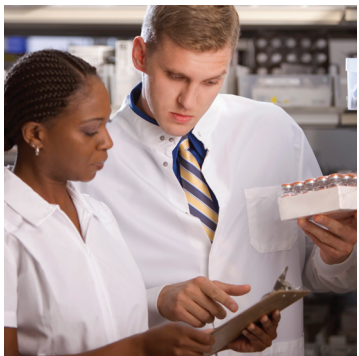


# ➤ Laboratory Turnaround Times in Emergency Departments

**ELIMINATING WASTEFUL STEPS AND BOTTLENECKS WITH LEAN SIX SIGMA**



Walk into the Emergency Department (ED) of your community or university hospital during peak hours and what will you most likely see?

- A chaotic environment where everyone is moving in various directions
- Many patients sitting around wearing a “waiting” expression on their faces
- Some patients being treated ahead of others, while the priority for being seen is unknown to them
- Patients laying in beds, on gurneys, and sitting in chairs; others waiting and attached to IVs
- Everything stopping and changing when an emergency patient is brought in by the EMS

For the physicians, nurses, technicians, administrators, and clerks who work in the ED, this is too often the norm. To the outside observer it looks confusing and unorganized. One is tempted to ask, “Isn’t there a better way to do this?” And the answer to that is, “yes.” The challenge is how to achieve it.

The ED is often the primary care for many patients. Patients who are uninsured, under-insured, or those who have no primary care provider turn to a hospital ED as a safety net to gain access to the healthcare network. Surprisingly, some people move from one hospital ED to another in the hope that no one will remember them or gain access to their records. For other patients they simply cannot get an appointment or do not want to wait for an appointment with their primary care physician. Indeed, surveys have shown that ED visits are expected to continue to increase.

Of course, EDs are designed to be for emergency patients requiring immediate and often lifesaving treatment. They were not intended to handle high numbers of walk-in patients. It is no surprise then that many ED patients complain about their care. Chief among the reasons for long wait times is laboratory turnaround times (TATs). Laboratory results have a cascading effect on patient throughput: Tests influence patient management decisions from admittance to discharge.

The reality is that the quality of patient care and a hospital’s financials can be significantly affected by laboratory test processes from the collection of specimens and their travel time to reporting. In addition to these process flow issues, surveys have shown that slow laboratory TATs result in negative perceptions of a healthcare facility by ED physicians. In a survey performed by the College of American Pathologists (CAP) of 1,937 ED physicians in the U.S., six out of ten reported that slow laboratory TATs lowered their overall satisfaction of a hospital.

## › Background

To address the waste and bottlenecks in the critical laboratory test process, San Diego’s Sharp Chula Vista Medical Center (SCVMC) expanded its implementation of Lean Six Sigma. A pioneer in change, the medical center serves a growing population in San Diego’s South Bay. Between 2000 and 2005, SCVMC experienced a 25 percent growth rate, owing in part to its location 14 miles from the Mexican border.<sup>1</sup>

Management had recognized the value of Lean methodologies to improve patient care while reducing costs and was using Lean tools in various projects throughout the hospital. The hospital had held several Lean events centered on their Rapid Medical Evaluation area to improve the process flow for non-urgent patients. However, over a period of time the hospital began having the same problems as before – too many patients waiting in the ED and numerous patient complaints.

## › Define Phase

To jumpstart the ED Laboratory TAT project, senior leadership chose a Project Sponsor, who

### At a Glance

#### Organization

Sharp Chula Vista Medical Center (SCVMC)

#### Industry

Healthcare

#### Business Issue

Perception by Emergency Department physicians that access to Laboratory data for ED patients is taking too long.

#### Methodology Applied

DMAIC, Value Stream Analysis

#### Business Impact

Improved access to lab test results will lead to: (1) 51% reduction in laboratory waiting times in ED and quicker disposition of patient to home or hospital admission; (2) fewer patients diverted to other hospitals with more admissions to SCVMC; and (3) more efficient utilization of ED and laboratory staff.

then formed a multi-disciplinary team from the ED and the laboratory. Since SCVMC was more accustomed to using Lean events for improvement projects, NOVACES provided a Black Belt to help guide the team along the DMAIC roadmap. The Six Sigma DMAIC approach is a closed-loop project roadmap that includes defining the problem, measuring the problem, analyzing the data, improving the process, and controlling and sustaining the improvements.

During the initial meetings, the charter was refined and the problem statement and business case were clarified. The problem was stated that there is a perception among ED physicians that access to Laboratory data for ED patients is taking too long. Survey data from ED physicians show a satisfaction rating of 68.8/100. This ranks ED satisfaction with Lab TAT at the 15th percentile in the Press Ganey All Facilities peer group. Prolonged access to laboratory results may result in delayed diagnosis and treatment of ED patients. Patients may be diverted to other area hospitals, resulting in lost revenue. Prolonged access may lead to inefficient use of Laboratory and ED staff. Delays in patient diagnosis and treatment create patient dissatisfaction and the perception of not receiving timely, quality care. The business case included savings of reduced cycle time in the ED, reduced potential for patient diversion to other hospitals and increased ED capacity.

The Laboratory at SCVMC is accredited by CAP and staffed by 62 full-time employees who perform over 2 million tests annually. Over 20 percent of ED patients are admitted to the hospital, which is an acute care facility of 333 beds that serves an average of 135 patients a day with peak hours between 10:00 am – 11:00 pm.<sup>2</sup>

An important part of Sharp HealthCare's quality efforts include measuring physician satisfaction every year. The 2007 survey identified the ED physicians' dissatisfaction with the TATs for laboratory results. They noted that they made frequent computer checks until all of their results were available, finding the process to be frustrating. Nurses were affected, too. They also reported frequent computer checks for results on the same patients. This was an "Aha!" moment. Why were both physicians and nurses checking the same computer system for results on the same patient? As a quick-hit improvement for this effort, it was decided that checking for test results should be the physicians' task since they had to act upon the results.

In addition, the previously completed process improvement efforts that impacted this project were standardized phlebotomy carts, color coding of ED patient labels, and moving the pneumatic tube station to the phlebotomy area within the laboratory. Keshgegian and Bull have shown that the use of a pneumatic tube system has resulted in faster TATs by reducing transport time.<sup>3</sup> Nevertheless, despite improvements in laboratories over the past several decades, the laboratory ED TAT has remained at or greater than one hour.<sup>4-7</sup> A study of outlier TATs, defined as TATs in excess of 70 minutes, showed that only 28 percent are caused by the analytic phase of the total testing process; rather most delays occur in pre-analytic steps associated with specimen collection and transport or post-analytic stages involved with reporting the results.<sup>8</sup> Importantly, the factors found to statistically contribute to faster TATs were laboratory control of specimen handling and rapid transport time.<sup>9</sup>

To address the ED physicians' perceptions of slow test results, the team used Value Stream Mapping (VSM) to analyze how the process flowed to bring the results to the ED physicians and ultimately to the patients. As part of this evaluation, the team also developed a SIPOC diagram illustrated in Figure 1 that helped to identify all the relevant elements before the work began. Another tool called the Critical-to-Quality Tree (CTQ) in figure 2 was utilized to convert the most important needs of customers (the patients) to measureable characteristics of the laboratory

## Tools Applied

### Define

Project Charter, Current State Value Stream Map, SIPOC, VoC

### Measure

Value Stream Mapping, Data Sampling, Control Charts

### Analyze

Cause & Effect Diagram, Control Charts, Graphical Data Analysis

### Improve

Trystorming, Future State Process Map, Implementation Plan

### Control

Control Charts, Control Plan

process. The CTQs were rendered from the Voice of the Customer (VOC) by working directly with the external customers (patients) and internal customers (Physician, MEC, RN, LVN Phlebotomist, Radiology, and Clerk) for the process.

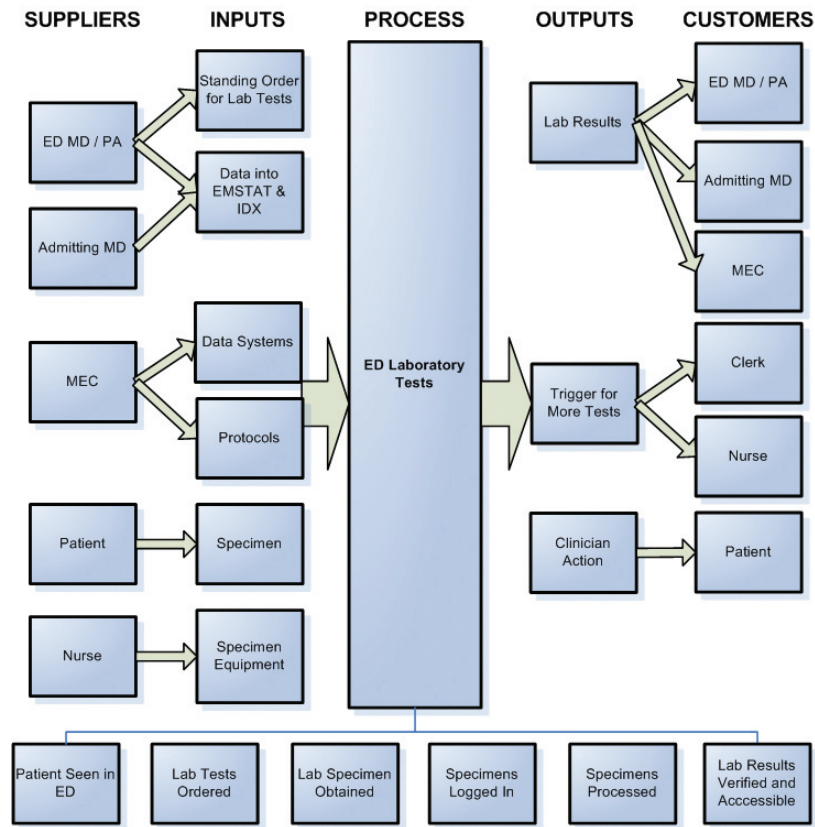


Figure 1 – SIPOC Diagram for Laboratory Results

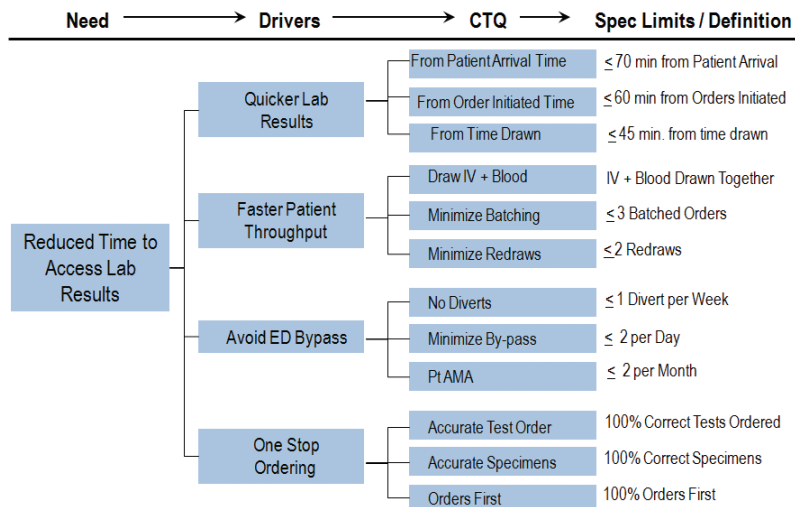


Figure 2 – The CTQ Tree

## › Measure Phase

Measurement of the key inputs and outputs is only possible if the patient flow is known. In this case, the flow needs to be viewed from the point the patient enters the ED to the time laboratory results are available. After the baseline data was collected and processed, it was determined that the average time from arrival of the patient at the ED triage window to the first test results was 109 minutes during peak hours (10:00 am – 10:00 pm). The VOC and CTQ exercises revealed that the key satisfiers for both physicians and patients were safety in starting the IV and drawing blood samples, rapid transport to the laboratory for processing, and quick availability of results.

## › Analyze Phase

A Cause & Effect Diagram figure 3 was created to focus the team's efforts. The first finding was the time that passed at the Triage window and patient registration. Compounding these delays, the patient was moved from one room to another – from Triage to waiting to blood drawn. The effect these two impediments had on the TAT for laboratory results was severe so they became the initial areas of the process to improve.

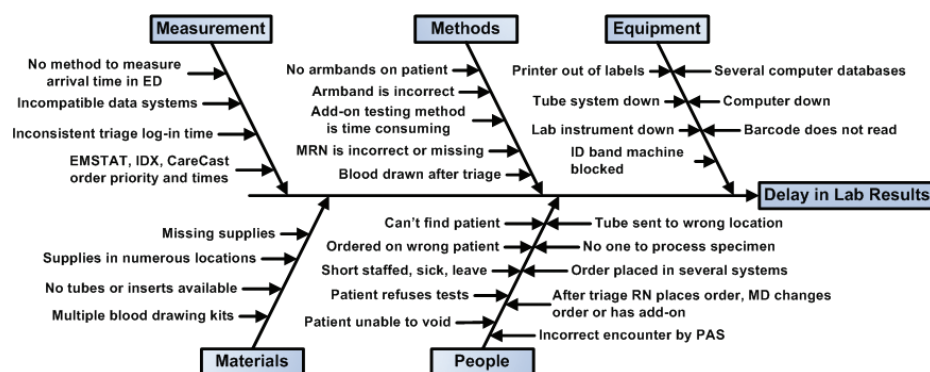


Figure 3 – Cause & Effect Diagram

During the Analyze Phase, a number of key discoveries were made about the process. The primary delays occurred in the “Arrival to Order” and “Order to Collect” steps, while the delays in transporting blood to the laboratory for processing were considered short delays and well within acceptable limits. Based on this analysis, the team members agreed that the major focus of process improvements needed to be in reducing the non-value added steps that were uncovered.

The team also identified that these issues are Critical to Quality [CTQ] for patient safety. (1) The starting of the IV and the drawing of blood specimens could be done by any one of three types of staff – laboratory phlebotomists, LVN phlebotomist in the ED and ED staff nurses – each with their own set of process steps. (2) There are multiple hand-offs in patient registration at the Triage window which lead to delays in initiating standing laboratory orders. (3) The IV blood drawing process occurs only after the patient has been fully evaluated by the Triage Nurse and returned to the waiting room. Since there is no central processing area for the IV start and phlebotomy to be carried out, the staff must look for a vacant spot in a hallway, an alcove or whatever other small space is available at the moment. Then a mobile supply cart must also be moved to that area. Only then can they escort the patient from the waiting area to this location to carry out the procedure.

## › Improve Phase

Based upon a review of the Value Stream Map and the Cause & Effect diagram as well as discussions with both the ED and laboratory staff, the team implemented a “Trystorm.” Trystorm is a common reference to piloting a trial improvement that focuses on a few select factors, usually conducted over a one or two week period. The team conducted its Trystorm for two weeks during the peak hours of 10:00 am to 10:00 pm. The ED directors and laboratory monitored the Trystorm from beginning to end, insuring the data was appropriately collected.

The principal process improvements established for the Trystorm included:

1. One ED RN or LVN, trained in starting IVs and drawing blood, drew all blood specimens for triaged patients. Other RNs and laboratory phlebotomists drew blood on critical patients arriving by ambulance. Previously the lab specimens were held in the ED until they had collected a batch before transporting them to the lab. During the Trystorm, each patient’s specimens were sent to the laboratory without delay.
2. The Patient Registration process was revised to enable faster entry of the standing laboratory orders into the hospital database.
3. Although there were space limitations in the general ED areas, the triage room was found to be adequate for both patient evaluation and the phlebotomy process. This allows the IV to be started and the blood specimens obtained by the IV nurse while the Triage nurse simultaneously evaluates the patient. The focus is on “one stop – one stick process” for the patient. If the nurse is unable to start the IV, then the Laboratory is contacted as a backup.

At the conclusion of the Trystorm, data from fifty random patients over a five day period were analyzed and compared with the pre-Trystorm patients as shown in Figure 5.

TAT (Minutes)	Mean	Standard Deviation
Before Improvements	108	64
After Improvements	53	27
% Improvement	51%	57%

Figure 4 – Dramatic improvements were made in laboratory test TATs.

## › Control Phase

The results of the Trystorm process improvements showed a 51% decrease in average TAT and a 57% reduction in process variation. Based upon the significant reduction in average processing cycle time and reduction in variation, the team moved to implement permanent improvements and to control the gains. The control chart in figure 5 depicts the improvements in both the mean TAT and the variation in TAT. The reduction in TAT variation enables the ED to provide much more consistent, reliable healthcare services.

The team recommended to the executive leadership that the improvements be made a permanent part of the EDs protocols. The ED supervisor will monitor the RN or LVNs who start the IVs and draw the blood. The start of the IV phlebotomy process will be done at the same time another RN triages the patient, while the laboratory provides the protocols for the IV phlebotomy process. If unable to start the IV, the RN or LVN is to call for backup from the laboratory.

There were a series of other important improvements to the process made that were uncovered by the project related to blood specimen orders, drawing and handling. Meanwhile for ongoing data collection, the ED staff will obtain data on randomly selected patients weekly as a means



to sustain the gains achieved. The data will be analyzed twice a month to assess process TAT times. If the data shows longer cycle times, the staff will immediately reassess the steps of the process and make appropriate modifications. Quarterly patient and physician satisfaction surveys will be conducted to insure that the process improvements remain ‘hardwired’ in the hospital system. Sustaining the gains will require a concerted effort by all levels of Sharp Healthcare leadership.

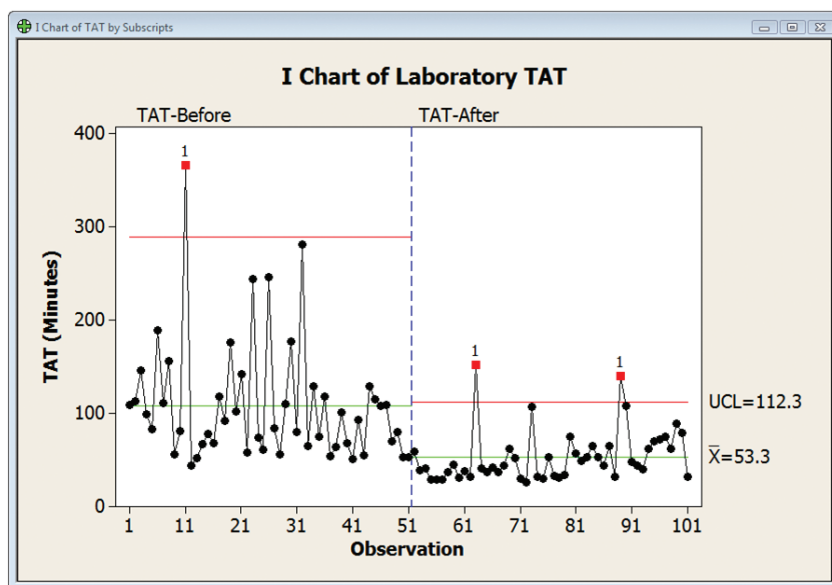


Figure 5 – Control chart of TAT

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## › Who We Are

NOVACES is a premier implementer of today's most powerful process improvement methodologies that strengthen operational capabilities and financial performance. We deliver Lean, Six Sigma and Theory of Constraints consulting and training to clients in the defense, healthcare, manufacturing, maritime and service industries. We are dedicated to advancing the science of process improvement and leveraging research to provide the most effective solutions in the market. For more information about our consulting and training services, visit [www.novaces.com](http://www.novaces.com).

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Arda is a Lean Six Sigma Green Belt and Certified Change Agent. She has over 15 years experience in quality management and quality improvement within several healthcare organizations in the San Diego area. She has been a speaker for the Clinical Laboratory Management Association (CLMA) on the topic of Lean Six Sigma in Laboratories. She also facilitated the first Kaizen event at Sharp HealthCare and has served on many other Lean and Six Sigma projects within the organization. In prior roles at Sharp, she instituted and completed the patient safety effort to ensure that every patient had a barcode enabled wristband and that every nurse had a barcode identification badge. She has won organizational recognition several times for her contributions to quality and growth.

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Sharon has 20 years of experience in managing the day-to-day operations of a very busy, crowded Emergency Department. In this role, she has led several initiatives to increase efficiencies and streamline processes. She is a member of the California Hospital Association Trauma and EMS committee, San Diego County Emergency Medical Oversight Committee and Emergency Nurse's Association. She received her BSN and MSN degrees from San Diego State University. Her professional appointments include representing the California Emergency Nurses Association on the State of California Emergency Medical Services Commission and vice-chairperson of this committee for three years.

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Charles, CAPT, USN (Ret.) is the director of healthcare services for NOVACES. He oversees the company's services in Lean Six Sigma programs to improve patient care, safety and satisfaction, which simultaneously generate more profitable business outcomes. He has deep and abiding experience at all levels of healthcare, owing to his 38 years in the U.S. Navy dedicated to advancing patient care at military hospitals around the world. For example, he coordinated the implementation of Total Quality Management for 5,000 employees at the U.S. Navy's largest medical center in San Diego. In addition to his expertise in healthcare and education, as a Commanding Officer, he has conducted strategic planning sessions for a variety of organizations with emphasis on development of mission, vision, and values. Over the years, he has written about managing change in healthcare for a variety of publications. He is both a Lean Six Sigma Black Belt and a graduate of the Institute for Federal Health Care Executives. He holds a B.Sc. degree in Nursing from the University of Washington and a M.Ed. from the University of San Diego.