Improving Emergency Department Length of Stay by Reducing Laboratory Turnaround Times

Dana Byrum

Submitted in partial fulfillment of the
requirements for the degree of

Doctor of Nursing Practice

East Carolina University
College of Nursing

July 19, 2021

Acknowledgements

I would like to thank several people for their help and support during my journey to achieving my Doctor of Nursing Practice (DNP) degree. I would first like to thank Beverly Venters who served as my mentor and site champion. You were always available to provide guidance and support throughout the entire project. To Dr. Brad Sherrod, thank you for all the guidance, phone calls, suggestions, and support you have given along the way. I would also like to thank my family and friends for their encouragement and support over the last four years. To my sister and best friend, Jenna Hebert, I do not know how I would have made it through this journey without you. You have supported me, listened to my frustrations, and encouraged me to reach the finish line. To my husband, Tony Byrum, thank you for your patience and support, you have given up so much for me to accomplish this goal. Lastly, to my son Tucker, thank you for understanding why there were times I couldn't do something with you and daddy or why I needed it to be quiet in the house. As you get older, I hope you will remember my dedication to completing this goal and it will ignite a passion in you to pursue and achieve your educational and career goals. Believe in yourself Beetlebug. You can do anything you put your mind to.

Dedication

I would like to dedicate this scholarly project to my mother, Vickie Williams, and my father John Williams. They have supported me in my educational journeys since childhood. My father has always stressed the importance of education and how it can benefit you personally and professionally. My mother has always been my best friend and my biggest fan. She has encouraged me and supported me every step of the way. Her strength and determination in life has showed me that I can do anything I want through self-motivation and perseverance. Thank you both for your support. I love you and I hope I have made you proud.

Abstract

The purpose of this quality improvement project was to improve lab turnaround times to decrease Emergency Department (ED) length of stay. The project participants included registered nurses (RN) and medical doctors (MD) in the ED and medical technologists (MT), medical laboratory technicians (MLT), and phlebotomists in the laboratory. EDs are challenged with diagnosing and treating patients promptly and often encounter delays from outside factors. One of those includes laboratory turnaround times (TAT). Using lean methodology, interventions selected were put into place in an effort to decrease lab TAT. Standard workflows were developed for lab and ED team members. ED RNs began using ED protocols to enter pertinent lab orders during triage after assessing patients. ED RNs collected blood samples when starting their intravenous line, and a 5S was carried out to improve workplace organization. ED RN protocol usage improved by 14.7% the first month of the project and continued to improve for a final improvement of 68% compared to the 50% improvement target. The volume of blood samples collected by RNs improved from an average of 476 per month to 535 per month for an increase of 12% vs. a goal of 10%. Workplace organization improved from 8 points to 20 points compared to a goal of 15-20 points. Lab TAT for arrival to first ordered lab for CBCs, BMPs, and Troponins improved from an average of 20.85 minutes to an average of 18.53 minutes. Lab TAT from labs ordered to collection time for CBCs, BMPs, and Troponins also improved from an average of 19.88 minutes to an average of 17.37 minutes. This project improved the overall lab TAT by 4.82 minutes; however, it did not meet the ED LOS improvement target of 5%.

Key words: lab, emergency department, turnaround time, length of stay, improving laboratory turnaround time, improving ED LOS, throughput

Table of Contents

Section I. Introduction

Healthcare costs continue to rise in the United States, and Emergency Department (ED) crowding, and throughput remain a national crisis leading to adverse effects on patient care, quality, and safety (Haq et al., 2018). A root cause analysis using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) conducted by Driesen et al. (2018) concluded that increased ED length of stay (LOS) is caused most of the time by factors outside of the ED. One of these outside factors is laboratory turnaround times. Li et al. (2015) performed a retrospective, multisite cohort study correlating the number of laboratory tests ordered to the ED LOS. In contrast, for every five additional tests ordered per order episode, the median ED LOS increased by 10 minutes (2.9%) (Li et al., 2015). Li et al. (2015) also concluded that for every 30-minute increase in turnaround time, there was a 5.1% (17 minutes) increase in ED LOS. Hospitals are faced with needing to find ways to increase patient care efficiency, decrease waste and costs, and improve healthcare quality.

Background

The ED is the first portal of entry into healthcare by many patients. According to the National Center for Health Statistics (2017), there were 139 million ED visits in 2017. Along with rising patient volumes, EDs are also seeing an increase in the aging population and patients with co-morbidities (DeAnda, 2018). EDs are also faced with challenges of limited access to primary care and community services, which leads to an influx of patients, lack of resources, and stress on staff (DeAnda, 2018).

Patients are quickly triaged using the Emergency Severity Index (ESI) to stratify their symptoms and are given a level score of one (emergent) to five (least urgent), and care is prioritized according to their ESI assigned (Agency for Healthcare Research and Quality

[AHRQ], 2020). There are multiple levels of care provided at one time in the ED, leading to an extremely fast-paced environment. Laboratory, radiology, and other ancillary tests are ordered on multiple patients at one time. If there is a disruption in any of these orders or workflows, a backlog of care may occur, which leads to increased ED LOS (DeAnda, 2018).

Laboratory tests provide valuable information to providers for diagnosing and developing treatment plans for patients in the ED. A quick turnaround of these results can expedite ED throughput, decrease LOS, and improve patient outcomes (Kaushik et al., 2018). Patient experience is improved as the wait time decreases, quicker diagnoses are made, and a faster treatment plan is developed and implemented (Inal et al., 2017).

By improving ED throughput, reduction in mortality rates and improved safety as well as decrease the percentage of patients that leave without treatment (LWOT) and decrease in-patient LOS (Leung et al., 2017). Improving laboratory turnaround time (TAT) and ED LOS can also lead to a reduction in health care costs by keeping ED beds open to treat patients as they arrive, increasing reimbursement from patient satisfaction, and lead to better-fixed cost distribution (Probus & Smith, 2020).

Organizational Needs Statement

The setting for this project is a non-profit, six-bed critical access hospital that belongs to a nine-facility healthcare system. The patient population served is diverse, impoverished, and complex. The ED has eight beds and sees approximately 950 visits per month, and an average of 5,000 laboratory tests are ordered for this population (ED Manager, personal communication, July 2, 2020; Laboratory Supervisor, personal communication, July 24, 2020). Laboratory tests are ordered by computer physician order entry (CPOE) through an electronic medical record (EMR) and collected by laboratory phlebotomists most of the time. In November 2019, the

laboratory upgraded to a new Laboratory Information System (LIS), Beaker, which interfaced with the facility's current EMR. This integration provided the ability to integrate provider orders related to blood collection with individual patient identification and specimen labeling at the bedside.

Before and after this integration, ED providers and ED staff verbalized concerns that there were delays in laboratory collection and result times. Laboratory team members have verbalized that staffing limitations and delays from nurse collected labs have resulted in delays. Safety Intelligence reports related to these delays have been entered by team members with blame placed on the team member's different departments that submitted the report. There is also no standard of work for who is going to collect lab specimens; therefore, nurses and phlebotomists are both collecting unbeknownst to each other. The organization has not evaluated any data or processes as they relate to laboratory collection and resulting. The laboratory has a policy and targets for selected laboratory tests; however, these have not been evaluated or updated since the new LIS interface. Current targets for the selected labs are Troponin in 90 minutes, CHEM7 in 90 minutes, CBC in 30 minutes, PT/INR in 40 minutes, Rapid Step in 60 minutes, and UHGC in 40 minutes once the specimens have been received in the lab (Laboratory Supervisor, personal communication, July 23, 2020). There are currently no state or national benchmarks related to laboratory turnaround times.

The arrival to discharge LOS in the ED of this critical access hospital for the fiscal year (FY) 2019 was 104 minutes, and for FY 20, October 1, 2019, to June 20, 2020, was 101 minutes (ED Manager, personal communication, June 26, 2020). The health systems defined target benchmark is 142 minutes, and the Centers for Medicare & Medicaid (CMS) Benchmarks of Care National median is 134 minutes (ED Manager, personal communication, June 26, 2020).

The current median minute average of Critical Access Hospitals in North Carolina is 133 minutes (Lahr et al., 2019). While this critical access hospital is currently meeting these targets, the administration would like to see a 5% overall improvement in the ED LOS.

This project seeks to optimize performance in the ED and lab to meet the Institute for Healthcare Improvement (IHI) Triple Aim three dimensions of improving the patient experience of care and health populations and reducing the per capita cost of health care (Berick et al., 2008). Reducing laboratory TAT and decreasing ED LOS improves the patient experience of care, improves populations' health, and reduces the per capita cost of health care (Kaushik et al., 2018). This project also assisted in meeting the goals of Healthy People 2020 by improving access to health services. The Healthy People 2020 Access to Health Services (AHS)-9 objective states that we should aim to reduce the frequency of emergency department visits, whereas the wait time to be seen exceeds the recommended timeframe (Office of Disease Prevention and Health Promotion [ODPHD], 2020).

Laboratory TAT efficiency and ED LOS have not been a top priority of the project facility in the past. Recently, the organization has struggled due to a lack of defined processes and accountability. The culture between the ED and laboratory teams lacks collaboration, ownership and promotes blame against each department. Thus, the administrative team would like this project to focus on having the workflow from lab test ordered to lab test resulted examined and evaluated for throughput efficiency as well as see a correlated improvement in ED LOS (Director of Quality, personal communication, May 28, 2020). Administration would also like this project to improve communication and collaboration between the lab and ED teams.

Problem Statement

Reviewed safety intelligence reports identified 57 events related to laboratory delays in the ED from June 1, 2019, to May 31, 2020. ED Accelerator data from October 1, 2019, to June 30, 2020, indicates that the LOS stay goal is met between 75% - 80% of the time on any given day. Providers and staff have shared written and verbal concerns with the administrative team that there are delays in laboratory TAT time within the ED setting. These delays and concerns indicate that there is an inefficient process from the time labs are ordered until the time a lab is resulted, which may be leading to increased ED LOS.

Purpose Statement

The purpose of this project was to identify wastes and opportunities in laboratory workflows with regard to implementing small tests of change to improve TAT in an effort to improve ED LOS.

Section II. Evidence

Literature Review

In order to develop a strategy to answer the question, “How to improve laboratory turnaround time and ED LOS?” a comprehensive literature search was performed using PubMed and CINHAL with MeSH terms, Boolean operators, and One Search followed by an analysis of abstracts and title words. Search terms used included LOS, ED, laboratory, and throughput. Phrases that were used included "improving laboratory turnaround time" and "improving ED LOS." Only journal articles in the English language from 2015-2020 were considered for inclusion. Only articles that described how lean tools were utilized to improve either ED LOS or laboratory TAT were those reviewed. Articles that described activities of lean in settings other than the ED or laboratory were excluded. The literature also had to describe how lean successfully made an impact on a workflow to be included in the review. The PubMed search

resulted in three articles of which one was retained for review. CINHAL yielded a result of 190 articles, of which 12 were saved for reviewing and synthesis. One Search resulted in 616 articles, with most of them having been previously identified through PubMed or CINHAL. Article reference lists were reviewed for studies that had not been identified through database searches. All levels of literature were searched. Articles chosen were in support of using lean methodology to improve laboratory TAT and ED LOS.

Current State of Knowledge

Literature supports that healthcare facilities should be focused on ED LOS and improving patient throughput. The Joint Commission (TJC; n.d.) states that reducing ED LOS can improve access to treatment specific to a patient's condition and increase the quality of care. TJC abstracts charts during accreditation for review of ED-1 Median Time from ED Arrival to ED Departure for Admitted ED Patients and ED-2 Admit Decision Time to ED Departure Time for Admitted Patients (TJC, n.d.). The Centers for Medicare & Medicaid Services (CMS; 2020) through the Hospital Outpatient Quality Reporting Program, measures OP-18 Median Time from ED Arrival to ED Departure for Discharged ED Patients and OP-22 Left Without Being Seen. The Emergency Nurses Association (ENA; 2020) published a position statement supporting the need for hospital-level administrators to create interdisciplinary teams to develop and drive quality improvement processes such as lean to address the problem of ED crowding which leads to increased LOS.

There is very little literature that defines measurable expectations for laboratory TAT. The literature reviewed supports that laboratories should have TAT thresholds and that there is minuscule data available for reasonably accepted times and benchmarks from state and national agencies (McKillop & Auld, 2017; Wilson, 2016). The College of American Pathologists (n.d.)

offers a repository of peer-reviewed journal articles related to TAT through Q-PROBES, which are short term peer-comparison studies and Q-TRACKS, which are long term studies. These studies can be utilized to help establish benchmarks and compare individual laboratory performance to participating laboratories.

Current Approaches to Solving Population Problem

Plan, Do, Study, Act (PDSA), Six Sigma, and lean methodologies are practical approaches used to correct and improve inefficiencies and waste in workflows that effect laboratory TAT and ED LOS. PDSA cycle, introduced by W.E. Deming (1982), is a framework and tool used for running and documenting a small test of change to improve patient care. The process includes developing a plan to implement the small test of change (Plan), carry the small test of change out (Do), observe and evaluate learnings from the small test of change (Study), and then make alterations in the plan if needed for the next cycle (Act) (Institute for Healthcare Improvement [IHI], 2017). Prybutok (2018) developed a Ninety to Nothing Task Force and utilized PDSA cycles to improve the average TAT in the ED of an acute care hospital by 30.2% in four months.

Six Sigma is a statistically technical framework utilizing analytical tools to discover hard-to-find causes of variation and errors (Pyzdek, 2018). Inal et al. (2017) conducted a "longitudinal, before-after analysis of process improvements in the central laboratory of a teaching university hospital" (p.1). Inal et al. utilized the Six Sigma tool define, measure, analyze, improve, and control (DMAIC) system to implement changes to barcode labels on blood samples and extinguish two steps in their reception area workflow. Their changes eliminated 3-hours and 22.5 minutes of non-value-adding work, reduced steps prone to medical

errors and potential biological hazards from tube relabeling from 30% to 3%, and improved TAT for stat blood samples from 68 to 59 minutes (Inal et al., 2017).

Lean methodology is used to restructure an organization based on the ever-changing needs of their population and market by discovering and eliminating inefficiencies such as waste, unevenness, and overburden (Pyzdek, 2018). A systematic review of 203 papers in 120 journals, performed by Ortiz-Barrios and Alfaro-Saiz (2020), using PRISMA methodology found that lean manufacturing was one of the most prominent interventions for improving throughput and workflows in the ED.

After exploring PDSA, Six Sigma, and lean concepts, these approaches were discussed with the administrative team at the project implementation site. The decision was made to utilize lean methodology, which would include PDSA cycles to improve laboratory TAT and ED LOS. A Kaizen event utilizing lean tools is the best approach for improving laboratory TAT and ED LOS because these tools assist with removing waste and unwarranted movement (White et al., 2015).

Evidence to Support the Intervention

White et al. (2015) conducted a "prospective, before-after analysis of laboratory process improvement in a teaching hospital emergency department" (p. 1572). The laboratory process flow was reorganized using lean methodologies eliminating waste and non-value-added actions. Before the implementation, nurse-collected blood samples were placed in a pick-up bin, and the sample was transported to a Kiosk by a laboratory technician. Once in the lab, screening and confirmatory testing were performed in two different locations. After the project implementation, blood samples were sent to the laboratory through a pneumatic system, eliminating the need for a laboratory technician to walk to the ED for specimen collection, and the screening and

confirmatory testing equipment were co-localized near the pneumatic tube. TAT was decreased by 33 minutes for troponin T tests, 88 minutes for urine sedimentation, 12 minutes for Troponin I, 9 minutes for urinalysis, and 10 minutes for urine human chorionic gonadotropin (White et al., 2015).

In an experimental and process analysis study by Gupta et al. (2018), lean methodologies, including Gemba, time studies, and value stream mapping, were utilized in a clinical laboratory to identify process improvements. Waiting time, transportation, and motion wastes were identified. Clarification of roles and relocation of equipment were interventions put in place after using the lean tools and techniques. This experiment led to the reduction in TAT from 180 minutes to 95 minutes for hematology blood samples and from 268 minutes to 208 minutes for biochemistry blood samples (Gupta et al., 2018).

In a quantitative analytical applied research study by Elamir (2018), lean concepts were applied to improve patient flow in a large ED with approximately 1,000 patient visits per day. A multidisciplinary team mapped out the flow from registration to discharge for an ED patient. Nurses then observed and documented the timing of each service provided to the patients, capturing waits and delays. Multiple input, throughput, and output solutions were implemented including the decision to establish a dedicated ED laboratory service. This solution improved service flow interruptions, standardized processes, created value for the patient, and minimized time to treatment for patients.

Huang and Klassen (2016) utilized Six Sigma, lean, and simulation to improve the phlebotomy process in the ED in the largest multisite hospital system in Canada. Process mapping was utilized to identify each step taken after a provider had entered an order for lab work until the blood specimen was obtained in the lab. After mapping, each step was evaluated

for value and flow time. Time studies, observations, and interviews were also performed to gain further insight into the process. Activities were categorized into three groups using the lean concept of value: value added, non-value added but necessary, and non-value added. Data collected related to delays in the process were described using cause and effect diagrams and pareto charts. The two most common causes of delays were the medical laboratory assistant (MLA) answers the phone during the process and the ED nurse waits for the MLA to come and draw the blood. The team developed eight individual suggestions for improvement and combined them to create models to implement for small tests of change. Huang and Klassen (2016) identified that combining suggestion one (nurse collects blood before any other treatments) and four (add a full time MLA to collect blood in the urgent care and ED settings) together made the most significant impact. This combined intervention yielded a 37% faster flow time in the ED which leads to reduction in laboratory TAT.

Evidence-Based Practice Framework

Conceptual frameworks to be used for this project are Lewin's Change Theory and Model and lean implementation methodologies. Kurt Lewin's Change Theory, developed in the 1940s, led to the development of his three-stage model of change known as unfreezing-change-refreeze, whereas prior learnings are removed and relearned (Lewin, 1951; McEwen & Willis, 2019). Lewin developed his model based on the concepts of field and force, whereas "field" is considered the system, and "force" is an entity that has direction, focus, and strength (McEwen & Wills, 2019). Driving forces movement to a new direction or outcome, and the restraining forces block progress towards the goal of the planned change. For a planned change to occur, identification and attention must be placed on the driving forces, and if possible, the restraining forces should also be identified so they can be minimized to prevent failure (McEwen & Wills,

2019). Lewin educates that change is successful once there is a return to equilibrium as a result of balancing the opposing forces and the three phases of unfreezing the status quo, moving to a new state-change, and refreezing the change (McEwen & Wills, 2019).

Lean was developed by Taiichi Ohno, a Toyota production executive, in Japan after World War II (Pyzdek, 2018). Lean principles focus on adding value and removing all non-value-added steps in a process. Wastes in processes that include overproduction, excess transportation, excess inventory, excess processing, waiting, correction, and motion are identified and removed or restructured to create a value-added process for the customer (Pyzdeck, 2018). Lean principles can also eliminate obstacles, worker frustration, and errors that can lead to low-quality patient care (Pyzdeck, 2018).

Tools utilized in lean include value stream mapping and analysis, spaghetti diagrams, and 5S. Value stream mapping captures all of the activities and resources needed to provide a specific service to a customer (Pyzdeck, 2018). Spaghetti diagrams are visual tools that show the physical movement of "work objects" such as people and for this project, laboratory specimens (Pyzdeck, 2018). A 5S (Sort, Set in order, Shine, Standardize, and Sustain) system is utilized to create a clean and clutter-free workspace (Pyzdeck, 2018). Pyzdeck (2018) defined each phase as:

- Sort: Evaluate what is needed in the workspace to perform the necessary job and eliminate what is not necessary
- Set in Order: Place needed items in a designated location for easy accessibility
- Shine: Keep the workspace clear of clutter and clean
- Standardized cleanup: Develop an intervention to keep the workspace clean, neat, and clutter-free

- Sustain: Hard-wire the habit of maintaining a clean, neat, and clutter-free workspace

The introduction of lean to a facility is considered a change within the organization and requires a change journey. Lewin's Change Theory was used as the conceptual framework for introducing lean methodology and changes during the project implementation.

Ethical Consideration & Protection of Human Subjects

Ethical knowledge is "based on obligation to service and respect for human life" (Moran et al., 2020, p. 110). This project implemented a quality improvement process that only involved health care providers, nurses, and laboratory team members to improve ED LOS by reducing laboratory TAT. There was no identifiable patient or team member information on any document, including chart audits. Pre and post surveys were distributed to the ED and laboratory teams to collect qualitative data to capture their understanding and thoughts related to the initial and post-project workflows. All electronic data was stored on a password-protected computer that only the project leader could access. All team members were treated equally, fairly, and not taken advantage of throughout project implementation.

There is potential for conflict of interest as the project leader is an employee at the facility where project implementation occurred. Leadership has been notified that the project leader only participated in activities during hours they were not working. There was no compensation for any team members participating in the project. However, thank you cards were sent to the ED and laboratory departments, Director of Quality, and hospital administration after the project completion for their support throughout the project.

The Collaborative Institutional Training Initiative (CITI Program; n.d.) provides educational courses focused on conduct, ethics, regulation, and administration of research. Post

completion of two of their courses: "*Social and Behavioral Responsible Conduct of Research*" and "*Social/Behavioral Research Investigators and Key Personnel*," it was determined that this project has no identifiable ethical issues. Project approval was obtained through an organizational approval letter signed by the entity president (see Appendix A). This rural hospital does not have an Institutional Review Board (IRB) but is supported by a health system with an IRB; therefore, approval of this project was submitted to the system Center for Research and Grants (CRG) department. The CRG determined on November 3, 2020 that this project was a quality improvement project and approval by the IRB was not required (see Appendix B).

Section III. Project Design

This Quality Improvement (QI) project was designed as an effort to standardize workflows for blood collection in order to decrease laboratory turnaround times and ED LOS. The first intervention was the implementation of ED protocols post triage of a patient, while the second intervention was the implementation of standard workflows for drawing bloodwork. After intervention implementation, data was monitored and the PDSA QI cycle was incorporated to continue to establish QI plans for continual improvement of these turnaround and LOS times.

Project Site and Population

The project setting was in the ED and laboratory of a Critical Access Hospital in rural, eastern NC. The hospital, initially established in 1952, belongs to a nine-facility health care system and serves over 19,854 residents (ARHS, 2018). The population of interest for this project was RNs and MDs in the ED and medical technologists (MT), medial laboratory technicians (MLT), and phlebotomist in the laboratory.

Description of the Setting

The ED located inside this Critical Access Hospital has seven private treatment rooms, one trauma room, and a triage room and is staffed by one MD per 24-hour shift and three RNs each 12-hour shift. The laboratory consists of two rooms separated by an open corridor. One smaller room serves as an outpatient blood drawing station and small workspace for the phlebotomist. The larger room contains all necessary equipment to perform tests that can be completed on-site and several workspaces for the MTs and MLTs. The laboratory is staffed by one to three MT/MLTs per shift depending on the time of day and one phlebotomist during the hours of 8 am – 4 pm Monday – Friday. There is no phlebotomist coverage on Saturdays or Sundays. Each unit also has a manger and medical director.

Description of the Population

The population for this project were the providers and RNs in the ED and the MTs/MLTs in the laboratory. The ED is comprised of five full-time MDs that work 24-hour shifts, 12 RNs, and a unit manager. The laboratory employees three MTs, eight MLTs, and two phlebotomists whereas one of the MLTs also serves as a supervisor and a unit manager.

Project Team

The team for this project consisted of the ED Medical Director, one ED RN, one MT, one phlebotomist, one Quality Specialist, and one RN that works outside of both the ED and the laboratory. The RN that works outside of the ED and Laboratory was chosen to participate to provide an outside perspective to the project and interventions. The ED and Laboratory managers were also part of the overall project team and provided oversight to the ED and Laboratory teams during the implementation of the interventions. A site champion for the project leader conducting this QI project and the administrative team for the facility were also participants in the overall project.

Facilitators and Barriers

During any project, there are facilitators and barriers encountered. The support of the administrative and quality teams served as a strong facilitator for this project. Team members in the ED and laboratory and patients served as the primary stakeholders. The ED and laboratory team members played a large role in the implementation of this project by identifying the correct protocol based on the patient complaint and inputting it into the electronic health record as well as following the standard work developed for the collection of blood samples. They also assisted in the 5S event to improve the workspace in the ED. The laboratory team members played a role in this project by following the standard work developed for the collection of blood samples by laboratory personnel. The patients that seek care in this ED are facilitators and stakeholders because this project directly impacts the way care is delivered to them.

The facility and overall healthcare system's focus on ED throughput and patient satisfaction also provided support for this project. This facility's ED Workgroup met monthly to review throughput data, current initiatives, and barriers to improvement thus providing an avenue for information and discussion for this project to take place. The ED Governance Group for the entire healthcare system, which comprises all of the ED medical directors and nurse leaders, also met monthly to review data and discuss projects to improve ED throughput and patient satisfaction adding increased support for this project.

Barriers to this project included lack of buy-in by team members and providers. There was also difficulty implementing the change because the ED and laboratory team members had hardwired workarounds in their current workflows. The team also did not understand the use of the ED protocols as they relate to chief complaints and treatment. Other barriers included the layout and location of ED supplies and the lack of standard work for blood collection. These

issues were addressed during an educational intervention, individual support offered by the project leader, site champion, and unit leaders, the creation of standard work documents for team member reference, and a 5S event.

Project Goals and Outcome Measures

The primary goal of this project was to decrease ED LOS by reducing laboratory TAT. Research supports that decreasing ED LOS improves overall patient outcomes and decreases mortality (Kaushik et al., 2018; Leung et al., 2017). It was likely that improving laboratory TAT, increasing the use of ED protocols, and increasing compliance with the standard workflow for blood collection would likely decrease ED LOS and improve care and treatment of the ED patient population (Inal et al., 2017; Kaushik et al., 2018; Leung et al., 2017).

Each patient that arrives to the ED presents with a chief complaint and based on this complaint; they had correlated ED protocol orders placed in the EHR. If the ED protocols indicated the patient was to have an intravenous (IV) line placed, the RN collected the blood work following the standard work developed whereas if no IV line is ordered, the RN indicated that in the bloodwork order so that the lab was notified, and they drew the patient's blood using their standard work developed. Once the blood was received in the lab, the automated testing process and resulting occurred so that the final lab value resulted in the EHR. Standard work was also created when lab results were abnormal or critical and was followed.

An educational handout in the form of a printed PowerPoint was distributed to staff during roving educational sessions. This was utilized to educate staff regarding the overall project, standard work developed, 5S, and metrics that were monitored during implementation. Standard work templates (see Appendix C) for RNs and laboratory team members were also distributed to serve as an educational reference during the workday. Additionally, ED RNs were

provided a handout identifying the ED protocols (see Appendix D) available based on chief complaints.

Description of the Methods and Measurement

Outcome measures are specific data metrics that are collected to show the impact of an intervention and whether an expected outcome has been achieved. Expected outcomes for this project were focused on staff education, percent of RNs drawing blood, ED protocol utilization, improved TAT in identified laboratory workflows, decreased ED LOS, and workplace organization. Time and percentage measurements were used to determine differences pre- and post- the project implementation. Table 1 outlines the expected outcomes and measurements used for each project objective.

Table 1

Objectives, Expected Outcomes, and Measurements

Number	Objective	Expected Outcome	Measurement
1	Staff will participate in project education training	95% of staff will participate in the project education training	Percent of staff who attend session
2	RN team members will implement ED protocol orders based on chief complaint	Post intervention usage will be 50% higher than pre-intervention usage	Pre-post percentage difference in use
3	Decreased time from patient arrival to first ordered lab	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time
4	Decreased time from order placed to blood collected	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time

Number	Objective	Expected Outcome	Measurement
5	Decreased ED LOS	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time
6	RNs will draw blood when starting an IV	10% increase in RNs drawing blood when starting an IV post intervention	Pre-post percentage difference in RNs drawing blood
7	ED Workplace Organization	Post intervention score criteria of 15-20	Pre-post difference in 5S checklist score

Note. Aggregated data was used for outcome and measurement data.

Discussion of the Data Collection Process

Data for this project was collected from the EHR and through observations utilizing data collection tools. A randomized, retrospective chart review of patients seen within 30 days prior to the implementation was conducted to serve as a baseline for measuring the difference in times post intervention. An educational roster was utilized during team member education and compared to the incumbent report for each department to determine the percentage of staff who attend an educational session. Reports were obtained from the EHR to evaluate the percentage of time a RN orders an ED protocol, percentage of RNs drawing blood, lab order placed to blood collected time, and blood collected time to lab resulted time. Data for the ED LOS: Arrival to Depart in minutes, was obtained from a Tableau dashboard that is fed data from the EHR.

A phased event, known as a 5S, was also conducted as part of the project implementation to clean and de-clutter the workspace. Post the event, a 5S Audit Checklist and Report tool (see Appendix E) was utilized during weekly rounding sessions to evaluate the ED unit on workplace organization and focused improvement. Using the tool, the department was scored on each of the five phases (Sort, Set in order, Shine, Standardize, and Sustain) and the score was compared to

the ED's baseline score which was determined after a pre-intervention rounding session was performed using the 5S Audit Checklist and Report tool.

Data collection occurred daily and weekly depending on the data collected. Run charts, pie charts, Pareto charts, and bar graphs were used to display the data on a Monitoring for Daily Improvement (MDI) board in the ED. Comparative and trend analyses were performed on data obtained and evaluation of meeting targeted benchmarks was also performed.

Implementation Plan

Implementation of this project occurred January 19, 2021 – April 30, 2021 (see Appendix F). The pre-implementation phase of this project which included a thorough literature review to identify evidence-based practices (EBP) was completed to assist with developing interventions to be deployed during the implementation phase. During the pre-implementation phase, the project leader along with the project team mapped the patient journey in the ED from arrival to the time labs were resulted in the EHR. The project team embarked on a Gemba to the ED and laboratory settings to observe the activities, tasks, and workflows related to this process. The team then flowcharted every detail of a patient's visit from time of arrival to time labs resulted in the EHR capturing all of the value-added and non-value-added steps. Current state (see Appendix G) and proposed future state (see Appendix H) value stream analysis (VSA) maps were created and a gap analysis (see Appendix I) was performed to identify opportunities for improvement. Interventions that were implemented during the implementation phase of this project to improve or correct the opportunities for improvement were developed from EBPs found in scholarly literature. Those interventions included implementation of standard work for blood collection for RNs and laboratory team members, initiation of RNs drawing blood for laboratory tests, and implementation of triage protocol use in the ED.

Protocol usage is very common in healthcare and the use of diagnosis-specific nurse-initiated protocols in the ED promotes teamwork between providers and nurses, shortens wait times for patients, and optimizes patient flow in an ED (Li et al., 2018). A study by Li et al. (2018) describes how nurse-ordered diagnostic protocols were implemented and during triage in the pediatric ED, specific tests within the protocols were ordered based on the patients' chief complaints and symptoms in an effort to decrease the ED LOS. In their study, they were able to decrease ED LOS for patients by 15 minutes (Li et al., 2018). Douma et al. (2016) performed a pragmatic randomized evaluation of nurse-initiated protocol use in an urban ED that led to a decrease in troponin tests for patients presenting with chest pain by 79 minutes. Their study also suggested that the use of the protocols which contained orders for laboratory tests decreased the median ED LOS for patients presenting with hip fractures (reduction of 224 minutes) and vaginal bleeding (reduction of 232 minutes).

During this project, ED RNs were educated on the available protocols that had been developed and approved by the health system's ED Medical Directors and the local Medical Executive Committee and ED Medical Director. These protocol order sets contain orders for labs, medications, diagnostic tests, and other nursing orders that could be carried out prior to the patient being examined by the provider. The RNs were empowered to use their assessment skills and implement the triage protocol order set that correlated with the patient's chief complaint and their assessment findings.

Implementing the practice of RNs drawing blood for laboratory tests when initiating an intravenous line in the ED can reduce the length of time from when the order is placed until the time the blood is collected as well as influence patient flow and ED LOS (Nazaretian, 2017). It is assumed that limiting the number of venipunctures to one will lead to less pain and discomfort

for the patient thus also improving patient experience. In a study by Nazaretian (2017), it was shown that having RNs perform blood collection with a vacutainer adaptor when initiating IV therapy reduced collection time from 187 seconds to 46.2 seconds. Huang and Klassen (2016) describe a project that used six sigma, lean, and simulation to change the workflow in an ED that would allow RNs to perform phlebotomy as soon as it was identified that the patient needed lab work. When this practice was combined with the current practice of phlebotomists drawing blood, the ED saw an improvement in their total phlebotomy TAT from 27.73 mean minutes to 16.18 mean minutes.

For this project, the ED RNs initiated the collection of blood specimens for their patients when they initiated intravenous therapy and documented the collection in the EHR. For patients that did not have an order for intravenous therapy, the phlebotomist continued to perform phlebotomy and collect the specimens in the EHR. Education for this workflow change occurred during education rounds that were completed during week two of the project.

The team also identified interventions that could benefit the overall work environment of the ED and laboratory teams. These interventions were placed in a parking lot (see Appendix J), shared with unit and administrative leadership, and some interventions were chosen to also be implemented during the implementation phase. Those that were not chosen by the team of leaders were handed off in during face-to-face meetings the respective unit leader for further investigation; therefore, were not part of this project implementation.

Prior to implementing this project, team members in the ED and laboratory were educated during roving educational sessions on the standard work written for their departments. These sessions were conducted by the project leader and were performed January 19, 2021 – January 23, 2021 three times a day to ensure all team members in the ED and laboratory were

educated. RNs were also educated on selecting and ordering the correlated ED protocol to the patient's presenting chief complaint. Additionally, MDs were educated on the need for them to co-sign the protocol orders entered by the RN to meet compliance regulations. A 5S was also conducted in the ED by the project team. Observations and data collection began, and support was provided for all team members.

Section IV. Results and Findings

Results

The purpose of this project was to identify waste and opportunities in laboratory workflows with regard to implementing small tests of change to improve TAT in an effort to improve ED LOS. Using the lean method of rapid improvement, the project took place over a three-month period. All EHR charts of ED patients that had labs (CBC, BMP, and Troponin) were reviewed. Patients that went straight to radiology were excluded from the study because the lab order and collection times were skewed because the patient was not in the ED when ordered.

Outcomes Data

The intended outcomes of this QI project were staff participation in education, increased use of ED triage protocols, decrease time from patient arrival to first ordered lab, decreased time from order placed to blood collected, decreased ED LOS, increase the number of RNs drawing blood, and ED workplace organization. Baseline data was obtained from November 1, 2020 through January 31, 2021 for ED protocol usage, time from patient arrival to first ordered lab, time from order placed to blood collected, and ED LOS. Project data for the three-month project period from February 1, 2021 through April 30, 2021 was obtained and analyzed.

Staff Training. Team members in the ED and laboratory were educated using a narrated PowerPoint and follow-up rounding. Educational content consisted of the standard workflows

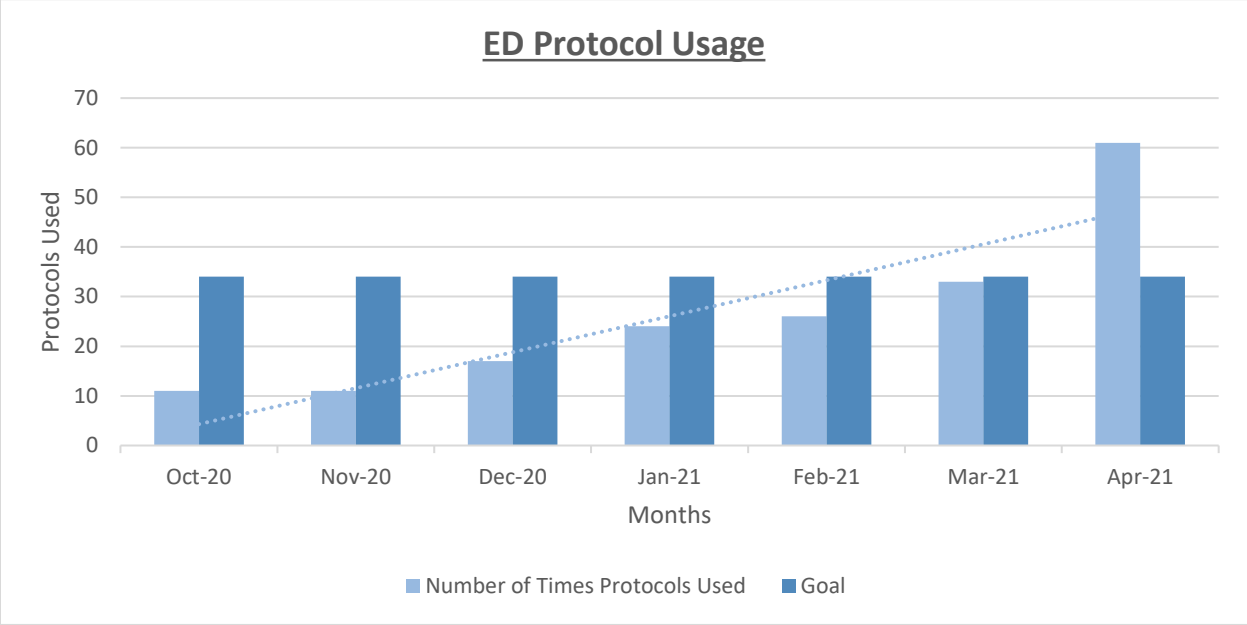
developed by the project team, tools to be utilized during the project, and expected project outcomes. Data collected revealed that 97% of ED and laboratory team members reviewed the provided education which was greater than the goal set of 95%.

ED Protocol Usage. At implementation of the project, the ED protocols were used an average of 17 times per month over a three-month period. After the first month, ED protocol usage increased by 14.7% to an average 19.5. The second- and third-month data continued to show an increase in the usage of the protocols. In the second month, usage increased by 31% and by the third month, the usage had increased by 68% to an average of 40 usages per month which is greater than the target of 50%. Figure 1 illustrates the monthly usage increase during project implementation.

When using the protocols, the ED RN has the ability to select multiple orders within the protocol. The volume of orders when using the protocols was also collected and analyzed. Prior to the project, an average of 59.5 orders were placed monthly. Data for November 2020 cannot be accounted for as the protocols were not used at this time. Each month of the project, the volume of orders placed increased. After implementation of the project, the volume of orders increased by 184% to an average of 169 orders placed per month. Figure 2 illustrates the monthly volume of orders placed.

Figure 1

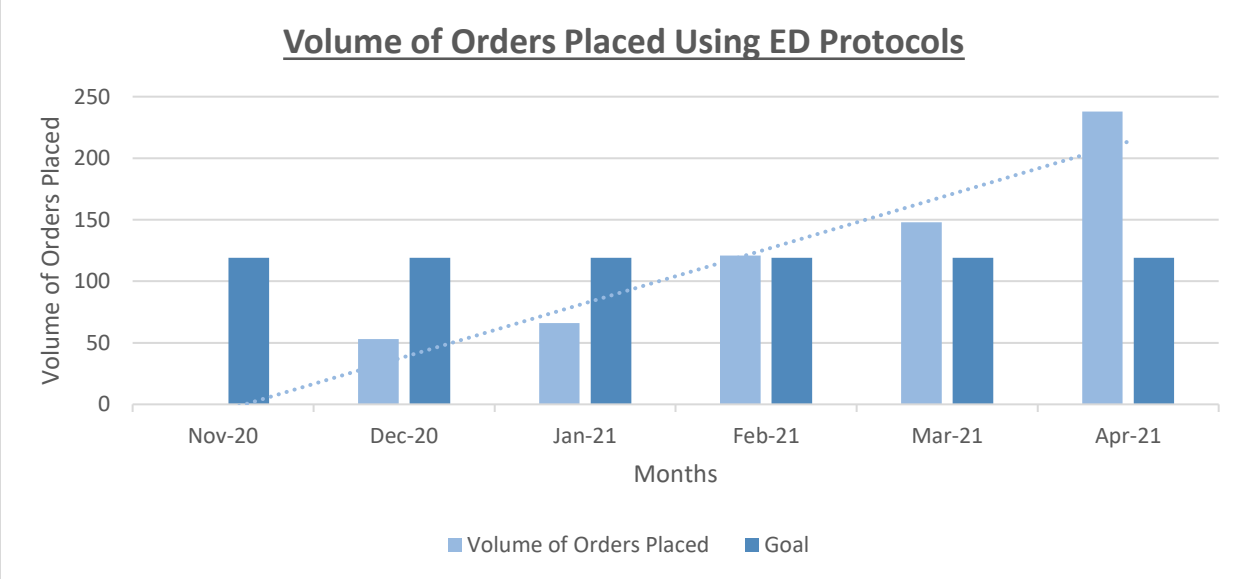
ED Protocol Usage



Note. Number of ED protocols used each month compared to the monthly goal.

Figure 2

ED Orders Placed from Protocols

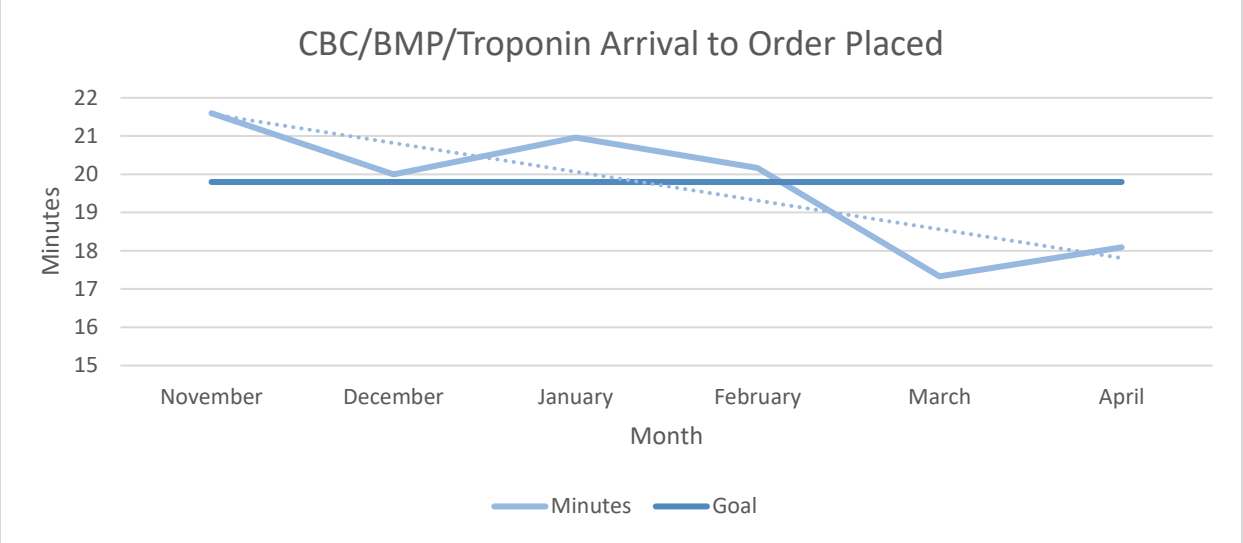


Note. Volume of orders placed when ED protocols were used.

Laboratory Turnaround Time. The average TAT for patient arrival to lab order time three months prior to the project (November 2020, December 2020, and January 2021) was 20.85 minutes. During month one (February 2021), the TAT decreased by 3.3% to 20.17 minutes. There continued to be a decrease in TAT over the last two months (March 2021 and April 2021) of the project with a 16.9% decrease in month March 2021 and a 13.2% decrease in April 2021. There was on overall decrease in TAT during project implementation of 11.1% compared to a target of 5%. Figure 3 illustrates the TAT for ED patient arrival to order placed for CBC, BMP, and Troponin lab tests.

Figure 3

CBC/BMP/Troponin Arrival to Order Placed TAT



Note. Arrival to order placed TAT in average minutes compared to the goal November 2020 – April 2021.

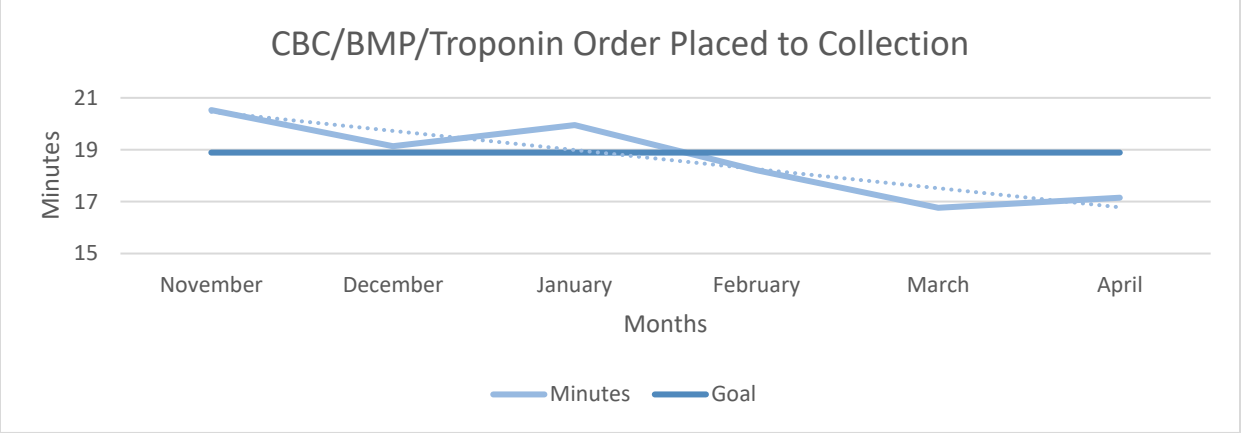
The average TAT for lab order placed to blood sample collected three months prior (November 2020, December 2020, and January 2021) to the project was 19.88 minutes. During month one (February 2021), the TAT decreased by 8.4% to 18.21 minutes. There continued to be a decrease in TAT over the last two months (March 2021 April 2021) of the project with a 15.7%

decrease in March 2021 and a 13.7% decrease in April 2021. There was on overall decrease in TAT during project implementation of 12.6% compared to a target of 5%. Figure 4 illustrates the TAT for lab ordered placed to blood sample collected for CBC, BMP, and Troponin lab tests.

The average TAT for patient arrival to blood sample collection prior to the project was an average of 40.7 minutes. At the end of the three-month project (February 2021-April 2021), the average time was 35.9 minutes. This resulted in a 4.82-minute reduction in TAT for patient arrival to blood sample collection for ED patients. Figure 5 illustrates the total TAT for patient arrival to blood sample collection.

Figure 4

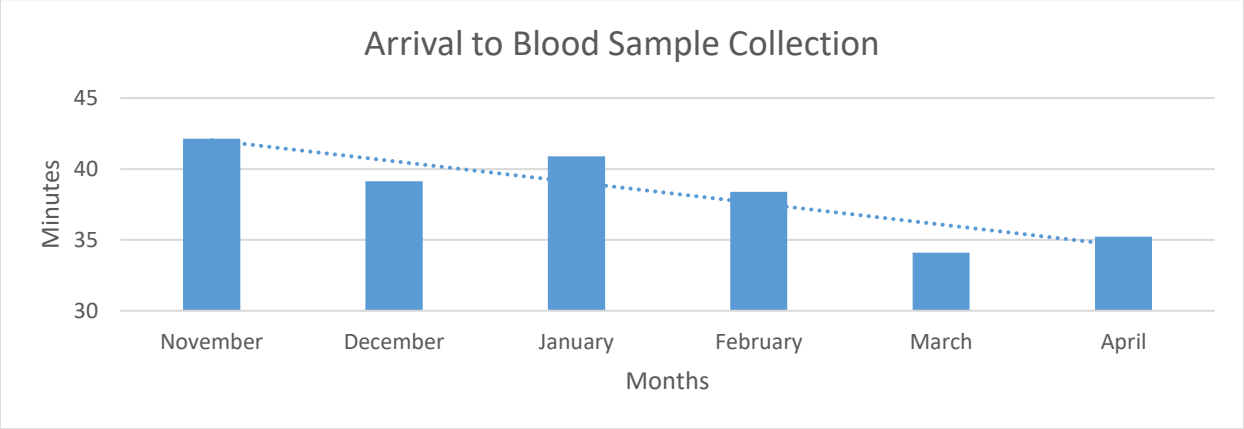
CBC/BMP/Troponin Lab Order Placed to Blood Sample Collected



Note. Lab order placed to blood collection TAT in average minutes compared to the goal November 2020 – April 2021.

Figure 5

Arrival to Blood Sample Collection



Note. Patient arrival to blood sample collection TAT November 2020 – April 2021.

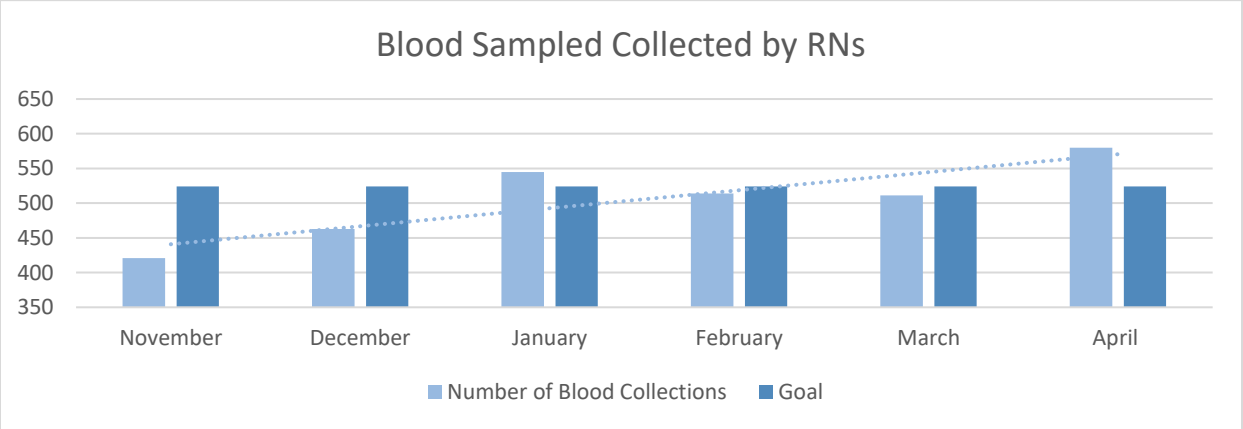
ED LOS. The average ED LOS in median minutes three months prior (November 2020, December 2020, and January 2021) to the project was 103.6 minutes. The outcome measure of decreasing the ED LOS by 5% during the project was not achieved. During month one (February 2021), the ED LOS decreased by 1.5% to 102 minutes. However, this decrease did not continue during month two (March 2021) of the project as there was a 7.9% increase to 111.50 median minutes. The third month's (April 2021) data revealed a decrease from month two (March 2021) but did not meet the goal of 98.4 minutes. The average ED LOS for the three months (February 2021-April 2021) of the project was 107.8 median minutes which was a 4% increase from the pre-project LOS.

Blood Draws by RNs. Three months prior to project implementation (November 2020, December 2020, and January 2021), ED RNs drew an average of 476 blood samples per month when starting their patient's IV. During the first month (February 2021) of implementation, the ED RNs drew 514 blood samples, an increase of 8%. During month two (March 2021), there was a 7% increase and in month three (April 2021), a 22% increase from the prior three-month

average (November 2020-January 2021). Data reviewed at the conclusion of project implementation revealed that the ED RNs drew an average of 12% more blood samples during the project than the three months prior to (November 2020-January 2021), exceeding the target of 10% improvement. Figure 6 illustrates the increase of ED RNs drawing blood when starting their patient's IV.

Figure 6

Blood Samples Collected by RNs



Note. Volume of blood samples collected by RNs compared to the determined goal November 2020 – April 2021.

ED Workplace Organization. The 5S event scheduled for the fourth week of project implementation was postponed until week 12 due to staffing shortages and changes in the ED. Due to this delay, there is limited sustainment data. The initial workplace organization score in the ED was 8 out of 25 points. Post the event, the workplace organization score was 25 out of 25 points. The workplace organization score one week, and two weeks post the event remained at 25 out of 25 points exceeding the target of 15-20 points.

Discussion of Major Findings

This QI project was the first lean project in the ED, setting the foundation for this team to use lean methodology to remove wastes and enhance patient care leading to quality outcomes for their ED patients. Project implementation is consistent with and supported by current literature available; however, not all project goals were met. Consistent with literature, analyzed project data indicated that laboratory TATs can be improved using lean methodology, ED triage protocols, and standard work processes. When the ED protocols are not used and the provider is not available, patients experience a delay in their diagnostic testing. While this project resulted in a 4.82-minute decrease in overall laboratory TAT, this improvement did not lead to a reduction in overall ED LOS.

This project did lead to a reduction of non-value-added steps for blood collection (see Appendices G & H), improved ED organization, increased blood draws by ED RNs, and increased use of ED protocols. ED and lab team members have verbalized that the project also led to improved communication between lab and ED team members and improved understanding of expected workflows related to blood collection in the ED.

During project implementation, it was noted that patients presenting to the ED were frequently taken to radiology for diagnostic testing before lab work was collected and sent to the lab. The facility may want to consider evaluating this practice if the patient is not a trauma, emergent, or code stroke level patient as it may also help improve their lab TAT and processes. Team members verbalized that they did not know if the patient should go to radiology first or have their blood for labs drawn first.

During rounding, it was determined that the Patient Access Services (PAS) team was completing registration and time stamping the chart before they had completed the registration process. This results in increased length of time from arrival to first lab order and potentially

skewed the data collected three months prior to the project. The PAS team was re-educated on the appropriate workflow when discovered during month one of project implementation.

When meeting with the project team at the end of month one, it was shared by the ED RN that electro cardiology (EKG) orders could not be ordered by using the ED protocols even though this order is listed on the paper copy of the protocols and a separate order had to be placed. The Clinical Informaticist was made aware and continues to work with system Information Services to have this corrected. It is possible that if this were corrected, RNs would use the protocols to order the EKG which may lead to them placing other orders pertinent to their patient since they are in the protocol order set.

Section V. Interpretation and Implications

Cost Benefit Analysis

The total cost to implement this quality project was $1951.62. There are no additional costs to the organization to sustain the interventions put in place during the project until labels utilized during the 5S need to be replaced. This cost is minimal and does not outweigh the benefits of continuing the current workflows. The current workflows benefit patients, providers, and the ED and laboratory departments. Patients are experiencing less venipunctures since nurses are drawing blood when starting their IV. They also receive the benefit of timely diagnostic testing when RNs utilize the ED protocols. This utilization also benefits the providers because when they are not available and an RN has used the protocols, their patients' labs are being collected and processed so when they are available to see the patient, they have the diagnostic results needed to make a diagnosis and develop a plan of care. Lab and ED team members also benefit from this project because there are clear expectations of their role when lab work is ordered, and phlebotomist are no longer presenting to the ED to draw blood unless the RN has

changed the order(s) to lab draw or the 30-minute threshold set by the project team is reached thus reducing waste and movement. Table 2 outlines the organizational costs associated with the project.

Table 2

Organizational Project Costs

Item	Cost/Unit	Quantity	Subtotal
Supply Expenses			
Mapping Paper	$25.89/roll	1	$25.89
Post-It Notes	$6.98/pack	1	$6.98
Copy Paper	$8.92/pack	1	$8.92
Pens	$5.92/pack	1	$5.92
Markers	$15.99/pack	1	$15.99
Carts for IV and Blood Draw Supplies	$300.00/each	2	$600.00
Label Maker Tape	$13.98/each	4	$55.92
Supply Expense Total	---	---	**$719.62**
Salary Expenses for 5S Event			
RN 1	$35.00/hour	16	$560.00
RN 2	$42.00/hour	16	$672.00
Salary Expense Total	**---**	**---**	**$1232.00**
Total	**---**	**---**	**$1951.62**

Note. Supply and salary expenses during project implementation.

Resource Management

Human resources, information technology, and equipment resources were used throughout project implementation. Computers and EHR applications were used to place, retrieve, and review lab test orders, input appropriate ED protocol orders, and run reports for data collection. Human resource support was provided by hospital leadership, site champion, the ED and lab team members as participants in the project, and the lab supervisor as the primary resource for running reports for data collection.

Implications of the Findings

Doctoral prepared nurses have advanced knowledge and the ability to improve nursing practice across many different facets in healthcare and can practice in many different roles (American Association of Colleges of Nursing (AACN; 2006). A doctoral prepared nursing leader focuses on organizational leadership and improves practice through quality improvement projects. The AACN developed eight Essentials that should guide these projects and serve as the foundation of advance practice nursing (AACN, 2006). This quality improvement project is grounded in the eight Essentials developed by the AACN and has improved patient care and nursing practice.

Implications for Patients

This quality improvement project improved patient care and experience in the ED. Patients experienced a decrease in wait time from their ED arrival to the time their lab work was ordered and collected. This 4.82-minute reduction potentially provided their provider with results faster resulting in them developing their plan of care quicker. However, this is implied and was not an outcome measure of the project. By standardizing the practice that RNs would collect their patient's blood for lab work when starting an IV, patients received less venipunctures which we can assume leads to improved patient satisfaction and less pain (Nazaretian, 2017).

Implications for Nursing Practice

Essential I: Scientific Underpinnings for Practice. The DNP prepared nurse should utilize scientific underpinnings to guide practice (AACN, 2006). They should analyze and use information to develop practice, integrating knowledge from humanities and science, and translate research to improve practice and develop new approaches (AACN, 2006). This quality improvement project used lean methodology and demonstrated the significance in utilizing ED protocols, having nurses draw blood for lab work, improved understanding of job roles, and

workplace organization. This multidisciplinary approach led to improved lab TAT and improved care and experience in the ED

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking. A DNP prepared nurse should develop and evaluate practice based on science, assume and ensure accountability for quality care and patient safety (AACN, 2006). This nurse should also demonstrate critical and reflective thinking (AACN, 2006). This DNP project initiated a change process and embedded the EBP of standard work and waste elimination. New practices were introduced to the ED to improve patient care and lab TAT. These practices and lean methodology used to implement this project could be replicated in other departments within this organization and as well as others.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-based Practice. The DNP prepared nurse should be able to critically analyze literature, implement evaluation processes, design and implement quality improvement strategies, and develop practice guidelines (AACN, 2006). This quality improvement project was implemented due to ED and lab staff identifying that there were delays in lab TAT and confusion of job roles when lab orders were placed for the ED patient. A literature review was completed, and evidence-based change practices were identified and implemented. Data was collected, analyzed, and practices were changed accordingly. Recommendations were made to the facility to use lean methodology to continue to evaluate their practices and workflows to improve their ED LOS.

Essential IV: Information Systems – Technology and Patient Care Technology for the Improvement and Transformation of Health Care. The DNP graduate should utilize information systems and technology to analyze practice and improve practice as well evaluate systems of care and manage data (AACN, 2006). This DNP project used information technology

in multiple ways. Protocol orders and lab work were ordered through the EHR. RNs and lab team members utilized scanning technology to document their blood collection after using its safety features identifying the correct patient. Project data was collected through EHR reports and chart reviews. The EHR is built to guide the ED and lab team members through workflows. This technology is utilized daily and will continue to be used to improve the delivery and care for the organization's patients.

Essential V: Health Care Policy of Advocacy in Health Care. The DNP prepared nurse should provide leadership in developing and implementing health policy, educate stakeholders on policy, and advocate for policies that impact quality, finance, safety, and experience (AACN, 2006). This DNP project did not lead to the development of any health policies. However, the project did align with the Institute for Healthcare Triple Aim dimensions of improving patient experience of care and The Healthy People 2020 Access to Health Services (AHS)-9 objective by decreasing the amount of wait time for patients in the ED.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes. The DNP prepared nurse should effectively collaborate and communicate to implement practice, provide leadership, and consult intra-and inter-professionally to develop care across the health care continuum (AACN, 2006). This quality improvement project focused on collaboration between the ED and lab team members and leaders. The project team collaborated throughout implementation sharing ideas, data, and feedback. This collaboration led to practice changes in the ED that improved lab TAT and workplace organization.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health. The DNP graduate should be able to evaluate and implement changes to improve quality and integrate data to support health care delivery (AACN, 2006). This DNP

project improved health care delivery for patients in the ED. The collaborative approach improved quality of care by decreasing the number of venipunctures for patients and wait time for diagnostic testing when ED protocols were used. This project also resulted in improved lab TAT.

Essential VIII: Advanced Nursing Practice. The DNP prepared nurse should design, implement, and evaluate nursing interventions, focus on quality, and demonstrate advanced clinical judgment (AACN, 2006). They should be supporters and mentors to colleagues and provide support for teams experiencing change (AACN, 2006). Throughout all phases of this project, the project leader provided support and mentored the ED and lab team members. A literature review was completed, evidence-based solutions identified, and the project was implemented using lean methodology to promote quality care for ED patients.

Impact for Healthcare System(s)

This project improved communication between the lab and ED team members as well as provided role clarification for each discipline within these departments. The project also led to a reduction of wastes in two departments of the organization. The organization could take the methods utilized in this project and replicate them in other departmental and facility projects leading to decreased waste throughout the entire facility. The development of standard work for each role is also replicable within the facility for other roles. Reducing wastes, improving flow, and the use of standardization throughout the entire facility can improve overall operations and patient flow (Sanchez et al., 2018).

Sustainability

The workflows implemented during this project will be sustained by the facility. The ED and lab team members have verbalized they think the standard work has improved

communication and everyone knows their role in the lab collection process in the ED. The ED has planned another lean event focused on their triage process and leadership has stated that they think these two projects will continue to improve efficiencies in the ED. The ED manager has put a sustainability process in place to continue monitoring data and support these workflows moving forward.

Dissemination Plan

Quality improvement project findings should be shared with others who may want to use the information in their practice. Using a well-developed poster, PowerPoint, and this project paper, the findings of this project will be shared internally, institutionally, and externally. Internally, presentations will take place with ED and laboratory team members at their staff meetings. Institutionally, a presentation will be provided to Management Council, Tactical, ED Workgroup, and the Patient, Safety and Quality Improvement (PSQI) team. External presentations will occur at East Carolina University with DNP faculty and this paper will be placed in The ScholarShip database.

Section VI. Conclusion

Limitations

There were two main limitations of this project. The first limitation was staff buy-in and change. Phlebotomists on the laboratory team initially verbalized that they felt their job was being given to someone else and continued to report to the ED. The ED RNs initially voiced concerns that they would not have time to place protocol orders and did not see a need for them. Frequent follow-up and support were provided to both teams and both teams were able to move through Lewin's three phases of change: unfreezing, change, refreeze. The second limitation of this project was that not all data is available in the EHR and had to be collected manually which

is time consuming and opens opportunity for error. Times for arrival to first ordered lab had to be collected and manually calculated.

Another limitation of the project was the discovery that PAS was not following proper registration workflows consistently which could have caused skewed pre-project data. It is also important to note that ED care is multifaceted and complex and other factors also impact ED LOS such as radiology procedures, decision making time after tests (lab and radiology) are resulted, and the medication administration process to name a few. Leadership has made the decision that each phase of ED care will be examined through lean methodology to improve efficiencies and reduce ED LOS. The next project will focus on triage workflows.

Recommendations for Others

While this project did not lead to the overall goal of reduced ED LOS, it could be replicated in other EDs to reduce laboratory TAT and ED LOS. Lean methodology is successfully used to restructure an organization based on their needs by discovering and eliminating inefficiencies (Pyzdek, 2018). Lean principles focus on standard work and lead to decreased team member frustration, improving satisfaction and patient outcomes (Pyzdek, 2018). Team members in the lab and ED were encouraged to share ideas on improvement of workflows during mapping and throughout project implementation which resulted in them feeling empowered. These principles could be replicated for projects similar to and very different than this one.

Recommendations for Further Study

This quality improvement project did not meet the ideal outcome of decreasing the overall ED LOS but did meet improvement outcomes for use of triage protocols, standard work for collecting blood samples, and laboratory TAT for arrival to first ordered lab, lab order to

collection time, and overall laboratory TAT. When performing real time observations and chart reviews to collect data, it was observed that the ED RNs do not follow a defined or standard workflow when completing the triage process. Having standard processes and workflows during triage may improve the use of the protocols because selecting these based their patient's chief complaint would be built into their standard work practices. It was recommended that the triage workflow be evaluated and restructured to include the use of the protocols (Li et al., 2018; Sanchez et al., 2018).

Final Summary

The results of this evidence-based project indicates that lean methodology can improve workflows and remove waste and inefficiencies in lab TAT and workplace organization. The tools, standard work, and lean workflows are sustainable in the ED and can be replicated in other settings within the organization and healthcare system. Implementing this project positively impacted overall lab TAT, resulted in clear role responsibilities for lab and ED team members related to blood collection for lab testing, and workplace organization.

References

Agency for Healthcare Research and Quality (AHRQ). (2020). *Emergency severity index (ESI): A triage tool for emergency department.* https://www.ahrq.gov/professionals/systems/hospital/esi/index.html

AlManei, M., Salonitis, K., & Tsinopoulos, C. (2018). A conceptual lean implementation framework based on change management theory [Special issue]. *Procedia CIRP, 72,* 1160-1165. https://doi.org/10.1016/j.procir.2018.03.141

American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice.* https://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf

Bertie County. (2018). *2018 Community health needs assessment. Bertie County*. https://schs.dph.ncdhhs.gov/units/ldas/cha2018/BERTIE%20CHA%202018.pdf

Berwik, D., Nolan, T., Whittington, J. (2008). The triple aim: Care, health, and cost. *Health Affairs*, *27*(3), 759-769. https://www.healthaffairs.org/doi/pdf/10.1377%2Fhlthaff.27.3.759

Centers for Medicare & Medicaid Services (CMS). (2020). *Hospital outpatient quality reporting program.* https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalOutpatientQualityReportingProgram

CITI Program. (n.d.). *CITI program mission statement*. https://about.citiprogram.org/en/mission-and-history/

College of American Pathologists. (n.d.). *Quality management programs.* https://www.cap.org/laboratory-improvement/quality-management-programs

DeAnda, R. (2018). Stop the bottleneck: Improving patient throughput in the emergency department. *Journal of Emergency Nursing, 44*(6), 582-588.

Deming, W. E. (1982). *Out of the crisis.* Massachusetts Institute of Technology.

Douma, M., Drake, C., Dochartaigh, D., & Smith, K. (2016). A pragmatic randomized evaluation of a nurse-initiated protocol to improve timeliness of care in an urban emergency department. *Annals of Emergency Medicine, 68*(5), 546-552). https://doi.org/10.1016/j.annemergmed.2016.06.019

Driesen, B., van Riet, B., Verkerk, L., Bonjer, H., Merten, H., & Nanayakkara, P. (2018). Long length of stay at the emergency department is mostly caused by organization factors outside the influence of this emergency department: A root cause analysis. *PLOS One, 13*(9), 1-15. https://doi.org/10.137/journal.pone.0202751

Elamir, H. (2018). Improving patient flow through applying lean concepts to emergency department. *Leadership in Health Services, 31*(3), 293-309. doi: 10.1108/LHS-02-2018-0014.

Emergency Nurses Association (ENA). (2017). *Crowding, boarding, and patient throughput* [Position Statement]. https://www.ena.org/docs/default-source/resource-library/practice-resources/position-statements/crowdingboardingandpatientthroughput.pdf

Gupta, S., Kapil, S., & Sharma, M. (2018). Improvement of laboratory turnaround time using lean methodology. *International Journal of Health Care Quality Assurance, 31*(4), 295-308. https://www.emerald.com/insight/content/doi/10.1108/IJHCQA-08-2016-0116/full/pdf?title=improvement-of-laboratory-turnaround-time-using-lean-methodology

Haq, N., Stewart, R., Hamrock, E., Perin, J, & Khliq, W. (2018). Emergency department throughput: An intervention. *Internal and Emergency Medicine, 13*(1), 923-931. https://doi.org/10.1007/s11739-018-1786-1

Huang, Y., & Klassen, K. (2016). Using six sigma, lean, and simulation to improve the phlebotomy process. *The Quality Management Journal, 23*(2), 6-21.

Institute for Healthcare Improvement. (2017). *QI essentials toolkit.* http://www.ihi.org/resources/Pages/Tools/Quality-Improvement-Essentials-Toolkit.aspx

Inal, T., Ozturk, O, Kibar, F., Cetiner, S., Matyar, S., Daglioglu, G., & Yaman, A. (2017). Lean six sigma methodologies improve clinical laboratory efficiency and reduce turnaround times. *Journal of Clinical Laboratory Analysis, 32*(1), 1-5. https://onlinelibrary.wiley.com/doi/epdf/10.1002/jcla.22180

Kaushik, N., Khngulov, V., O'Hara, M., & Arnauout, R. (2018). Reduction in laboratory turnaround time decreases emergency room length of stay. *Open Access Emergency Medicine, 10,* 37-45. http://dx.doi.org/10.2147/OAEM.S155988

Lahr, M., Chantarat, T, Quick, M., Norris, A., & Moscovice, I. (2019, April). Hospital compare quality measure results for North Carolina CAHs: 2017. *Flex Monitoring Team State Data Report.* https://3jzjstox04m3j7cty2rs9yh9-wpengine.netdna-ssl.com/wp-content/uploads/2019/04/North-Carolina-Hospital-Compare-Report-2017-data.pdf

Leung, A., Whatley, S., Dechang, G., & Marko, D. (2017). Impact of process improvements on measures of emergency department efficiency. *Canadian Journal of Emergency Medicine, 19*(2), 96-105. DOI 10.1017/cem.2016.382

Lewin, K. (1951). *Field theory in social science: selected theoretical papers.* (1st ed.). Harper.

Li, L., Georgiou, A., Vecellio, E., Eigenstetter, A., Toouli, G, Wilson, R., & Westbrook, J. (2015). The effect of laboratory testing on emergency department length of stay: A multihospital longitudinal study applying a cross-classified random-effect modeling approach. *Academic Emergency Medicine, 22*(1), 38-46. https://onlinelibrary.wiley.com/doi/epdf/10.1111/acem.12565

Li, Y., Lu, Q., Du, H., Zhang, J., & Zhang, L. (2018). The impact of triage nurse ordered diagnostic studies on pediatric emergency department length of stay. *The Indian Journal of Pediatrics, 85*(1), 849-854. https://doi.org/10.1007/s12098-018-2617-0

McEwen, M., & Wills, E. (2019). *Theoretical basis for nursing* (5th ed). Wolters Kluwer Health.

McKillop, D., & Auld, P. (2017). National turnaround time survey: Professional consensus standards for optimal performance and thresholds considered to compromise efficient and effective clinical management. *Annals of Clinical Biochemistry, 54*(1), 158-164. DOI: 10.1177/0004563216651887

Moran, K., Burson, R., & Conrad, D. (2020). The phenomenon of interest. In *The doctor of nursing practice project: a framework for success* (3rd ed., p. 110). Jones & Bartlett Learning.

National Center for Health Statistics. (2017). *Emergency department visits.* https://www.cdc.gov/nchs/fastats/emergency-department.htm

Nazaretian, H. (2017). Blood withdrawal from intravenous catheters by ED nurses: Comparison of two practices. *Journal of Emergency Nursing, 43*(4), 322-328. https://dx.doi.org/10.1016/j.jen.2017.01.002

Office of Disease Prevention and Health Promotion. (2020, July 10). *Access to health services.* https://www.healthypeople.gov/2020/topics- objectives/topic/Access-to-Health-Services/objectives

Ortiz-Barrios, M., & Alfaro-Saiz, J. (2020). Methodological approaches to support process improvement in emergency departments: A systematic review. *International Journal of Environmental Research and Public Health, 17*(2664), 1-41. doi: 10.3390/i/jerph17082664

Probus, K., & Smith, T. (2020). Improving quality with emergency department throughput in a critical access hospital. *The Journal of Nursing Administration (JONA), 50*(6), 363-368. Doi: 10.1097/NNA.0000000000000898

Prybutok, G. L. (2018). Ninety to nothing: A PDSA quality improvement project. *International Journal of Health Care Quality Assurance, 31*(4), 361-372.

Pyzdek, T. (2018). *The lean healthcare handbook: A complete guide to creating healthcare workplaces that maximize flow and minimize waste.* Atlantis Publishing.

Sanchez, M., Suarez, M., Asenjo, M, & Bragulat, E. (2018). Improvement of emergency department patient flow using lean thinking. *International Journal for Quality in Health Care, 30*(4), 250-256. https://doi.org/10.1093/intqhc/mzy017

The Joint Commission. (n.d.). *Emergency department. https://www.jointcommission.org/en/measurement/measures/emergency-department/*

White, B., Baron, J., Dighe, A., Camargo, C., & Brown, D. (2015). Applying lean methodologies reduces ED laboratory turnaround times. *American Journal of Emergency Medicine, 33*, 1572-1576. http://dx.doi.org/10.1016.j.a.jem.2015.06.013

Wilson, M. (2016). Regulations, standards, guidelines, and benchmarks: A need for evidence-based management. *American Journal of Clinical Pathology, 145*, 742-743. DOI: 10.1093/AJCP/AQW108

Appendix A

Organizational Approval Letter

[redacted]

July 13, 2020

To East Carolina University College of Nursing:

We at [redacted]bital have reviewed Dana Byrum's DNP Project Proposal ***"Improving Laboratory Turnaround Time and Emergency Department Length of Stay."*** Ms. Byrum has organizational support and approval to conduct her Doctor of Nursing Practice student project within our institution. Our organization's liaison, or project champion, for the project is Beverly Venters, MSN, RN- Director of Quality.

We understand that the timeframe for this project is from the date of this letter through July 31, 2021. Implementation at the project site will occur August 1, 2020 through July 31, 2021, unless otherwise negotiated. We understand that for Ms. Byrum to achieve completion of the DNP program, dissemination of the project is required by the University and will include a public presentation related to the project and submission to the ECU digital repository, The ScholarShip. In addition, we understand that ECU College of Nursing encourages students completing exemplary scholarship to develop a manuscript for publication, but that is not a requirement. Our organization understands and agrees that the student will not use our organization's name in the formal project paper or any subsequent posters, presentations, or publications.

Our organization has deemed this project as a quality improvement initiative and process assessment project. Our organization is aware that this project will be processed first through our organizational approval process and then through the ECU College of Nursing process, which may include a formal review through University and Medical Center Institutional Review Board of East Carolina University (UMCIRB), if needed. Our organization does not have an Institutional Review Board (IRB). We are aware that in the absence of an organizational IRB, the project will be submitted through the ECU College of Nursing review process which may include UMCIRB review if needed.

Thank you,

[redacted]

[redacted]

Appendix B

Quality Assurance/Quality Improvement Project vs Human Research Study (Requiring IRB Approval) Determination Form

Center for Research & Grants

Quality Assurance/Quality Improvement Project vs. Human Research Study (Requiring IRB approval) Determination Form

This worksheet is a guide to help the submitter to determine if a project or study is a quality assurance/quality improvement (QA/QI) project or research study and is involving human subjects or their individually identifiable information and requires IRB approval as defined by the Health and Human Services (HHS) or Food and Drug Administration (FDA). Once completed, please email the form to the Vidant Health Center for Research and Grants (VH CRG) CRG.REQUEST@vidanthealth.com. A CRG team member will contact you with the results of their review and may request additional information to assist with their determination. The determination will be made in conjunction with the UMCIRB office.

Please contact the VH CRG with any questions at 252-847-1177 or **CRG.REQUEST@vidanthealth.com**.

For more guidance about whether the activity meets the definition of Human Subjects Research see https://rede.ecu.edu/umcirb/irb-faqs/definitions/ or https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html#c1

Project Title: Improving Emergency Department length of Stay by Reducing Laboratory Turnaround Times		
Funding Source: N/A		
Project Leader Name: Dana Byrum	☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ☑ R.N. ☐ Other(specify):	
Job Title: ECU Student / VBER Director of Patient Care Services	**Phone:**	**Email:** byrn
	Primary Contact (If different from Project Leader): N/A	
	Phone: N/A	**Email:** N/A

Key Personnel/ Project Team members:

Name and Degree:	Department: (Affiliation if other than Vidant)	Email:
Beverly Venters, RN		
Renee White, RN BSN		
Donnie Pope		
Stephanie Swain		

QI/QA Assessment Checklist:

Consideration	Question	Yes	No
PURPOSE	Is the PRIMARY purpose of the project/study to: • IMPROVE care right now for the next patient? OR • IMPROVE operations outcomes, efficiency, cost, patient/staff satisfaction, etc.?	✓	
RATIONALE 1	The project/study falls under well-accepted care practices/guidelines or is there sufficient evidence for this mode or approach to support implementing this activity or to create practice change, based on: • literature • consensus statements, or consensus among clinician team	✓	
RATIONALE 2	The project/study would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "Yes" to this statement does not preclude publication of a quality activity.)	✓	
METHODS 1	Are the proposed methods flexible and customizable, and do they incorporate rapid evaluation, feedback and incremental changes?	✓	
METHODS 2	Are patients/subjects randomized into different intervention groups in order to enhance confidence in differences that might be obscured by nonrandom selection? (Control group, Randomization, Fixed protocol Methods)		✓
METHODS 3	Will there be delayed or ineffective feedback of data from monitoring the implementation of changes? (For example to avoid biasing the interpretation of data)		✓
METHODS 4	Is the Protocol fixed with fixed goal, methodology, population, and time period?		✓
RISK	The project/study involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	✓	
PARTICIPANTS	Will the project/study only involve patients/subjects who are ordinarily seen, cared for, or work in the setting where the activity will take place?	✓	
FUNDING	Is the project/study funded by any of the following? • An outside organization with an interest in the results • A manufacturer with an interest in the outcome of the project relevant to its products • A non-profit foundation that typically funds research, or by internal research accounts		✓

If all of the check marks are inside the shaded gray boxes, then the project/study is very likely QI and not human subject research. Projects that are not human subject research do not need review by the IRB.

Methods 4- The project will be implemented during the months of January 2024- April 2024 as required by IRB. The population/setting is limited to the ED and ED patients.

In order to assess whether your project meets the definition of human subject research requiring IRB review or may qualify as a quality improvement/assurance activity, please provide the following information:

1. **Project or Study Summary:**
   Provide a summary of the purpose and procedures of the proposed project/study, please address (in addition to completing the summary, you may also attach documentation describing your proposal):
   - The project question/hypothesis
   - The project design
   - Any interaction or intervention with humans
   - A description of the methods that will be used and if they are standard or untested
   - Whether identifiable data from individuals will be used (if so, identify the source of the data and how the data will be obtained and accessed, as well data details).
   - A description of how the collected data will be used (internal/external reports, publishing, posters, etc.).

2. **If the Primary purpose of your project/study is for QA/QI, have you obtained approval from the operational leader within your department or health system:**
   ☑ **Yes** – Please specify whom:
   ☐ **No** [Contact the appropriate operational leader for approval.]

Please note:
- By submitting your proposed project/study for QA/QI determination you are certifying that if the project/study is established to qualify as QA/QI project, you and your Department would be comfortable with the following statement in any publications regarding this project: "This project was reviewed and determined to qualify as quality improvement by the Vidant Health Center for Research and Grants."
- If you are submitting a Poster to Media Services for printing, you will need to also submit this Quality Improvement Worksheet or proof of your IRB Application and IRB Approval.
- If the VH CRG determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research", "exempt research" or "expedited research".
- If you would like the VH CRG to verify that an project/study is not human subject research, please provide this form completed with the summary of your activity and any additional information to the VH CRG at **CRG.REQUEST@Vidanthealth.com** and the following will be completed and returned to you for your records.

VH CRG Determination:

☒ **Not Human Research:** The VH CRG has determined that based on the description of the project/study, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the VH CRG at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ **Human Research:** This project/study requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted

Department (Site) Manager: _____ **Date:** 10/25/2020

VH CRG Reviewer: Nichole Manning **Date:** 11/3/20

UMCIRB Office Staff Reviewer: Suzanne Sparrow **Date:** 11/3/20

Improving Emergency Department Length of Stay by Reducing Laboratory Turnaround Times
DNP Project
Dana Byrum

Table 1

Objectives, Expected Outcomes, and Measurements

Number	Objective	Expected Outcome	Measurement
1	Staff will participate in project education training	95% of staff will participate in the project education training	Percent of staff who attend session
2	RN team members will implement ED protocol orders based on chief complaint	Post intervention usage will be 50% higher than pre-intervention usage	Pre-post percentage difference in use
3	Decreased time from patient arrival to first ordered lab	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time
4	Decreased time from order placed to blood collected	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time
5	Sustained/decreased time from blood collected to lab resulted	Post intervention time will be the same or lower than pre-intervention time	Pre-post difference in time
6	Decreased ED LOS	Post intervention time will be 5% lower than pre-intervention time	Pre-post difference in time
7	RNs will draw blood when starting an IV	10% increase in RNs drawing blood when starting an IV post intervention	Pre-post percentage difference in RNs drawing blood
8	ED Workplace Organization	Post intervention score criteria of 15-20	Pre-post difference in 5S checklist score

Appendix C

Standard Work Templates

Standard Work

Project: Improving Emergency Department LOS by Reducing Laboratory TAT
Target Audience: ED RNs
Workflow: Triage Protocols with Orders for IV

Step	Task
1	Triage Patient
2	Place order(s) for appropriate ED protocol based on assessment; leave lab work as "unit collect"
3	Room patient
4	Assign RN to patient
5	Pull supplies for IV and lab work
6	Verify patient using two patient identifiers
7	Scan patient armband
8	Scan Beaker printer
9	Print lab labels
10	Start IV and collect blood for labs (Note: if unsuccessful in collecting blood, change order to "lab collect" so that lab is notified
11	Scan labels to "collect" bloodwork in .EHR
12	Take blood to lab or delegate to NAII

Standard Work

Project: Improving Emergency Department LOS by Reducing Laboratory TAT
Target Audience: ED RNs
Workflow: Triage Protocols without Orders for IV

Step	Task
1	Triage Patient
2	Place order(s) for appropriate ED protocol based on assessment
3	Change lab work orders to "lab collect"
3	Room patient
4	Assign RN to patient

Standard Work

Project: Improving Emergency Department LOS by Reducing Laboratory TAT
Target Audience: Lab MTs/MLTs
Workflow: RN Drawing Blood Work/Triage Protocols with Orders for IV

Step	Task
1	Scan and receive blood tubes in .EHR when brought to lab by ED team members
2	Place blood in appropriate equipment (analyzer vs centrifuge); FYI: normal results flow automatically to the .EHR
3	Store blood in designated area after resulted

Standard Work

Project: Improving Emergency Department LOS by Reducing Laboratory TAT
Target Audience: Lab MTs/MLTs
Workflow: Lab Team Drawing Blood/Triage Protocols without Orders for IV

Step	Task
1	Go to ED after order notification
2	Verify patient using two patient identifiers
3	Scan patient armband
4	Print lab labels
5	Draw blood work
6	Scan labels to "collect" bloodwork in .EHR
7	Take blood to lab
8	Scan blood and receive it in the .EHR
9	Place blood in appropriate equipment (analyzer vs centrifuge); FYI: normal results flow automatically to the .EHR
10	Store blood in designated area after resulted

Standard Work

Project: Improving Emergency Department LOS by Reducing Laboratory TAT
Target Audience: Lab MTs/MLTs
Workflow: Critical/Abnormal Lab Value
Trigger: Bloodwork results as abnormal or critical

Step	Task
1	Call ED to make aware further testing is needed
2	Perform further testing (may be done simultaneously with step 1)
3	Call final result to MD; if not available, call result to RN
4	Document in .EHR who you gave the results to

Standard Work Expectations

RNs will use triage ED protocols with all patients as applicable based on assessment
RNs will draw initial bloodwork when they are staring the patient's IV
RN and Lab team members will follow standard work steps
RN and Lab team members will not "collect" blood until it has physically been collected and labeled
Lab team members will not "receive" blood in the EHR until it has arrived in the lab

Appendix D

ED Triage Protocols

- The following orders have been approved by both nursing and physician leadership. ED nursing may implement any or all orders in a given order set, as well as apply multiple sets per patient as needed. If a POC test is unavailable, equivalent/similar main lab testing may be substituted.
- Medication dosages should be ordered that are weight and age appropriate and should not be given if allergies, intolerances or hemodynamic instability are in question.
- These orders will be entered by nursing into the EHR under Protocol **or** the following order sheet is to be signed by both the nurse and physician when applicable (i.e. downtime)
- Triage order sets are named per presenting symptoms or suspected/possible diagnosis to initiate treatment and **do not** constitute a medical screening exam or provider's provisional diagnosis.

Abdominal Pain / Vomiting / Diarrhea

- ☐ NPO
- ☐ Saline lock
- ☐ Lipase
- ☐ beta hCG blood if female (VMC only)
- ☐ POC urine pregnancy
- ☐ CBC
- ☐ UA
- ☐ Ondansetron (Zofran) IV 4 mg once (if patient has IV access)
- ☐ Ondansetron (Zofran) ODT 4 mg once (if no IV access)
- ☐ CMP
- ☐ POC creatinine

Altered Mental Status

- ☐ NPO
- ☐ Saline lock
- ☐ AVPU checks q2h
- ☐ CMP
- ☐ CBC
- ☐ Protime-INR if patient on Coumadin
- ☐ FSBS
- ☐ ETOH (if indicated)
- ☐ Urine Drug Screen
- ☐ UA

Acute Pain (not chronic or recurring)

- ☐ Ibuprofen PO 800 mg once

Laceration

- ☐ Apply Non-toxic wound cleanser
- ☐ Lidocaine-epinephrine-tetracaine (LET) topical solution 3 ml

Adult Asthma

- ☐ If O2 sat <94%, O2 at 2 liters/minute via nasal cannula
- ☐ Duoneb (2.5 mg/3 ml) 0.083% nebulizer solution 5 mg once (repeat once if needed)

Behavioral Health Clearance

- ☐ CBC
- ☐ CMP
- ☐ TSH
- ☐ Urine Drug Screen
- ☐ Ethanol Level
- ☐ UA
- ☐ POC urine pregnancy
- ☐ EKG (if over 30yo)

ETOH/Substance Abuse without SI/HI

- ☐ CMP
- ☐ FSBS
- ☐ Ethanol level
- ☐ CBC
- ☐ Urine drug screen, qualitative
- ☐ Stat beta hCG blood if female (VMC only)
- ☐ POC urine pregnancy
- ☐ EKG
- ☐ Therapeutic drug levels as indicated (Dilantin, Valproic Acid, Lithium, Keppra)

Behavioral WITH Overdose

- ☐ Saline lock
- ☐ Stat beta hCG blood if female (VMC only)
- ☐ POC urine pregnancy
- ☐ CMP
- ☐ Ethanol level
- ☐ Salicylate level
- ☐ Acetaminophen level
- ☐ CBC
- ☐ Urine drug screen, qualitative

Chest Pain (Suspected Cardiac)

- ☐ Saline lock
- ☐ CMP
- ☐ CBC with diff
- ☐ POC Troponin
- ☐ PT-INR (order if pt is taking Coumadin)
- ☐ Troponin I x3
- ☐ CXR 2 view (portable if appropriate)

COPD/Shortness of Breath

- ☐ If O2 sat <94%, O2 at 2 liters/minute via
- ☐ nasal cannula
- ☐ CMP
- ☐ CBC
- ☐ EKG
- ☐ Duoneb (2.5 mg/3 ml) 0.083% nebulizer solution 5 mg once
- ☐ CXR 2 view (portable if necessary)

☐ EKG ☐ FSBS	☐ 4 81mg chewable ASA PO (if not allergic)(if pt took partial dose at home give remaining dose to equal 324mg) ☐ EKG within 10 minutes	
GI Bleeding ☐ NPO ☐ Saline lock ☐ Hemoccult at bedside ☐ CBC ☐ Type and screen ☐ PT-INR if pt on Coumadin ☐ POC occult blood ☐ CMP **Possible Sepsis/Infection (SIRS Criteria)** ☐ Saline Lock ☐ CBC ☐ Lactate ☐ CMP ☐ Blood Culture ☐ UA ☐ CXR 2 view (portable if necessary) ☐ Stat beta hCG blood if female (VMC only) ☐ POC urine pregnancy ☐ Acetaminophen 1000mg PO/PR for temperature >100.4	**Extremity Injuries** ☐ NPO except meds ☐ Apply ice to affected area (if injury <48 hours old) ☐ X-ray of injured area (Notify attending if more than 2 orders required) **Urinary Symptoms** ☐ POC urine pregnancy ☐ UA complete, with microscopic, may I&O cath If menses	**Eye Injuries / Complaints** ☐ Visual acuity screening ☐ Chemical exposure: Irrigation of eye(s) with 1 liter NS, with or without Morgan lens for 15-20 minutes (remove contact lenses) ☐ Contact attending about needing Tetracaine order (0.5% ophthalmic solution for foreign body or chemical exposure, 2 drops) ☐ Fluorescein ophthalmic strip to bedside ☐ Woods Lamp to bedside **Vaginal Bleeding** ☐ NPO ☐ Pelvic set-up at bedside ☐ STAT Beta hCG ☐ POC urine pregnancy ☐ U/A
Testicular Pain ☐ Stat Scrotal U/S ☐ UA ☐ NPO ☐ Notify Physician ASAP	**Sore Throat / URI** ☐ Rapid strep screen ☐ POCT rapid strep ☐ Acetaminophen 1000mg PO once for mild pain, temp >100.4° F	**Hypoglycemia** ☐ POC glucose (repeat 15 minutes following intervention) ☐ *Give one of the 2 glucose options if FSBS <70 and the pt is cooperative and able to swallow* o 4 oz. fruit juice *OR* 4 oz. regular soda o Dextrose (Glutose) oral gel: 1 tube ☐ *Give one of the 2 glucose options if FSBS <70 and the pt is uncooperative* o 25gm Dextrose per 50mL IV once o 1 mg Glucagon IM once (if no IV access)
Renal Colic ☐ Saline lock ☐ CBC ☐ CMP	**Fever (Temperature > 100.4 F)** ☐ Acetaminophen 1000mg PO (PR if vomiting)	**Seizure** ☐ NPO ☐ Seizure precautions ☐ Saline lock

☐ UA ☐ NPO	☐ Ibuprofen 800mg PO (If Acetaminophen given within 4 hours of a prior dose)	☐ CMP ☐ CBC ☐ POC urine pregnancy ☐ Stat beta hCG blood if female (VMC only) ☐ FSBS ☐ Therapeutic drug levels as indicated
Pregnant, less than 20 weeks, with Lower Abdominal Pain and/or Vaginal Bleeding ☐ Saline lock ☐ CBC ☐ Beta HCG ☐ UA ☐ Fetal Heart tones ☐ NPO ☐ Pelvic set up to bedside	**Sickle Cell Crisis** ☐ Saline lock/access port ☐ If O2 sat <94%, O2 at 2 liters/minute via nasal cannula ☐ CMP ☐ CBC with diff ☐ POC urine pregnancy ☐ beta hCG, blood if female ☐ Retic count ☐ Chest 2 view; *If pt c/o of dyspnea and/or fever: (portable if necessary)*	**Syncope, Near-Syncope, Weakness** ☐ Saline lock ☐ POC urine pregnancy ☐ beta hCG, blood if female ☐ CMP ☐ CBC ☐ FSBS ☐ EKG

Only for EHR Downtime:
RN Signature: _____ Date/time: _____ Physician signature: _____ Date/Time: _____
RN printed name _____ Physician printed name: _____

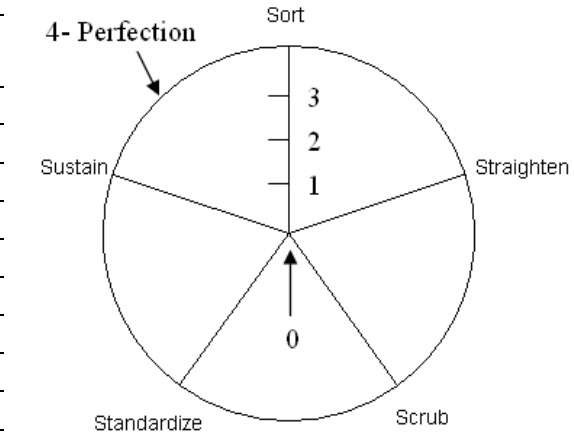
Appendix E

5S Audit Checklist and Report Tool

5S Audit		Area	Auditor	Date / /				
		Previous Score	Score	0-Very Bad, 1-Bad, 2-Average, 3-Good, 4-Very Good				
5S	**No.**	**Checking Item**	**Evaluation Criteria**	**0**	**1**	**2**	**3**	**4**
1S- Sorting Total = _____ /5=_____	**1**	**Parts and Materials List**	**No Unnecessary Items or Work in Process**					
	2	**Equipment**	**All Equipment in Regular Use, All Cabinets, Drawers, and Desks are Functional**					
	3	**Supplies**	**All Folders, Cabinets, Files, Tabletops, and Sign Boards are in Regular Use**					
	4	**Visual Control**	**All Unnecessary Items Can Be Distinguished at a Glance**					
	5	**Documentation**	**All Obsolete Documents are Routinely Purged**					
2S- Straightening Total = _____ /5=_____	**6**	**Materials**	**All Material is Presented to the Worker at the Point of Use, Frequency of Use, and in the Order of Standard Work; There is a Clearly Marked Place for Everything**					
	7	**Labeled Shelves and Stored Items**	**All Shelves and Items in Storage are Labeled Clearly. Documents are Labeled as to Contents and Responsibility for Control and Revision.**					
	8	**Quantity Indicators**	**There are Clear Indicators of maximum and Minimum Quantities**					
	9	**Bulletins and Announcements**	**All Bulletins and Announcements are Updated and Orderly**					
	10	**Supplies**	**Open Storage of All Office Supplies is Well Organized for Ease of Extraction and Return;**					

			All Supplies are Marked Clearly					
3S- Shine, Scrub Total = _____ /5=_____	**11**	**Floor**	**The Floor is Always Clean as Possible**					
	12	**Equipment and Supplies**	**All Desks and Tables are Clean**					
	13	**Cleaning and Checking**	**Cleaning and Checking are Regarded as the Same Thing.**					
	14	**Cleaning Responsibilities**	**There is a Rotation and Standard of Work for All Cleaning Activities**					
	15	**Habitual Cleaning**	**Sweeping and Wiping are Regarded as Habitual Activities**					
4S- Standardizing Total = _____ /5=_____	**16**	**Procedures**	**All Standard Procedures and Labels are Used**					
	17	**Lighting**	**The Angle and Intensity of Illumination are Appropriate**					
	18	**Area Layout**	**Minimizes the Work Required to Maintain the First 3 S's by Ensuring Waste Cannot Accumulate Over Time**					
	19	**Containment**	**Emphasis is placed on Avoiding Accumulation of Paperwork**					
	20	**The First 3 S's**	**There is a System Which Revisits the First 3 S's Frequently; All Abnormalities are Recorded and Corrected.**					
5S- Sustaining Total = _____ /5=_____	**21**	**5S Audits**	**<u>All</u> Audits are Posted in the Area, Done Weekly, and Reviewed Monthly**					
	22	**Process**	**5S Process Defined for all Employees; 5S Board Used and Updated**					
	23	**Disciplined System**	**There is a <u>Disciplined</u> System of Control and Maintenance to Assure 5S is Maintained at the Highest Possible Level**					

	24	**Rules and Procedures**	**All Rules and Work Procedures are Acknowledged and Respected**							
	25	**Observation of Rules**	**All Rules and Regulations are Strictly Observed**							
Comments										
	1S									
	2S									
	3S									
	4S									
	5S									



Score Calculation	
Sort Score	
Straighten Score	
Scrub Score	
Standardize Score	
Sustain Score	
Total	
Average	

Connect Dots and Shade in Area

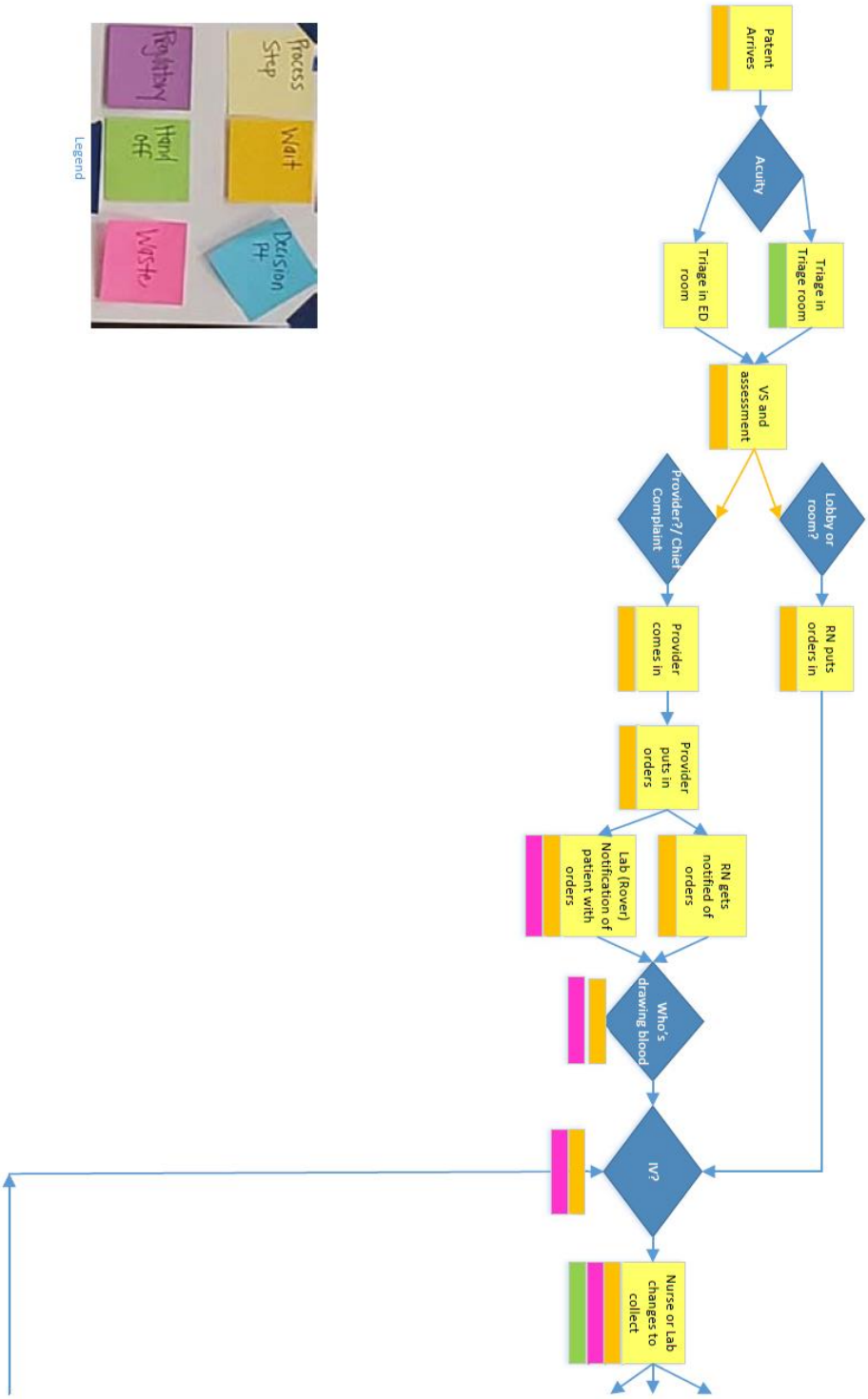
Appendix F

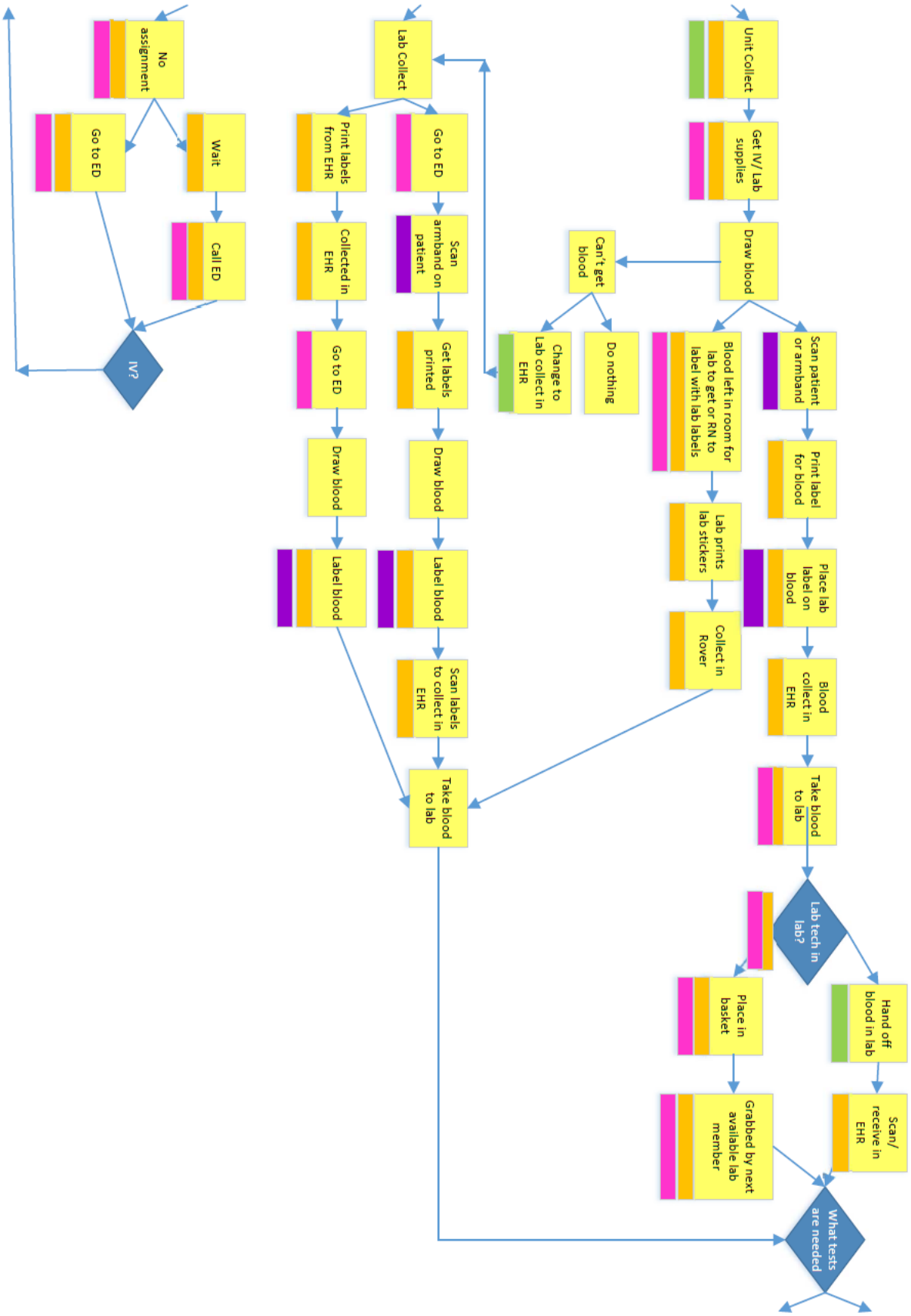
DNP Project Timeline

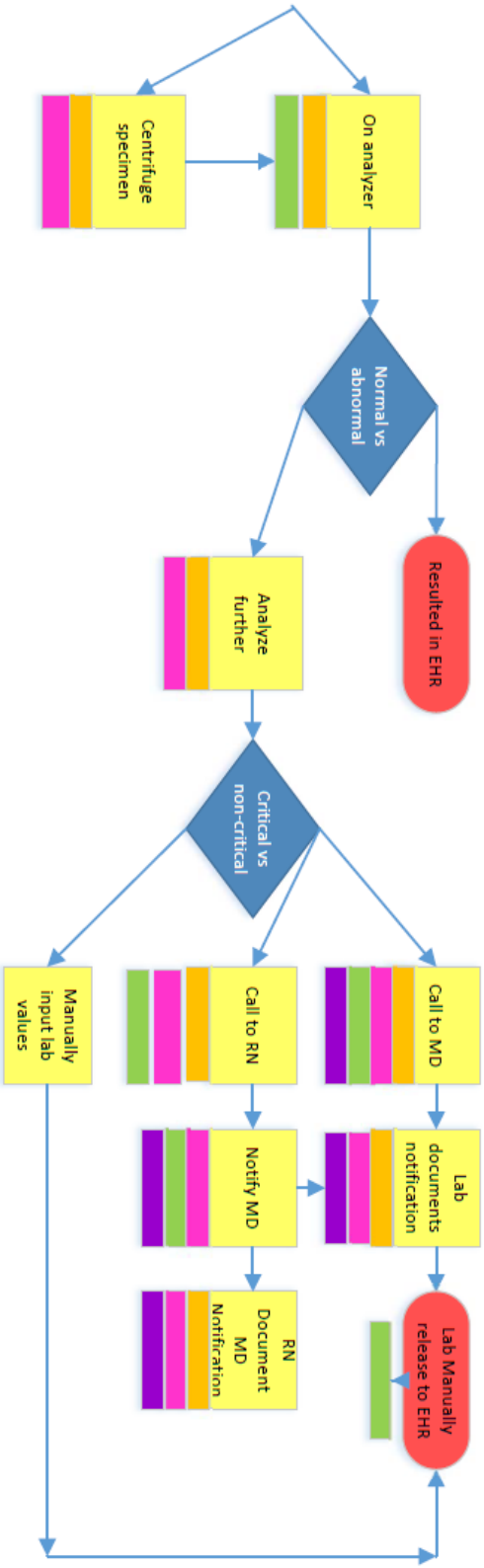
DNP Project Implementation Timeline	
Week 1 1/19/2021-1/23/2021	• Email notification and reminders to laboratory and ED unit leaders, medical director, and administrative team project and start date • Post MDI board in ED and laboratory with pre-intervention data so team members can visualize the current state • Post flier with roving educational session times
Week 2 1/24/2021-1/30/2021	• Conduct roving educational sessions utilizing the developed educational tools. Sessions will occur during all shifts to help ensure all team members are educated. An opportunity will be provided for those who are on FMLA or LOA • Place laminated standard work documents on the units for team members to refer to during their workday • Place laminated ED protocols in the triage room and on each WOW in the ED
Week 3 1/31/2021-2/6/2021	• Go-live of implementation of new workflows for blood collection and ED protocols • Monitor implementation process and data collection • Provide support for participants
Week 4 2/7/2021-2/13/2021	• Perform 5S event • Continue monitoring implementation process and data collection • Perform PDSA cycle as needed • Provide support for participants
Weeks 5-15 2/14/2021-4/30/2021	• Continue monitoring implementation process and data collection • Conduct 5S audit rounds weekly • Perform PDSA cycle as needed • Provide support for participants
Weeks 16-17 5/2/2021-5/15/2021	• Compile all collected data using chart audit tools and charts • Analysis and evaluation of data • Complete evaluation
Week 18 5/16/2021-5/22/2021	• Disseminate project results to project champion and ED and lab leaders.

Appendix G

Current State Process Map

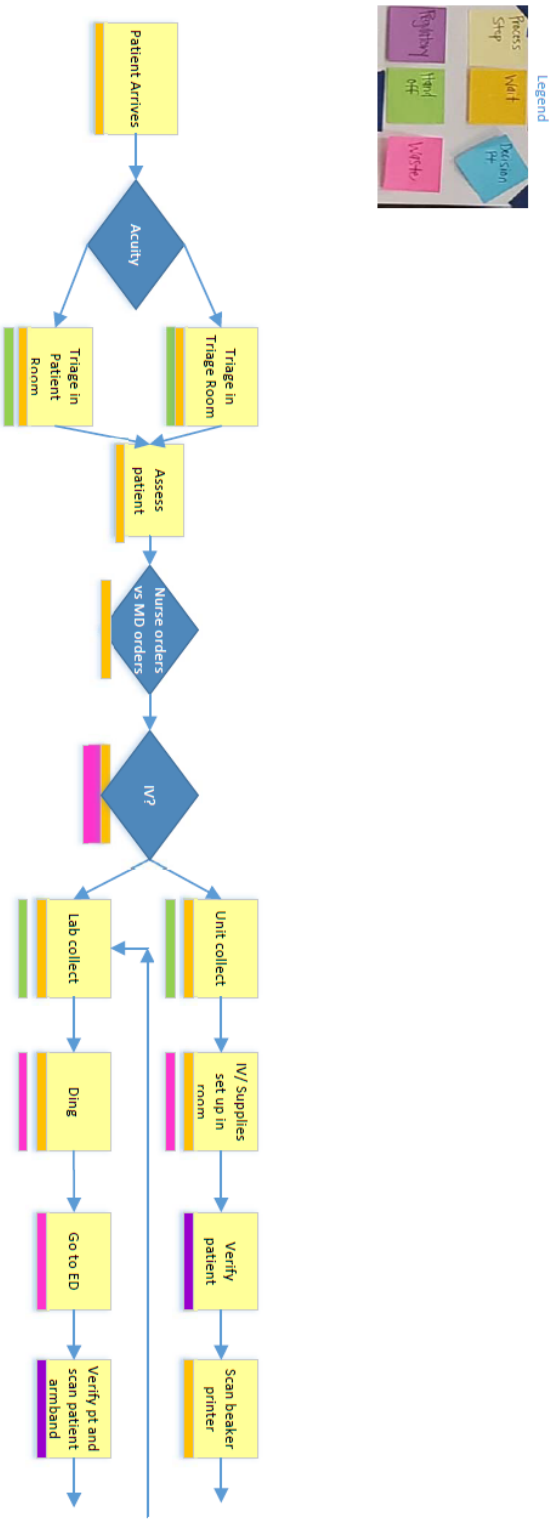


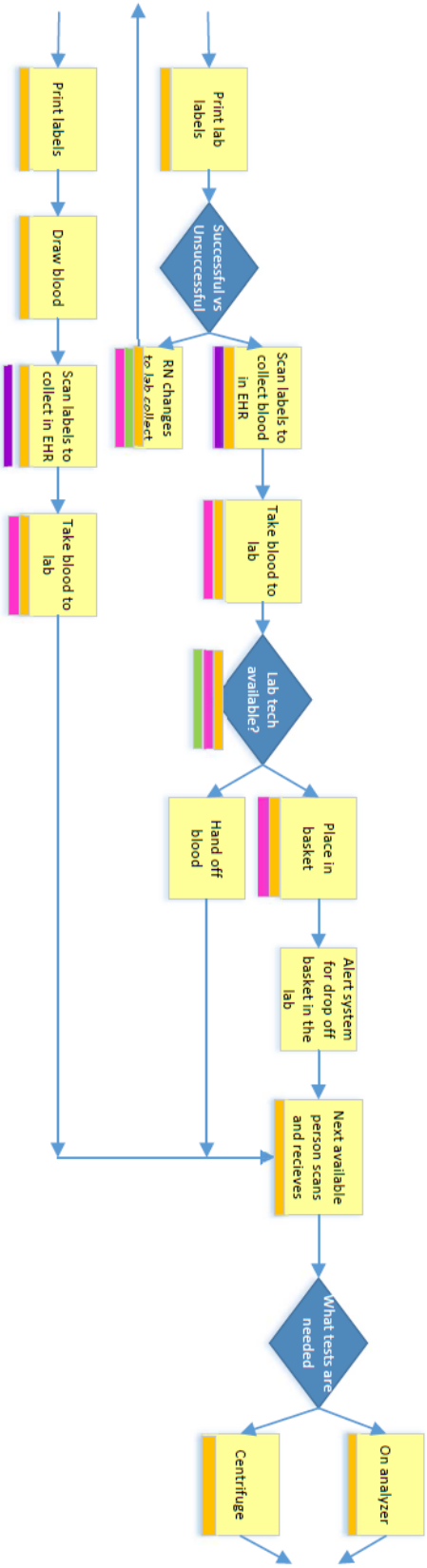

No assignment
Go to ED
Wait
Call ED
IV?
Lab Collect
Print labels from EHR
Collected in EHR
Go to ED
Draw blood
Label blood
Go to ED
Scan armband on patient
Get labels printed
Draw blood
Label blood
Scan labels to collect in EHR
Take blood to lab
Unit Collect
Get IV/ Lab supplies
Draw blood
Can't get blood
Change to Lab collect in EHR
Do nothing
Blood left in room for lab to get or RN to label with lab labels
Lab prints lab stickers
Collect in Rover
Scan patient or armband
Print label for blood
Place lab label on blood
Blood collect in EHR
Take blood to lab
Lab tech in lab?
Place in basket
Grabbed by next available lab member
Hand off blood in lab
Scan/ receive in EHR
What tests are needed

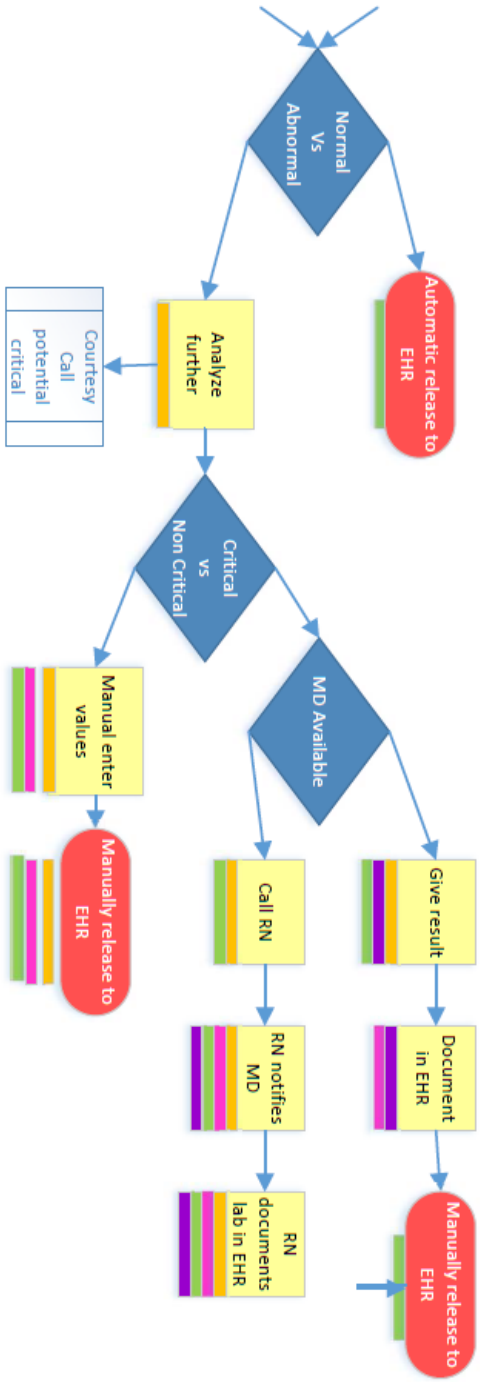

Centrifuge specimen
On analyzer
Normal vs abnormal
Analyze further
Resulted in EHR
Critical vs non-critical
Manually input lab values
Call to RN
Call to MD
Notify MD
Lab documents notification
RN Document MD Notification
Lab Manually release to EHR

Appendix H

Future State Process Map




Print labels
Draw blood
Scan labels to collect in EHR
Take blood to lab
Print lab labels
Successful vs Unsuccessful
RN changes to lab collect
Scan labels to collect blood in EHR
Take blood to lab
Lab tech available?
Hand off blood
Place in basket
Alert system for drop off basket in the lab
Next available person scans and recieves
What tests are needed
Centrifuge
On analyzer


Normal Vs Abnormal
Automatic release to EHR
Analyze further
Courtesy Call potential critical
Critical vs Non Critical
Manual enter values
Manually release to EHR
MD Available
Call RN
RN notifies MD
RN documents lab in EHR
Give result
Document in EHR
Manually release to EHR

Appendix I

SWOT/Gap Analysis

Emergency Department LOS/Laboratory TAT Event SWOT Analysis (Gap Analysis)	
Strengths	**Weaknesses**
• Administrative support • ED unit leadership support • Lab unit leadership support • Lab draw buddy cards available for all ED RNs • Unit champions for standard work support	• Inconsistency in RNs drawing blood/willingness • Inconsistency in MT/MLTs drawing blood/willingness • No dedicated location for blood drawing supplies in patient rooms • Some team members wait until next shift of team members to perform blood draws • Inconsistency of ED RNs taking bloodwork to lab • Small TV makes it hard for lab team members to see orders for the ED • Inconsistent and inappropriate use of ED protocols
Opportunities	**Threats**
• Project time endured by DNP student-decreases resource need for facility • First lean event for these two departments collaboratively • ED throughput is a system-wide focus	• Unit leadership for lab and ED does not support the other department • Lack of buy-in from patient facing team members • Blame-like culture between ED and lab • Competing priorities when there are several patients in the ED • One RN in ED is the charge nurse for the whole hospital • Only one lab tech in the building at night and weekends

Appendix J

Emergency Department LOS/Laboratory TAT Event Parking Lot

Emergency Department LOS/Laboratory TAT Event Parking Lot		
Topic	Department	Next Steps
Diagnosis Codes not on Walk-In Laboratory Orders	PAS	Project leader to follow-up with PAS leader to re-educate PAS team members to verify MD wrote diagnosis code on order to ensure payment
Armband Pile	ED	Project leader to follow up with ED leader to re-educate team members that extra armbands should not be printed for scanning.
Unit Secretary for Lab and ED	Lab and ED	Project leader to share suggestion of adding a unit secretary in the ED and Lab
RT to perform and result ABGs	RT	Project leader to share suggestion with RT leader and RT administrator.
EMS SBAR	Lab	Project leader to share with EMS appropriate labeling of blood when brought in.
RTs to perform EKGs in ED	ED/RT	Project leader to share suggestion of having RT perform EKGs in the ED.
NAIIs working to top of Certification	ED	Project leader to share with ED leader that it is recognized that NAIIs do not always work to the top of their certification.
Consistent NAII Coverage in ED	ED	Project leader to share with ED leader that there is an opportunity for consistent NAII coverage in the ED
Internal Rural Health Clinic Lab Draws	Rural health clinic/Lab	Project leader to share with RHC and lab leaders' suggestion to revamp lab collection process in the rural health clinic.
ABG, EPOC, Sed Rate Analyzers	Lab	Project leader to share with lab leader suggestion of requesting new model, non-

		manual analyzers for ABGs, EPOC, and Sed Rate tests.
Vocera	Lab	Project leader to share with lab leader suggestion of getting lab team members Vocera for ED team members to call them when they are not in the lab.
Nurse Assignment	ED	Project leader to share with ED leader that re-education is needed to remind RNs in the ED to assign themselves to their patients, so the lab team members will know who is caring for the patient.
Labs before Radiology (Unless Code Stroke)	Lab/ED/Radiology	Project leader to share with Radiology leader suggestion of allowing lab work to be drawn prior to taking the patient to radiology if labs and radiology ordered to help improve TAT time for lab.