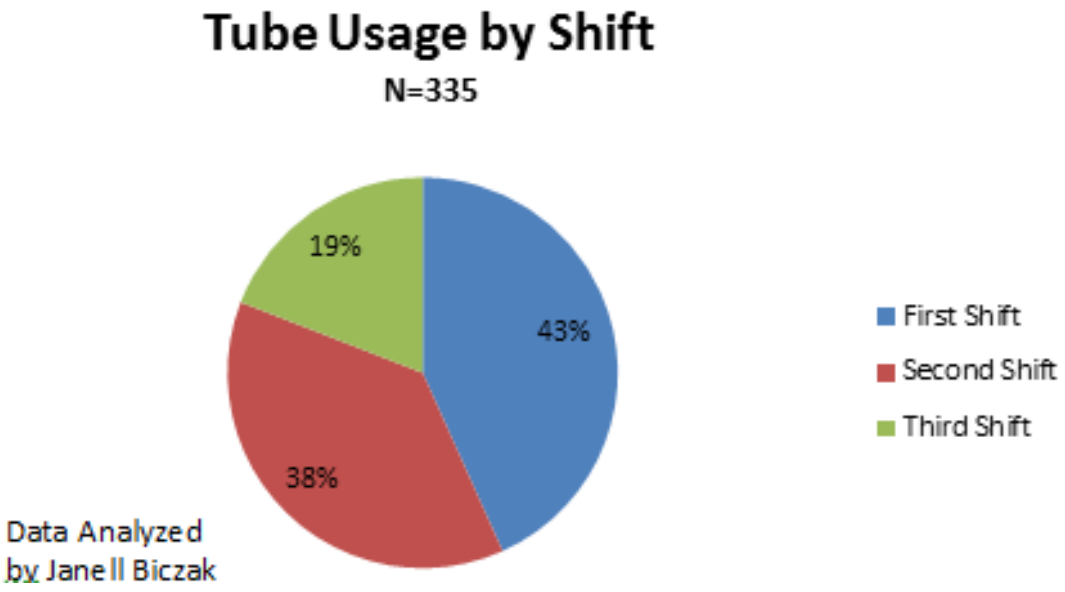


Figure 19: Tube Usage by Shift

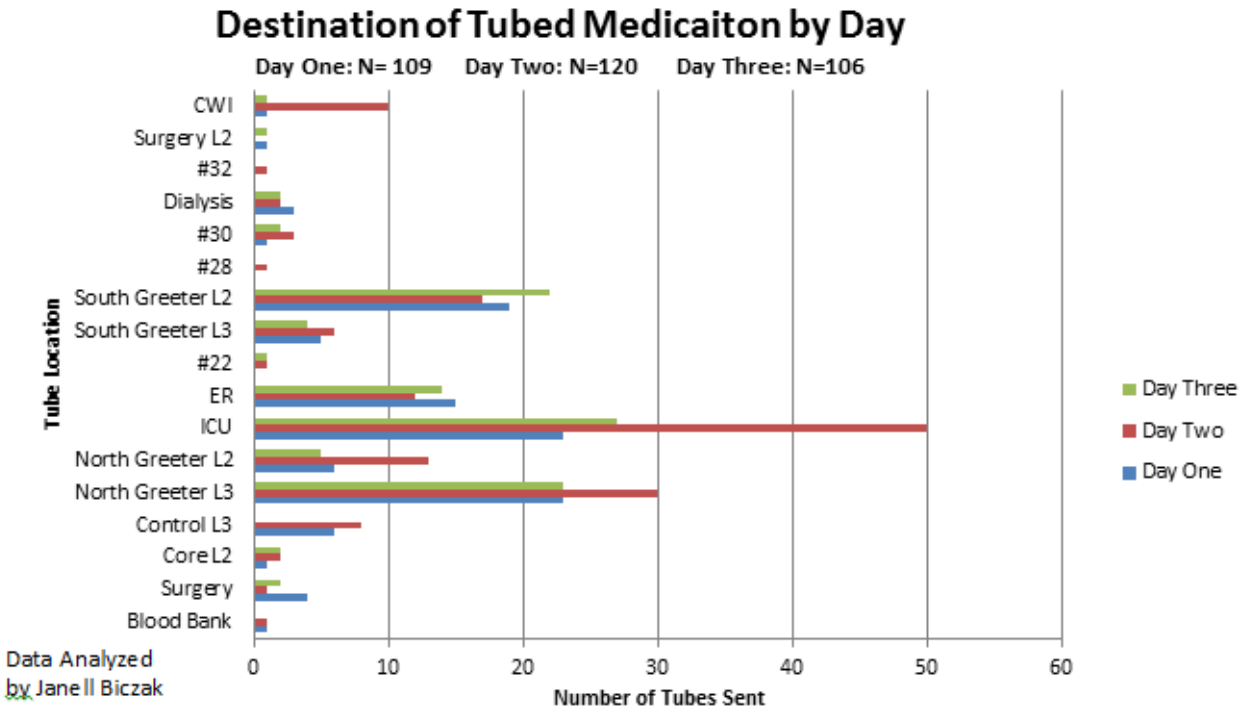


Figure 20: Destination of Tubed Medication of Day

The data shows that the average time on an AcuDose run is 45 minutes for 15 stops; the data the team collected based on a new technician was not used for these calculations. The data also indicates that the time spent in the AcuDose rooms is about half of the total run time shown in Figure 15 and Figure 16. Factors that increased run time are: gown for clean room is needed, an AcuDose needs to be updated, narcotics need to be delivered, and there are an increased number of medications. Most of these causes of increased time are unavoidable, but necessary for delivering medications safely.

The process has room for improvement in the preparation process, the way the runs are performed, and how often the runs go out. The preparation deals with gathering the medicine needed from the orders for the entire run. What was observed was that the preparation actually took longer with two technicians working inefficiently then it did for one working efficiently.

While on the run, technicians who did not have an organizational system for empty bags took longer on the run. The longer times were due to increased search time for the correct bag. Not having an organized system could also lead to errors if the wrong medication was put in the wrong AcuDose system.

Overall there were more runs than needed. Looking at the tube related data there are five locations receiving most of the tubed medication as shown in Figure 17 through 20. The five locations are then a good test of how well the medication is being delivered. There are some locations that need medications more frequently and some that need fewer less frequently. Thus unnecessary stops are being included on all runs, which are resulting in longer run times.

4.2.3d Recommendations

To help speed the preparation time to gather medications, the team recommended that all of the orders be laid out at once on rolling carts by the medication area. Laying the orders out would allow the technicians to keep track of what orders still need to be filled and how many are still left to complete. It would also allow the technician to pull the same medication for multiple orders at once, because they can see all the orders, and can fill the orders by medication instead of by order form. Another simple opportunity to cut down on preparation time is to have technicians open the plastic wrap on medication with a pen, badge, or pair of scissors. It was observed that some technicians struggled with the packaging that the medications came in. Since all technicians have pens and badges on them already, it is an easy step that would save up to forty five seconds for every package opened.

Standardizing how the empty plastic bags are stored in the red baskets on the run would help lower the AcuDose run time. It is estimated that an unorganized technician spends roughly thirty seconds at each stop searching and digging for the correct bag. With fifteen stops that is

roughly eight minutes, and with four runs a day, the time savings come out to over thirty minutes. A suggested standardization would be to place the empty bags all on one side of the basket. Doing so would coincide with the way the baskets are already laid out in order of the run locations. Although it may seem like a small suggestion, it has the potential to lower the run times by 17% and lower the possibility of losing a full bag in the basket or mixing up the order of the bags in the basket.

The run frequency and stops could also be adjusted to include only needed stops in every run. Most runs would be smaller runs focusing on high volume areas. Then fewer runs to the stops would occur. A pharmacist could help to determine when it is important to include another location on the high volume runs. The downside of restructuring the runs is that it would put a higher strain on the pharmacists because they would be the ones deciding when medications should go out and how often. The data behind these decisions could be gleaned from the tubing data, but would have to constantly be analyzed based on which tubes and departments are demanding the most medications at certain times.

4.2.4 Pharmacy Phone Calls

In the pharmacy department there are two types of phone calls. The first type of call is a clinical call; a call only a pharmacist can answer. These calls are typically longer and are based on questions about prescriptions. The second type of call is a non-clinical call. These are calls about status reports and missing medications and can be answered by a technician.

4.2.4a Goals

The goal of the sub-project was to reduce pharmacy phone calls to improve the pharmacist's ability to verify orders. The verification of prescriptions, which is the main responsibility of pharmacists, can be interrupted by nonclinical calls and other distractions. Other

interruption types were also identified, along with the length of the interruptions. Five pharmacists were also interviewed to find out what they consider to be distractions in the work place. A set of recommendations were presented to the department heads to see what would be the best plan for implementation. Any implemented recommendations should be analyzed to see if a positive impact was made. The outline for the plan of the project can be found in the RIE in Figure 21.

Rapid Improvement Event

SAINT VINCENT HOSPITAL
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Team: WPI Karen and Janell MQP Project

Last updated: 11-15-2012

Problem Statement:

The pharmacists are receiving nonclinical calls and are being interrupted from verifying orders.

	Metric	Baseline	Target
Primary:	Number of Nonclinical calls	22	0
Secondary:	Number of interruption Occurrences	10	0
Financial:	Length of interactions		0 minutes
Other:			

Scope:

Pharmacist phone calls

Risks / Goals:

- Reduce nonclinical calls
- Reduce time spent away from verifying orders.

Team Membership			
Sponsor:	Kim Walker	Sponsor:	Paul
Leader:	Diane Charest	Leader:	
Facilitator:	Janell Biczak	Facilitator:	Karen McDonald
Member:	Violetta Sobiech	Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	
Member:		Member:	

Milestone	Target completion Date
Observe Pharmacist	One week
Report findings and recommendationsto Paul and Diane	One Day
Implement changes agreed upon changes	One Week
Observe and evaluate changes	One Week

Figure 21 RIE for the Pharmacy Calls

4.2.4b Process

The process map for the pharmacist order verification process can be seen in Figure 22. The pharmacist spends the majority of their time verifying doctor's prescriptions. It is common for the pharmacist to be working on multiple prescriptions. The pharmacist will start by checking dosage, frequency, and other important factors for accuracy. If the pharmacist notices an issue with the prescription the prescribing doctor will be paged. The issues can vary from missing height and weight data to the dosage appearing to be for the maximum dosage for the given medicine. The pharmacist will continue working on other issues while waiting to receive a call from the doctor. The pharmacist will explain issue and the doctor will either confirm the prescription is correct, or the prescriptions will be corrected and updated with the new information.

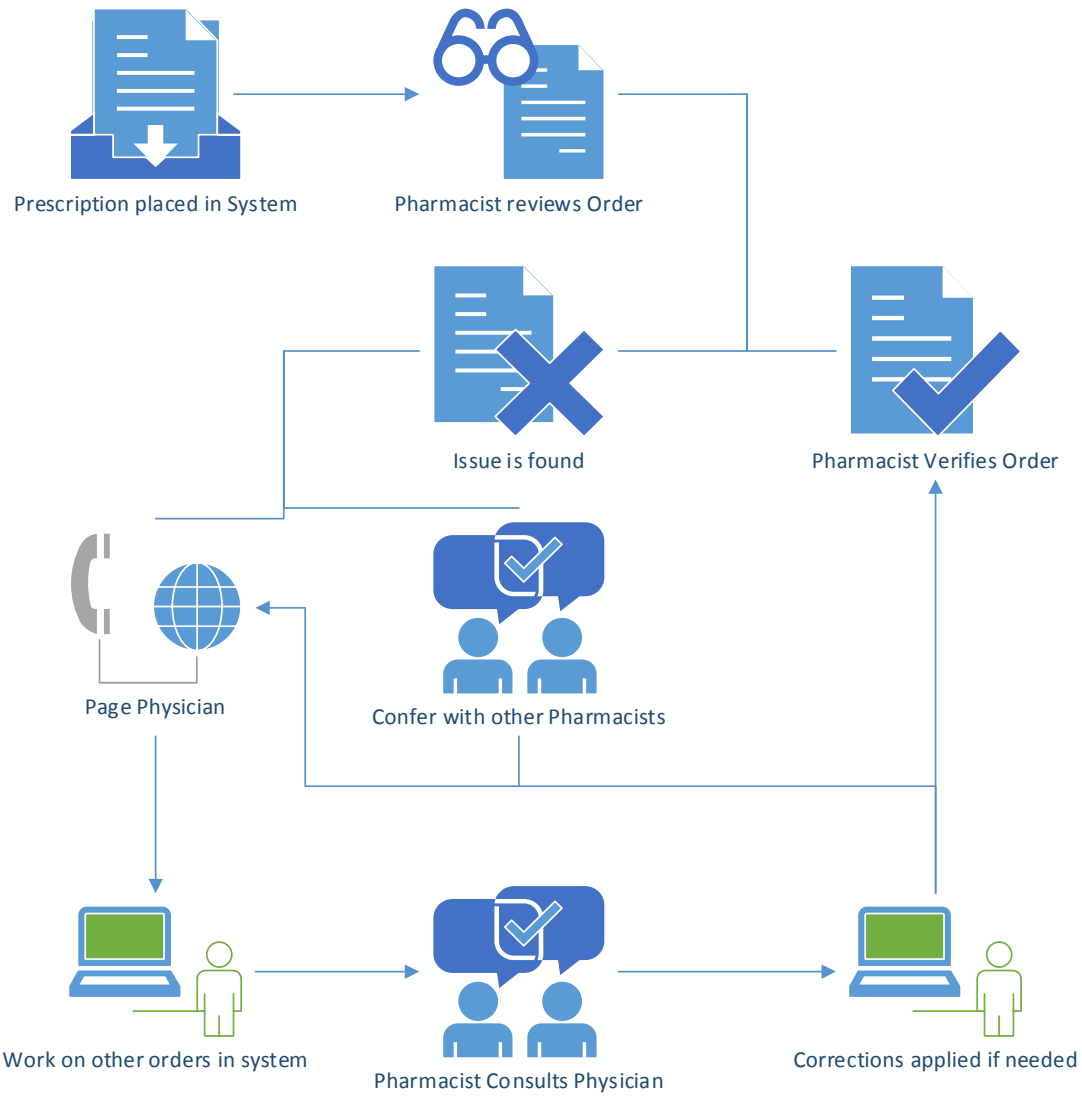

Figure 22: Pharmacist Order Verification Process

Another element to the pharmacy department is the stay at home pharmacists. Their main job function is to verify orders and monitor the system remotely. These pharmacists only verify orders that are fully accurate otherwise the order remains in the system for an in house pharmacist to verify. Stay at home pharmacists only verify accurate orders because they have no method of communication with the in house pharmacists, and therefore can correct or flag any issues.

4.2.4c Analysis

As shown in Figure 25: Number of Incoming Calls and Figure 26: Duration of Phone Call, pharmacists receive a disproportionate number of the phone calls. Fourteen of twenty seven calls on day one and eight of sixteen calls on day 2 are nonclinical. Thus over half of the pharmacist's calls are non-clinical. These nonclinical calls last an average of 42 second, while the clinical calls last an average of 1 minute 53 seconds. Based on the data we analyzed over one shift, non-clinical calls waste 15 minute and 33 seconds of the pharmacists' time over 7 hours, or 3%.

The pharmacists also experience many distractions and interruptions while working. The computers used in the pharmacy can slow down and in order to restore the speed the pharmacist must restart the system. Restarting a computer can take up to 7 minutes. The pharmacists are also interrupted by technicians whenever medication or prescription needs to be verified. What is in need of verification could be anything from a single medication to all the medications for the run. The space the technicians and pharmacists are in also contains enough general noise to make hearing people on phone calls an issue. The noise also prevents some relevant communications, such as when a call is on hold or a medication order is waiting to be filled, from being received. There is also no communication between pharmacists at the hospital with pharmacist working from home.

Day 1	Call Type	Call Length (Sec)	Call on Hold	Page
Call 1	Clinical	47		
Call 2	Clinical	71		
Call 3	Clinical	85		
Call 4	Clinical	166		
Call 5	Clinical	28		
Call 6	Clinical	80		
Call 7	Clinical	54		
Call 8	Non-Clinical	10		
Call 9	Non-Clinical	37		
Call 10	Clinical	53	192	
Call 11	Clinical	289	161	
Call 12	Non-Clinical	40		Page
Call 13	Non-Clinical	34		
Call 14	Non-Clinical	113		Page
Call 15	Clinical	312		
Call 16	Non-Clinical	45		
Call 17	Clinical	98		
Call 18	Non-Clinical	60		
Call 19	Non-Clinical	15		
Call 20	Non-Clinical	102		
Call 21	Non-Clinical	13		
Call 22	Non-Clinical	40		
Call 23	Clinical	259		
Call 24	Clinical	36		
Call 25	Non-Clinical	10		
Call 26	Non-Clinical	33		
Call 27	Non-Clinical	3		

Figure 23: Day 1 - 4 Hours of Observation

Day 2	Call Type	Call Length (Sec)	Page
Call 1	Non-Clinical	47	
Call 2	Non-Clinical	85	
Call 3	Clinical	259	
Call 4	Clinical	125	
Call 5	Non-Clinical	38	
Call 6	Non-Clinical	65	
Call 7	Non-Clinical	9	
Call 8	Clinical	25	Page
Call 9	Clinical	78	
Call 10	Clinical	20	Page
Call 11	Non-Clinical	54	
Call 12	Non-Clinical	20	
Call 13	Clinical	120	
Call 14	Clinical	25	page
Call 15	Non-Clinical	40	
Call 16	Clinical	50	

Figure 24: Day 2-3 Hours of Observation

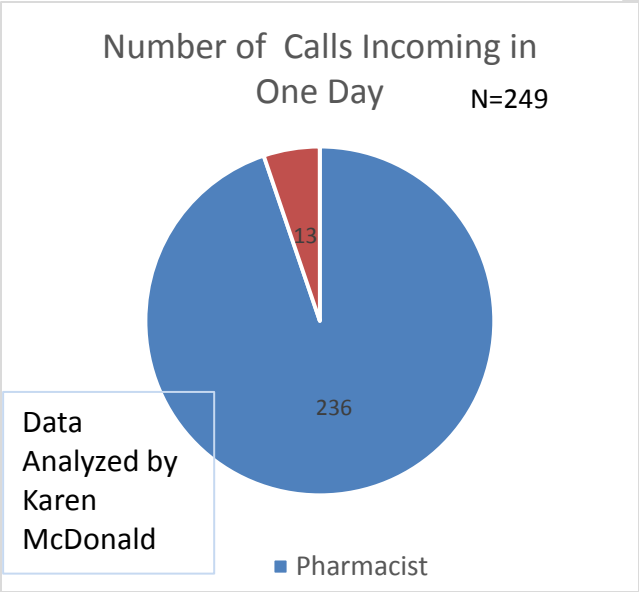

Figure 25: Number of Incoming Calls

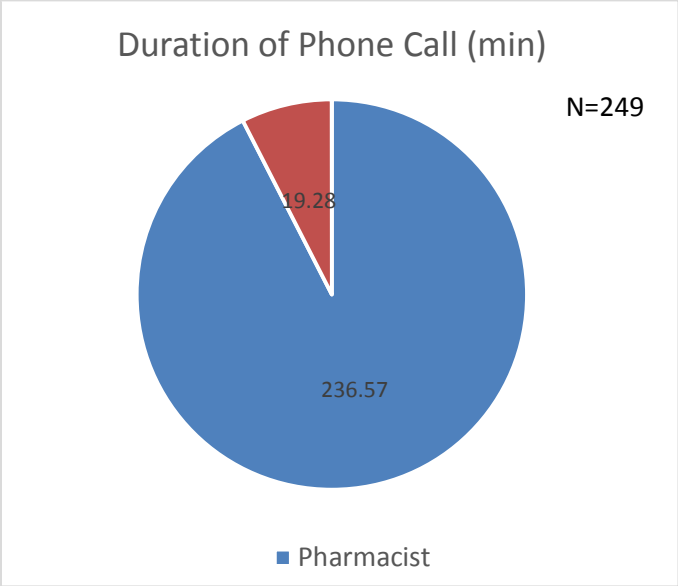

Figure 26: Duration of Phone Call

4.2.4d Recommendations

In order to prevent distractions and interruptions, the project team recommended that one pharmacist be assigned to check and verify the technicians' work. Dedicating a pharmacist to verify the technicians' work allows others to focus on confirming the medication orders in the system. The additional pharmacists can then use a sound barrier or headsets to cut down on the noise in the room and allow them to focus. These pharmacists can then evaluate medications, review the medications, and adjust the time of medications that do not have to be taken immediately so medications can be delivered to patients after the next run instead of needing to be tubed. The pharmacist should also restart their computers at the start of every shift and break to prevent doing so during their work.

There are also opportunities to increase communication. The clean room could have a signal, such as a flag being up, that there is a medication to be processed. Otherwise if the message is missed there is no method that informs the technician of an order waiting to be filled.

Another recommendation is that a technician could have a form to fill out when a call is being transferred to a pharmacist. Notes create clear communication between the technician and the pharmacist on what the call is about. Notes also build trust between nurses and technicians because if the call was an issue the technician could handle they now have the opportunity to do so. Finally the at home and hospital pharmacist could use online messenger to stay in contact with each other.

4.2.5 Pharmacy Implementation Table

The group presented the results in Table 2: Pharmacy Recommendations to the pharmacy department. Some of the recommendations were implemented, while the rest of the recommendations were either taken into advisement or not feasible. Table 2: Pharmacy Recommendations also summarizes the results.

Table 2: Pharmacy Recommendations

Recommendations	Summary	Results
Use a basket to refill code cart medications	When more than 10 medications need to be refilled use a basket	Baskets are being used
Bring code cart to medication area	To cut down on travel time the code cart was recommended to be placed over by the medication area	Unable to implement due to space constraints
Lay out all medication orders	For clarity all medication orders should be laid out on rolling carts for ease of filling and visibility	Implemented by technicians
Unwrap plastic with pen or badge	New medication is wrapped in plastic, and to cut down on the time it takes to open the plastic by hand technicians were encouraged to use their badge or a pen	Implemented by technicians
Standardize how plastic bags are organized for runs	Standardizing the empty medication bags would cut down on mistakes and time while on the runs	Implemented by technicians
Frequency of runs	Runs should be increased to every half hour or hour with less medication	Not implemented due to AcuDose system update constraints
One pharmacist to verify technician work	Pharmacists have to sign off on all medications that the technicians send out	Not implemented due to staff constraints
Add flags to clean room	Make a visible indicator when medication is ready to be picked up in the clean room	Flags are ordered
Put a note on all calls that get transferred from a technician to a pharmacist	Putting a note on all phone calls ensures that no information is missed	Not implemented because of time constraints
Online messenger for pharmacist communication	The online messenger will give the at home and in hospital pharmacist a way of communicating.	Not implemented due to costs and technology constraints

5. Conclusions

At St. Vincent Hospital, our group achieved its goal of improving different processes in the hospital with lean implementation. The two areas in which our group focused were the NucMed and Pharmacy departments. We offered the departments solutions that would both increase the quality of patient care and improve efficiency. We worked closely with the employees of these departments to find solutions, and in many cases improvement ideas originated from them. In NucMed the group examined interdepartmental relationships between transportation and NucMed technicians, and gained skills that furthered our understanding of when an issue is truly a problem. In the NucMed sub-project the team was brought in to examine if transporters needed to be assigned to NucMed on the weekend, and found that the data and our observations did not support a change. In the pharmacy the group examined different processes that needed improvement, and by doing so we honed our observation skills and data analysis.

Plans were in place to implement some of the recommendations that we offered to the Pharmacy Department. We helped with the implementation of some solutions, including using baskets for code cart refills, restructuring the AcuDose prep, and putting flags on the clean room. Some solutions were easy to implement, such as putting flags on the clean room with the potential to reduce medication fulfill response time by five hours a week overall. Others were more difficult to achieve and could not be addressed in the project time frame of seven weeks. The team was also unable to implement any changes that involved employee changes or large financial investment by the hospital. In the end, we gave the two departments the means and tools to finish the projects that we started.

The overall goal of our project was to use lean to make improvements at St. Vincent Hospital. Finding new places to implement lean is never over, especially in a place that is constantly changing and advancing. Our team proposed a possible future project for the Pharmacy Department to examine medications either returned from units or thrown away. The hospital loses money because these costly medications cannot be repackaged. Returned medications takes up technician time and cost the hospital money if the medication has to be thrown out. To solve the problem a lean approach should be undertaken where the issue is examined more deeply to find a link or root cause. Then the two departments with the highest medication return rate should be the focus of improvements to try to generate the most impact.

6. Reflections

In this reflection section of our paper, the team got to look back on the entire project. The first section discusses what our design process was and what constraints we faced. The final section addresses what the team learned from the project and how it can be applied to life beyond the project. The whole section sums up what we learned and accomplished outside of what we provided and improved at St. Vincent.

6.1 Design Component and Constraints

A requirement to any engineering project is a design component to display the student's knowledge of engineering design. Engineering design is a decision making process where the engineering sciences are applied to the creation of a system, component, or process to meet the goal of the project. The seven steps to completing an engineering design process are as follows: identifying the problem, identify criteria and constraints, generate ideas, explore possibilities, select an approach, build a model, and refine the design (Dunbar 2013). For our project the team identified a need for process improvement in both the NucMed and Pharmacy departments. The team studied raw data given to us in order to better understand the processes that we worked with and to generate preliminary suggestions before we started to look at the areas to improve. After the group explored different options we selected improvements that could be accomplished in the amount of time we were given. Afterwards we looked at and refined our suggestions as needed.

6.1.1 NucMed

In NucMed we reviewed the patient transportation process and the testing process. We created a process map of a patient moving through the system, and analyzed the system through the use of a process map and time motion studies.

The analysis showed the process was constrained by the size of NucMed, number of employees, and the location of the equipment. These constraints limited the number of patients who could be tested in NucMed. The process map and time and motion study showcased to the department heads what type of employee and equipment reorganization that was needed to reach more effective levels. If the department took our suggestions into consideration, they would decrease the time it takes for patients to be tested by approximately ten percent, thereby increasing the potential number of patients that could come in without increasing the number of employees.

6.1.2 Pharmacy

The Pharmacy identified several opportunities for process improvement. The three systems mapped by the team were the code cart, the AcuDose runs, and pharmacy verification process. The first step our group took was to collect and analyze run data, and our group found that the code cart and AcuDose systems both could be improved by using the red baskets effectively. The AcuDose run restructuring that we proposed was based on mapping the runs and noting inconsistences in the routes. From the route data a new run schedule was made to decrease some of the perceived redundancies and unnecessary stops on the run. Several constraints the team encountered when proposing changes to pharmacy process were interdepartmental complications between the nurses and the pharmacy staff, the number of employees, and the number of medications that need to be processed in a timely manner daily.

The group also collected data on the phone calls that were part of the verification process. These calls often resulted in medications being tubed to different locations. Data for tubing medication was also retrieved from the system. Both sets of data were analyzed and a new process for data analysis in these two areas was created. The data analysis tools created by the

team were designed such that they could be used by members of the department for future analysis and improvement. Here the data being input was the constraint, and the results are only as good as the data put into it.

There were also several small changes made to improve communications between the technicians and the pharmacists, due to missed messages. We implemented solutions to help prevent missed messages from happening. The first solution proposed was to have any transferred calls also include a written attachment to inform the receiver of the call the purpose or issue. The group also suggested implementing a flag system for the clean room in the pharmacy department. The flag would indicate when there was medicine that needs to be processed in the clean. The proposed solution would cut down on miscommunication and missing medication between the pharmacists and the technicians.

6.2 Lifelong Learning

While working on our project, we recognized several differences between working in a product-oriented environment and working in the people-oriented environment of the hospital. When dealing with people as the primary unit flowing through the system there is a lot to take into consideration, such as people's comfort and safety. People are also free thinking and autonomous, so it can sometimes be difficult to develop a system that is responsive. For instance, we observed patients refuse service or require additional assistance, both of which put additional strain on the system. It is also important to ensure that people received the proper level of care, while still getting through processes in a timely manner, meaning it is not just about curing people but how they are cured. For instance a patient cannot be left unattended or in a work in progress state like a product.

One of the things that our team found that can be carried to any place and any project was that it is very important to have someone that is familiar with the system and the staff to be a champion for the cause. One of the two projects the team worked on, NucMed and Pharmacy Department, had a strong champion. We learned that it makes a big difference in the success of a project if there is someone to help out the project team and answer any questions that may arise. We also found that it is easier to get more in depth information and a greater level of support and understanding in the project. Some advantages that a champion may provide is data, process understanding, or a link to other people in the department. Champions also sometimes provide intangible benefits like vigor for a project, and although the benefit may not seem as important as the others, it can sometimes play a large role in the project lasting longer than just a few weeks. These are just a few reasons that a champion is a key element to the success of projects.

A significant part of the team's data collection involved shadowing people to get an understanding of their job and process. The more receptive people were to change, the more information they provided us while we observed them. People who accepted our role were also more open to questions, which allowed for a deeper understanding of the problems. Working with people who are receptive to change also helped when we tried to make suggestions, because they listened to the suggestions without complaint and were more willing to implement and improve on the changes. These people were also able to make the changes without a superior telling them to, which means that the changes are more likely to be sustained.

Another learning opportunity that our group encountered was that in any process improvement project there will be people who know the job better than you, and thus may not want to listen to the advice given. In many cases changes and ideas have to be presented with tact in order to avoid offending people who have been doing their job for a long time. We

learned that it is always a best practice to be delicate and non-critical when explaining and presenting your ideas to improve their jobs. Also it was very important to our project to present our ideas as suggestions and to be open to feedback, because sometimes we did not know what is best or understand the process fully. We also learned it is important not to alienate any one group in the organization, which can be accomplished by not putting blame on any one person or department.

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