University of Michigan Health System
Program and Operations Analysis

Reducing Pre-Infusion Wait Time for Cancer Center Patients

Final Report

To: Steven Bednarski, RN, Infusion Nurse Supervisor – Cancer Center Infusion
    Sam Clark, Senior Management Engineer – Program and Operations Analysis
    Richard Coffey, Director – Program and Operation Analysis

From: IOE 481, Team 10 – Program and Operations Analysis
    Paul Gunnels
    Michelle Morosan
    Shannen Palmer

Date: December 17, 2007
Table of Contents

Executive Summary.................................................................1
Introduction..............................................................................4
Background..............................................................................4
Goals and Objectives...............................................................5
Key Issues..............................................................................6
Project Scope..........................................................................6
Methodology............................................................................6
  Patient Observations and Time Studies.....................................6
  Interviews............................................................................7
  Lab Observations and Turnaround Times.................................7
  Drop-off Study.....................................................................8
  Historical Data.....................................................................8
  Data Analysis......................................................................8
  Literature Research............................................................8
Results....................................................................................10
  Findings from Observations and Time Studies..........................10
  Findings from Drop-off Study..................................................12
  Historical Data....................................................................14
Conclusions............................................................................15
Recommendations....................................................................16
Bibliography............................................................................17
Executive Summary

Background
It was reported by the Infusion Nurse Supervisor at the University of Michigan Cancer Center that a majority of infusion patients were experiencing a wait time of 3+ hours between having blood drawn and being admitted to the infusion area. The UM Cancer Center has approximately 600-800 patient visits per week and 75% of these patients require lab tests to be completed during their visit.

According to the Infusion Nurse Supervisor, there was a 66% difference in time needed to complete a Hematology lab (22 minutes) and a Chemistry lab (60+ minutes). Currently, the goal within the Chemistry department is a lab turnaround time of 45 minutes. The Infusion Nurse Supervisor believed that lab turnaround times were the main driver behind apparent lengthy pre-infusion wait times. The purpose of this project was to investigate how to reduce pre-infusion wait time for patients, specifically focusing on lab turnaround time.

Currently, the Cancer Center has its own Hematology lab, where the majority of Hematology lab specimens from infusion patients are sent. There is no such on-site Chemistry lab specifically for Cancer Center patient specimens. An initial solution to reducing lab turnaround time, as proposed by the Infusion Nurse Supervisor, was to implement an onsite Chemistry Lab within the Cancer Center dedicated for cancer center patients.

Methods
The methodology behind the project included three main phases: data collection, data analysis, and literature research.

Data Collection
In the data collection phase, observations and time studies were conducted, and a drop-off study was performed. Additionally, roughly 3 months of historical data on lab turnaround times was collected from Pathnet. The data collection phase also included interviews with the outpatient Phlebotomy Supervisor, the Medical Director of Laboratory Central Distribution, and various lab technicians and personnel.

Data Analysis
When analyzing the data, waste in the form of unnecessary waiting, moving to different rooms, and rework (redrawing and/or retesting labs) was sought out and identified. Flow charts were also created and various statistical tests were performed.
Literature Research
The team looked at various outside resources to investigate ways to reduce lab turnaround time. Credible sources were reviewed, including previous projects, articles from medical journals, and professional reports.

Results

Observations and Interviews
The team observed the flow of labs from Phlebotomy to the Chemistry lab. During these observations the team noticed labs were being dropped off at Central Distribution; however, no work was actually being done to the labs. To determine why this apparent non-value added handoff was taking place, the team interviewed the Medical Director of Laboratory Central Distribution and Sendouts/Division Director of MLabs who is leading the lean initiative in Pathology. During the interview, the team learned that currently labs are centrifuged and analyzed entirely in Chemistry, but in the future state labs will be centrifuged at Central Distribution and analyzed in Chemistry. In the future, all labs from the hospital will be sent through Central Distribution before being sent to Chemistry for analyzing. Turnaround times are expected to be reduced by 20 minutes after the lean initiative is fully implemented.

Literature Search
The team looked at five different sources of information to determine what is being done at other hospitals to decrease lab turnaround time. The most common methods for reducing lab turnaround times are: on-site oncology labs, point-of-care testing, satellite laboratories, and pneumatic tubing systems.

Historical and Drop-off Study Data
The chemistry lab turnaround times from the Cancer Center are taking longer than the 60 min expectation as stated by the Infusion Nurse Supervisor. From historical data (Sept. - Nov. 2007) mean turnaround time is 81 min. The team performed a drop-off study to determine the effect on turnaround time if the labs were dropped off directly at Chemistry, bypassing Central Distribution. From the drop-off study, the mean turnaround time for labs sent to Central Distribution was 76 minutes and 59 minutes for labs sent directly to Chemistry (Figure 1).
Figure 1. Turnaround Times 17 minutes Longer When Labs Dropped at Central Distribution

Recommendations
The team was asked to determine current lab turnaround times and determine ways to reduce them. Since there is a lean initiative currently being implemented in Pathology, the future state of the lab process will be changing. Since the future state will change anything implemented now, the team divided the recommendations into two parts, before and after the lean initiative completion.

Before Lean Initiative
The team recommends the labs from Phlebotomy in the Cancer Center be sent directly to Chemistry, avoiding Central Distribution as much as possible until the lean initiative is complete. This recommendation was supported by the Medical Director of Laboratory Central Distribution and Sendouts/Division Director of MLabs Labs.

After Lean Initiative Implementation
After the lean initiative is complete a follow-up study should be conducted to determine what turnaround times are, and whether or not they have been reduced to an acceptable time. If turnaround times have not been significantly reduced to under the 60 minute expectation as set by the Infusion Nurse Supervisor, the process will need to be changed further. The Cancer Center, therefore, has two options for processing Chemistry labs after the lean initiative is complete. The first option the Cancer Center has is to work with Phlebotomy, Central Distribution, and Chemistry to ensure the processes is as efficient as possible. The second option for the Cancer Center is to purchase a Chemistry lab for the Cancer Center to process labs. Further research should be done on the feasibility and cost effectiveness of a dedicated Chemistry lab in the Cancer Center.
Introduction
The University of Michigan Cancer Center has approximately 600 to 800 patient visitors per week. Seventy-five percent of these patients require lab tests to be completed during their visit. According to the Cancer Center Infusion Nurse Supervisor, there is currently a 66% difference in the time needed to complete a Hematology lab (22 minutes) and a Chemistry lab (60+ minutes). Furthermore, the Infusion Nurse Supervisor believes urgent Chemistry labs can be completed in 15 minutes. In addition, errors can occur in the lab process, which require the patient to have the labs re-drawn, thus increasing the patient’s wait time even more. Cancer Center patients who need to have infusions after their labs are complete have reported waiting for more than three hours between the time their blood is drawn until the time they are given their infusion. The Infusion Nurse Supervisor believes most of this three hours the patient spends waiting for lab results.

The Infusion Nurse Supervisor would like to know how to decrease the patient wait time prior to patient admittance to the infusion area, specifically focusing on lab turnaround time. To address the patient wait time concern, the Infusion Nurse Supervisor requested the team review the current pre-infusion process by performing observations, interviewing personnel related to the process, and creating a flow chart of the pre-infusion process. The purpose of this report is to present the team’s findings and recommend ways to decrease lab turnaround time and patient wait time.

Background
Patients in the pre-infusion area have reported long wait times after having their blood drawn (referred to as labs). These wait times include the time between their blood draw and seeing a physician, and between seeing a physician and being admitted into the infusion area. The pre-infusion process time depends on lab turnaround time, since the patients must have their lab results before their medicine can be prepared and they can be treated; however, the lab turnaround time varies, depending on the type of lab that is done, and the problems encountered when the labs are being analyzed. If no problems are encountered, the Infusion Nurse Supervisor believes the Hematology labs are completed in 22 minutes and the Chemistry labs are completed in 60 minutes. Technicians in the Hematology and Chemistry labs claim manual analysis has to be performed on most of the labs of patients who have an infusion the same day as when their blood is drawn. The process of manually analyzing labs can lead to long lab turnaround times. Some patients have experienced wait times over three hours, which is three times the expected pre-infusion process time.

The Infusion Nurse Supervisor observed the apparent excessive patient wait times in the pre-infusion process and performed a preliminary study on patient wait time and flow. The study from the Infusion Nurse Supervisor shows the whole pre-infusion process currently takes, on average, three or more hours. The Infusion Nurse Supervisor believes that patient wait time is
being driven primarily by lab turnaround time. A Lean Team analysis was also done in the Cancer Center to determine patient wait time; however, no study was done to determine lab turnaround time or its effects on patient wait time.

The lab turnaround time can be affected by several different factors including processes in four areas: Phlebotomy, Hematology, Central Distribution, and Chemistry. Between the peak hours of 7:00A.M. and 4:00P.M., one of two runners hand-carries blood specimens, every 15 minutes, in batches from the blood draw area (Phlebotomy) to Central Distribution (CD). CD sends the specimens to the Chemistry lab, in batches, every 5 minutes. The specimens for the Hematology labs are sent directly to the Hematology lab through a pneumatic tubing system. After peak hours, Phlebotomy uses the hospital’s pneumatic tubing system, which is different than the Hematology pneumatic tubing system, to send the specimens to CD. Phlebotomy believes it is quicker to deliver lab specimens via runners during peak hours because during these hours, traffic flowing through the hospital’s pneumatic tubing system delays the delivery process.

The Infusion Nurse Supervisor is considering purchasing a machine to process the Chemistry labs in the Cancer Center so labs would not have to be sent to CD and in turn, to the Chemistry lab. The Infusion Nurse Supervisor believes this machine could reduce lab processing time and, consequently, decrease patient wait time. The Infusion Nurse Supervisor is also considering reconfiguring the patient flow, possibly eliminating or combining steps in the process. The supervisor also believes the process can be changed to be parallel with the lab processing time, which would decrease patient wait time. These considerations were the basis for this project and determining the primary causes of the apparent long lab turnaround time.

Goals and Objectives
The primary project goal was to identify ways to streamline the steps in the Cancer Center pre-infusion process to reduce patient wait time. To accomplish this goal, the team determined what is causing the apparent long Chemistry lab turnaround times. To identify ways to reduce lab turnaround time and overall patient treatment time, the team completed the following tasks:

- Observed patient flow through the pre-infusion process
- Collected time study data for each step in the pre-infusion treatment process, from patient arrival to infusion admittance
- Observed the flow of lab specimens from the time the lab is drawn until the time a physician electronically verifies the lab results
- Identified wasted time and work in the pre-infusion process
Information gathered from the above tasks allowed the team to make recommendations to:

- Reduce overall patient wait time
- Reduce lab turnaround time

**Key Issues**
The following key issues drove the need for this project:

- There are apparent long patient wait times (3+ hours)
- Lab turnaround times are inconsistent (22-minute Hematology labs, 60-minute Chemistry labs, and apparent 15-minute urgent Chemistry labs)
- Errors in lab results require the patient to start the process over

**Project Scope**
The focus of this project was on the Cancer Center pre-infusion labs, primarily decreasing lab turnaround time. The team analyzed Hematology and Chemistry labs to determine how the turnaround times affect patient wait time. The team observed the whole pre-infusion process from the time a patient entered the Cancer Center to the time the patient was sent to the infusion area. These observations included the patient flow through the Cancer Center and lab specimen flow through the laboratories.

Any part of the pre-infusion process that is not handled during the patient’s stay, such as having the labs done at another hospital or prior to the current visit, was not analyzed. Additionally, the team did not analyze the clinical hours for the doctors. While the team looked at turnaround times by days of the week and times of the day, the team did not look at scheduling methods or the impacts of scheduling methods on turnaround time. Our analysis also did not evaluate the current staffing levels nor did the team study the pneumatic tubing downtime and its effect on staff performance.

**Methodology**
The team performed this project in three phases: data collection (patient observations and time studies, interviews, lab observations and time studies, drop-off point study, and historical data), data analysis, and literature research.

**Patient Observations and Time Studies**
The team observed four patients in the pre-infusion process, totaling over 11 hours of observation. During these observations, each team member conducted time studies by shadowing one patient at a time through the pre-infusion process. In addition, team members noted patient arrival times and wait times during their visit.
The team found it difficult to observe more than four patients since the Infusion Nurse Supervisor had to schedule the observations by calling and obtaining permission from each patient. The Infusion Nurse Supervisor encountered two problems when calling the patients: either the patient was not home when the call was placed or the patient declined to participate in the study. Consequently, the team focused on observing the lab flow process, which is more directly related to lab turnaround times.

**Interviews**

The team interviewed the Outpatient Phlebotomy Supervisor. After the interview, the team decided it was necessary to observe the entire pre-infusion lab process starting with blood draw in Phlebotomy. With the cooperation of the Outpatient Phlebotomy Supervisor, the team observed the blood draw area and the flow of labs through the clinic. During these observations, the team talked with lab personnel to understand problems identified during the observations. These informal interviews served as an important part of understanding the lab flow process.

During the observations of the lab flows, the team identified a possible area of concern which needed further clarification. The potential problem was identified in Central Distribution where labs from Phlebotomy are dropped off. From Central Distribution, the labs are sent to the Chemistry lab. Currently, Central Distribution does not perform spinning of the labs in centrifuges or analyzing of the labs. Central Distribution only currently scans the barcodes on the labs and is supposed to send them to the Chemistry lab every 5 minutes. The team found the labs were actually being sent on average every 15 minutes and this additional handoff was causing a bottleneck in the turnaround time. The processes of Phlebotomy handing off Chemistry labs at Central Distribution started on May 15, 2007 as part of a lean initiative. Prior to this date, all Chemistry labs were taken from Phlebotomy to the Chemistry lab.

The team met with the Medical Director of Laboratory Central Distribution and Sendouts/Division Director of MLabs to obtain information about a lean initiative. The team found out that the change in process to have phlebotomy take labs to Central Distribution is due to standardization taking place. Part of the lean initiative involves having all labs at the hospital sent to Central Distribution. Once at Central Distribution, labs will be ordered, labeled, sorted, and spun on the centrifuge. In the future, there will be more centrifuges added to central distribution and all labs will be spun in these centrifuges. In the future, this would mean the labs that are currently being spun in Chemistry will no longer be spun in Chemistry. After the lean initiative is complete, turnaround times are expected to be decreased by 20 minutes.

**Lab Observations and Turnaround Times**

Since the Infusion Nurse Supervisor believes a majority of patient wait time is spent waiting for lab results to be posted, the flow of lab specimens through the pre-infusion process was observed. The team observed the flow of labs including the Chemistry labs, which are sent to
Central Distribution and then to the Chemistry lab, and the flow of Hematology labs, which are sent directly to the Hematology lab.

During these observations, the team observed the processes in Phlebotomy, Hematology, Chemistry, and Central Distribution. The team observed how labs are processed, including possible batching of labs. The team also spoke to lab personnel to understand the processes and identify problems or bottlenecks in the processes, which could increase lab turnaround time.

**Drop-off Point Study**
Following the team’s interview with the Medical Director of Laboratory Central Distribution and Sendouts/Division Director of MLabs, the team conducted a study in Phlebotomy to determine the effect of the drop-off point on lab turnaround time. With the help of the Outpatient Phlebotomy Supervisor, the team arranged for a runner to drop off one specimen every run (every 15 minutes) directly at Chemistry. The remaining specimens were dropped off at central distribution according to the current protocol. The runners kept a log of the all the specimens they dropped off at Chemistry and Central Distribution. The log allowed the team to determine when the specimens were scanned into their respective location and track the specimens through the process.

**Historical Data**
Historical data for lab turnaround times was obtained from a Pathology Applications Programmer Associate and included turnaround times from September 4, 2007 through November 29, 2007. The historical data included the times the labs were ordered, time labs were scanned at Central Distribution, time labs were scanned at Chemistry, and the time the lab results were verified. This historical data allowed the team to verify the turnaround times from the drop-off study were a representative sample of all the labs.

**Data Analysis**
Based on the team’s patient observations, the team has developed patient flows that include patient wait times. From these flows, the team used lean concepts to identify points where waste was observed, in the form of non value-added waiting time. For the purpose of this study, non-value added time is defined as time that is spent in waiting rooms or time that is not spent with a nurse/physician (i.e. sitting in an examination room without a medical staff member present). The team determined ways to reduce this waste and bring more continuous flow to the pre-infusion process. The team focused on delays caused by processing labs, which the Infusion Nurse Supervisor suspects to be a large contributor to patient wait time.

**Literature Research**
Our team conducted a literature search to find information regarding reducing lab turnaround times. Reducing lab turnaround time is a common goal for medical institutions around the
world. Our main focus for reducing lab TAT is for the STAT chemistry labs. Possible solutions recommend to reduce lab turnaround time are point-of-care testing, satellite labs, dedicated STAT labs, and pneumatic tubing systems. The team reviewed previous IOE 481 projects, Lean Team projects, and other Program and Operations Analysis studies. Previous IOE 481 and Lean Team projects did not focus on lab turnaround time and, therefore, the studies did not provide much information for the team.

A report done by The Advisory Board Company suggests point-of-care/point-of-service options are the best option for reducing lab turnaround time. Specifically, on-site oncology labs reduced turnaround times more than any of the other options.

The book, Point-of-Care Testing Second Edition, states POCT (point-of-care testing) may be used for any of the purposes for which central laboratory testing is used: screening, diagnosis or monitoring patient treatment or process. Although, the book recommends for the purpose of reducing TATs, hospitals should also consider other options, such as satellite labs or dedicated STAT labs. POCT may not be the most cost effective way of reducing lab TATs. Things that should be considered before implementing POCT are: cost, quality of diagnosis, and staffing needs/training. In summary, although POCT reduces TAT it may not be the most cost effective solution and the Infusion Nurse Supervisor should be analyzed to determine if implementing POCT would be right for the University of Michigan Cancer Center.

The article “Strategies of Organization and Service for the Critical-Care Laboratory” suggests having dedicated STAT labs or satellite labs to reduce TAT. Also, the article recommends an automated transport system, such as pneumatic tubing systems, or reducing the distances labs are walked between drop-off points.

The article, “Improving Chemistry TAT with intradepartmental TQM (total quality management)” by Tiffany, Debbi, gives an account where a medical institution purchased an additional chemistry analyzer, which reduced lab TAT for STAT labs.

Lastly, the article “Turnaround times in the laboratory: A review of the literature”, by Pamela G. Manor, give a summary of different alternatives used to reduce lab TAT. These alternatives, similar to the other articles, are pneumatic tubing systems, point of care testing, and satellite (STAT) laboratories.

The general consensus from several articles on reducing lab TAT is either implementing point of care testing, using satellite laboratories for STAT labs, having a dedicated STAT laboratory, or using a pneumatic tubing system to transport the labs or reduce the distance the labs are walked.
**Results**

The team obtained three types of data: observation and time study data collected by the team, drop-off study turnaround times, and historical data provided by the Phlebotomy Applications Programmer Associate.

**Findings from Observations and Time Studies**

The team observed the pre-infusion process for four patients. Three observations were done on September 28\textsuperscript{th} from 8am–11am, and the fourth observation was done October 9\textsuperscript{th} from 7:30am–11:30am. During the observations, the team recorded the following:

- Time patient checked-in at phlebotomy
- Time of blood draw start and finish
- Time of check-in at Cancer Center Clinic
- Time patient arrived at examination room
- Time doctor saw patient (patient estimate)
- Time patient finished with doctor visit
- Time of check-in at infusion area
- Time patient went for infusion

An example of a patient flow from the team’s observations appears in Figure 1.

**Figure 1: Example of Long Delays in Patient Wait Time**

Figure 1 shows an example of a patient flow through the pre-infusion process. In this process, the value added time is much less than the non-value added time, which are 24 minutes and 109 minutes respectively. As mentioned earlier, for the purpose of this report, non-value added time for patient observations includes any time not spent with medical personnel, whether in Pathology or a clinic. All of the non-value added time was time spent waiting for lab results. The star bursts in the figure show where in the process the patient’s labs were posted. As seen in the
In addition to patient flow observations, the team observed lab flows through the pre-infusion process. The team observed patients having blood work done and followed the labs as they were sent to their respective locations. An example of one lab flow can be seen in Figure 2.

As seen in Figure 2, the time between when the lab was drawn and the time the Hematology lab started analyzing the lab can be 15 minutes for a worst case scenario (plus a short period for travel time); however, in this example it took 25 minutes. Fifteen minutes is considered a worst case scenario because Hematology and Chemistry labs are sent from phlebotomy in batches every 15 minutes; therefore, most labs do not have to wait the full 15 minutes. The Chemistry lab experienced a 28 minute delay before it was scanned in at Central Distribution and a 12 minute delay before it was scanned in at the Chemistry lab. These delays added 50 minutes to the total processing time (turnaround time).

These examples most likely do not represent a “typical” lab flow. However, due to the small sample size, the examples provide a general idea of the process and the areas in which delays could exist.

The team observed two important contributors to increased lab turnaround time. Two Chemistry lab personnel showed the team that Phlebotomy personnel are incorrectly putting labels on some of the lab specimens. One of the labels is a barcode which has to be placed high enough on the specimen tube for the automatic bar code reader to read the lab information. Second, the “Stat” sticker, which is placed on all labs for patients who have an infusion, are sometimes placed on the tube crooked, which causes the analyzers to jam. Both of these misaligned labels require the Chemistry lab personnel to re-print and re-attach the labels, thus increasing the lab turnaround
time. This information was immediately directed to the Phlebotomy personnel and the team followed up with the Chemistry lab to find the problem had drastically improved. Since the problem had not been solved (i.e. some labs still had incorrect sticker placement), another reminder was sent to the Phlebotomy personnel by the Outpatient Phlebotomy Supervisor. The Chemistry lab personnel also said the Central Distribution runners often place the lab specimens in the wrong inboxes. The Stat labs must be placed in a specific container but if they are not placed in the correct container, the Chemistry lab personnel have to sort the specimens, which leads to additional lab processing time.

In addition to the patient flow observations, the team obtained the times the labs were drawn and the time the results were posted for the team’s observed patients. The average lab turnaround times for the first three patients are 28.67 minutes and 64.33 minutes for Hematology and Chemistry, respectively. These turnaround times are similar to the current standard turnaround times of 22-minute Hematology and 60-minute Chemistry labs as reported by the Infusion Nurse Supervisor.

The team combined the patient observations with the lab times and found that patients three of the patients were taken to a clinic room to see a physician before the patient’s lab results were posted, the fourth went home before seeing a physician. This finding confirms the Infusion Nurse Supervisor’s belief that most of the patient’s wait time is spent waiting for the labs because in these three observations, rooms were available but the lab results were not. The physicians have to look at the lab results before seeing a patient; therefore patients 1, 2 and 3 had to wait in the room 30 minutes, 15 minutes and 20 minutes, respectively, before the physician could see them.

**Findings from Drop-off Study**
From the drop-off study, the team found a statistically significant difference between the turnaround times of labs sent directly from phlebotomy to Chemistry versus labs sent from Phlebotomy to Central Distribution. The labs that are sent to Central Distribution first are then sent to Chemistry, where the labs that are sent to Chemistry first are bypassing Central Distribution. The mean turnaround time for labs dropped off at Chemistry is 17 minutes shorter than the turnaround time for labs dropped off at Central Distribution. These findings come from data collected from October 29th to November 9th. Of this data, 170 of the labs sent directly to Chemistry and 264 of the labs sent to Central Distribution are shown in Figure 3. The team conducted a two-sample t-test of the lab turnaround times based on their drop location. The null hypothesis of the t-test states there is a difference between the mean turnaround times for the labs dropped off at Chemistry and Central Distribution. The t-test gives a p-value of 0.00 which proves that the null hypothesis is significant; there is a difference between the mean lab turnaround times based on their drop location.
As seen in Figure 3 below, labs sent to Central Distribution have longer turnaround times than labs sent directly to Chemistry.

![Boxplot of Drop-off Point](image)

*Figure 3: Difference of Lab Mean Turnaround Times Based on Lab Drop Location*

The messengers recorded the time they dropped off a lab at Chemistry or Central Distribution. Labs dropped off at Chemistry are scanned in and then processed. Labs dropped off at Central Distribution are scanned in and then sent to Chemistry where they are again scanned in.
The team analyzed the time from when a messenger dropped off a lab to the time it was scanned in at Chemistry, where it is then processed (Figure 4).

![Figure 4: Labs Dropped at CD Take an Average of 12 Minutes to get to Chemistry](image)

*Figure 4: Labs Dropped at CD Take an Average of 12 Minutes to get to Chemistry*

As expected, it takes longer for labs dropped at CD to be scanned in at Chemistry than the labs dropped off directly at Chemistry. However, it takes on average an additional 12 minutes for labs dropped at CD to be scanned in at Chemistry than the labs dropped directly at Chemistry. The team performed statistical significance tests and found labs dropped at CD take significantly longer to be scanned in at Chemistry than the labs dropped at Chemistry. This analysis is based on data collected from October 29th to November 11th. In Figure 4, 126 of the labs that were sent directly to Chemistry and 210 labs were sent directly to Central Distribution.

**Findings from Historical Data**

The team performed analysis on historical lab turnaround time data from September 4, 2007 to November 29, 2007 to determine if the drop-off study contained a representative sample of data. The historical data shows turnaround times were slightly faster in November compared to the September-November historical data. Likewise, the week of the drop-off study was slightly faster than all turnaround times in November.
The histogram in Figure 5 shows the turnaround times for the team’s drop-off study, all labs during the same time frame as the drop of study, all labs in November, and all labs from September to November.

![Figure 5: Drop-off Study Contains Representative Sample of TATs](image)

**Conclusions**

The team’s observations of lab flows and the team’s drop-off study provide evidence supporting the need to improve the current lab flow process. The current process of routing labs from the Cancer Center to Central Distribution before being sent to the Chemistry lab is increasing turnaround time and adding variation to the process. Currently no value-added work is being performed on the labs sent to Central Distribution from the Cancer Center. When the lean initiative is complete, all labs will be required to be routed through Central Distribution to be ordered, labeled, sorted, and spun in the centrifuge. Since labs from the Cancer Center are sent pre-ordered, pre-labeled, and pre-sorted, much of the work Central Distribution will perform will be of non-value to the labs from the Cancer Center. Once the centrifuges are removed from Chemistry, bypassing Central Distribution, like the team’s drop-off study, will not be possible.

The current expectations of 60 minute Chemistry lab turnaround time is currently unsupported by the process. Eighty-five percent of labs sent through Central Distribution have turnaround times greater than 60 minutes while 35% of labs sent directly to Chemistry have turnaround times greater than 60 minutes. These percentages suggest the current processes cannot meet the 60 minute expectation of the Infusion Nurse Supervisor.
The Cancer Center, therefore, has two options for processing Chemistry labs after the lean initiative is complete. The first option the Cancer Center has is to work with Phlebotomy, Central Distribution, and Chemistry to ensure the processes is as efficient as possible. The team was unable to determine best practices and opportunities for improvement since the current process is changing. The second option for the Cancer Center is to purchase a Chemistry lab for the Cancer Center to process labs. The on-site lab would decrease turnaround time by removing the handoff to Central Distribution and decreasing travel time to drop the specimens at the lab.

**Recommendations**

The team shared the aforementioned results and conclusions with the Medical Director of Laboratory Central Distribution and Sendouts/Division Director of MLabs who is in charge of the lean initiative. The team recommends the Cancer Center should eliminate the utilization of Central Distribution as much as possible to avoid unnecessary handoffs. The Medical Director supports the idea of the Cancer Center bypassing Central Distribution until the lean initiative is complete, which the team also recommends. However, after the lean initiative is complete, bypassing Central Distribution will not be feasible because Chemistry will no longer have centrifuges. Sending the labs directly to Chemistry before the lean initiative is complete will yield a 17 minute reduction in turnaround time; however, this reduction is only temporary until the labs are required to be sent to Central Distribution.

As mentioned earlier, the current process does not support 60 minute Chemistry lab turnaround times. It is also unlikely that the lean initiative will decrease the turnaround time for most of the cancer patients to less than 60 minutes. The team therefore recommends the Infusion Nurse Supervisor performs a cost analysis on purchasing a Chemistry lab for the Cancer Center to determine the feasibility of performing Chemistry labs in the Cancer Center. The team concluded an on-site Chemistry lab would decrease handoffs and travel time of the labs which add the most variation and time to the lab turnaround time. Literature research supports on-site Chemistry labs claiming in many situations it is the best method for significantly decreasing lab turnaround time.
Bibliography


