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Effect of Creatinine Point-of-Care Testing on Turnaround Time for Computed Tomography Exams with Intravenous Contrast

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This doctoral project, directed and approved by the candidate's committee, has been accepted by the College of Graduate and Professional Studies of Abilene Christian University in partial fulfillment of the requirements for the degree

Doctor of Nursing Practice

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by

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Acknowledgments

Thank you to my husband and children, who supported this endeavor to achieve a doctoral degree. I thank God for the vision and confirmation provided to achieve this momentous accomplishment. Thank you to my peers who supported and encouraged me along the way. May God use this degree for His glory and accomplish His kingdom's agenda.

Abstract

Emergency departments often have a stigma of long wait times. They face multiple challenges related to the flow of patient care due to the variety of factors that affect care and treatment. In order to support patient-centered care, the purpose of this project was to determine if point-of-care testing of creatinine decreases turnaround time for computed tomography exams with intravenous contrast in the emergency department. A mixed methodology of consecutive sampling and retrospective data collection was used. In all, 128 ratio data elements were reviewed, including a retrospective review of 64 charts from September 2018 and a consecutive sample of 64 charts from September 2019 for ED patients aged 18 or older who had a CT with IV contrast exam ordered and completed. Results showed a decrease in turnaround time of 66 minutes. Further research and data collection are recommended to ensure sustainability and a hardwired process change and to determine other benefits of implementation of point-of-care testing in the emergency department.

Keywords: point-of-care testing (POCT), intravenous (IV) contrast, turnaround time

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Chapter 1: Introduction

For many health care organizations, the emergency department (ED) is the front door to the facility. For most of these organizations, admissions in the acute care setting come primarily from the ED. There are several cause-and-effect relationships related to efficiencies or inefficiencies in the ED. Of course, every health care facility desires to operate an efficient ED in order to ensure it provides quality care, functions at its maximum potential, and maximizes revenue. Many factors affect patient experience and the decision whether or not to return to the ED, if needed. EDs with long wait times may lose revenue because of decreased patient satisfaction and patients who leave without being seen (LWBS). LWBSs are patients who arrive but leave without treatment or without being seen by a provider due to long wait times (Mandavia & Samaniego, 2016). In 2011 the Agency for Healthcare Research and Quality (AHRQ) published a guide for hospitals named *Improving Patient Flow and Reducing Emergency Department Crowding* (McHugh, Van Dyke, McClelland, & Moss, 2011). This guide serves as a template that organizations can use to assist with deploying strategies for performance improvement and patient flow initiatives in the ED to reduce overcrowding, wait times, and LWBSs. When these factors are decreased, organizations stand to gain increased revenue and improved patient satisfaction and quality (McHugh et al., 2011). A global view of patient flow requires exploration of several factors, such as staffing levels within the ED and inpatient units, the bed management system, the use of hospitalists in the ED, and turnaround time for lab and imaging results within the ED.

Background

Overcrowding in the ED is not a volume problem but rather a patient flow problem. This is not a new challenge for health care organizations. Overcrowding in the ED has been discussed in the literature as far back as 1987. Since that time, most organizations have not been successful in making improvements to correct patient flow issues. Initially, hours of ED operation were much like regular business hours, Monday through Friday. Given the changes in society, as well as what drives hospital operations, hospital operators have had to think outside the box to manage the ED efficiently and effectively (Salway, Valenzuela, Shoenberger, Mallon, & Viccellio, 2017). According to Barrett, Ford, and Ward-Smith (2012), overcrowding in the ED is due to not having available space on the inpatient units; therefore, since 2006, regulatory agencies have been called upon to enforce measures to improve patient flow within organizations.

The Centers for Medicare and Medicaid Services (CMS) has required hospitals to report five ED crowding measures under the Inpatient Quality Reporting (IQR) program since 2013 (QualityNet, n.d.). Numerous studies have proved that overcrowding produces less-than-adequate quality of care. Since 2014, hospitals have been required to report the median time from ED arrival to ED departure for admitted patients (McHugh et al., 2011). For hospitals that participate in the IQR, the data for these elements are displayed on the public-facing Hospital Compare website. Individuals in the community then use that information to make decisions about which facility to visit. Hospital Compare shows how each hospital compares to its peers, as well as state and national benchmarks. CMS bases the state and national benchmarks on the ED's volume for the reporting period by classifying it either as low, medium, high, or very high (QualityNet, n.d.).

Purpose of the Project

The purpose of this project was to evaluate point-of-care testing (POCT) in the ED, specifically i-STAT blood analysis for creatinine. The intent was to prove a decrease in turnaround time for completion of computed tomography (CT) with intravenous (IV) contrast. The goal of reducing turnaround time was to improve the flow of patients through the ED. The secondary effect was the reduction of ED wait times from arrival to departure, which would improve patient flow.

Statement of the Problem

The problem the ED faced as it related to patient flow was significant wait times for standard laboratory test results. Long wait times caused delays in diagnostic testing procedures for radiology, specifically CT exams requiring IV contrast. Multiple factors impede patient flow, including bed availability and staffing. Improvement in patient flow would be unlikely without implementation of POCT for creatinine levels.

Significance

The problem of interest was significant because it addressed patient flow throughout the organization. Improvement in turnaround time for diagnostic procedures within the ED reduced length of stay in the ED, which improved patient flow. According to Salway et al. (2017), capacity issues can result from improper use of surgical time. For example, if the majority of elective cases are booked on the same day as the highest-volume day in the ED, this limits bed availability due to boarding of patients in the ED. Boarding of patients in the ED results in increased medical errors, increased mortality rates, and decreased quality of care. This relates to the problem because if the organization is waiting on lab results before the patient can even be treated, there is a significant delay in care.

Mandavia and Samaniego (2016) stated, “for an ED that treats 30,000 patients annually, reducing the average patient visit from four hours to three would result in an additional 30,000 available bed hours, or the ability to treat an additional 10,000 patients per year” (p. 67). In

Mandavia and Samaniego's (2016) study, a redesign of the triage, registration, and waiting areas created a 50% decrease in overall wait times for patients in the ED. This is relevant because the amount of time spent waiting for lab results is only one internal factor that affects wait time. There is no one-size-fits-all approach to improving wait times but a host of many. In this project, I focused on turnaround time for CT exams in order to limit the wait time for lab results before diagnostic tests can be completed.

While revenue is not the only driving force that gives meaning to health care, it indeed helps in an era of competing services. It has become increasingly challenging for acute care facilities to continue to thrive financially in an environment of accountability and affordable health care. Community stand-alone facilities are being forced to evaluate their financials and ability to remain independent; many align with larger partners to stay viable (Gish & Kamholz, 2009). Therefore, leaders are required to evaluate all processes to ensure that waste is eliminated and process improvement is initiated in order to deliver quality health care at the lowest price. Evaluating a process measure such as the one investigated in this study may help eliminate wasted time and improve patient flow. Enhancing care delivery by reducing lab turnaround time is an internal factor that can be controlled by health care providers with the right process measures in place, which is the purpose of this project.

Nature of the Project

The primary focus of this project was on turnaround time for imaging results, specifically CT ordered with IV contrast. Evidence has shown that implementation of POCT in the ED results in a significant decrease in length of stay from arrival to the ED to admission. In one study, when POCT for creatinine was used, there was an 81-minute reduction in turnaround time for completion of CT with IV contrast (Singer, Williams, Taylor, Le Blanc, & Thode, 2015). It was crucial that this method be considered for implementation to improve patient flow.

Hypothesis. In reviewing the problem of interest as it relates to lengthy turnaround times for CT exams with IV contrast due to extended wait times on a serum creatinine, the following can be hypothesized: Implementation of POCT for creatinine in the ED would eliminate the wait time for lab values, thereby decreasing turnaround time for CT exams with IV contrast. The PICOT question evolved from this hypothesis: *In patients aged 18 or older who present to the ED needing a CT with IV contrast exam completed (P) through the use of point-of-care testing of creatinine (I) compared to standard laboratory testing (C), will there will be a decrease in turnaround time for CT exams with IV contrast (O) over a 3-month time frame (T)?*

Population (P). In this project, the population consisted of ED patients aged 18 or older who had a CT exam with IV contrast ordered and completed. No other patients were considered in the population of interest.

Intervention (I). The intervention for this project was the launch of creatinine POCT in the ED for patients who fit the population identified. A registered nurse (RN) completed the POCT at the bedside. The RN was a licensed professional credentialed through training and competency to collect lab work. It was within the scope of practice for the RN to collect lab work from patients (Texas Board of Nursing, 2013). The creatinine POCT was completed on patients aged 18 or older who presented to the ED and had a CT exam with IV contrast completed.

Comparison (C). The comparison for this project was an evaluation of standard laboratory testing. I completed a retrospective chart review on patients who met the study population inclusion criteria prior to the launch of POCT. Prior to the launch of the POCT, the organization utilized standard laboratory testing to obtain serum creatinine results. I retrospectively reviewed the data. The time frame for the current data collection was September 2019. I collected the retrospective data from September 2018, the year prior to the POCT. The rationale for using the same month a year prior was to eliminate seasonal differences.

Outcome (O). I used queuing theory (QT) as a framework to determine if there was any difference in turnaround times for CT exams with IV contrast utilizing creatinine POCT compared to the same time frame a year prior utilizing standard laboratory testing without POCT. I completed a descriptive statistical analysis, discussed the results, and provided recommendations.

Time (T). The time frame chosen for this project was three months of active data collection or until the desired sample size was reached, whichever came first. The time frame for the retrospective data coincided with the time frame of the consecutive data collection to eliminate seasonal volume differences. The actual time frame for this project was one month due to the high volume of CT exams. The sample size was met using the snowball sampling method.

Research Questions

The following research questions served as the basis for the project:

Q1. What process changes will occur to complete implementation of POCT for creatinine?

Q2. Will the turnaround time for CT with IV contrast improve with the use of POCT?

Q2a. Will the time from ED arrival to ED departure for patients who have a CT exam with IV contrast ordered improve secondarily?

Scope and Limitations

The scope of the project was limited to patients aged 18 or older who presented to the ED and had a CT exam with IV contrast completed. It is standard organizational policy to obtain a creatinine level on all patients who require a CT with IV contrast. Although I thought the volume of ordered diagnostic tests in the period of the project would pose a limitation, it did not prove to be a limitation; in fact, the opposite was true. Other limitations I considered were the learning curve of the staff and the introduction of a new process. I conducted the retrospective chart review for the same time frame of the current data collection the year prior to examine the data for standard laboratory testing. The population in the retrospective chart review was subject to the same inclusion and exclusion criteria as the population in the current chart review.

Operational Definitions

The following operational definitions are defined to give the reader insight to the research conducted and explanation of key terms:

Acute kidney injury. Acute kidney injury (AKI) is rapid in onset with a sudden inability to produce urine, which leads to elevated serum creatinine levels. AKI requires renal replacement therapy and is a predictor of mortality (Pearson, 2016).

Computed tomography. A computed tomography (CT) exam is a diagnostic exam in which detailed images and scans are taken of the inside of the body (National Cancer Institute, 2013).

Emergency department. The emergency department (ED) is an area of the hospital that is prepared to care for emergencies (“Emergency Department,” 2009).

Intravenous contrast. Intravenous (IV) contrast is a medium that is injected into the bloodstream to provide a clear picture with contrast in diagnostic imaging. This allows the radiologist to read the film accurately (Radiological Society of North America, 2018).

Patient flow. Patient flow is defined as the ability to move patients through the health care organization in a timely fashion (NEJM Catalyst, 2018).

Point-of-care testing. Point-of-care testing (POCT) is testing that is performed at or near the point of care. POCT is used primarily for laboratory testing. The most popular forms are urine testing and bedside glucose. Common lab values completed in the ED setting include cardiac enzymes and creatinine (Bargnoux et al., 2018).

Registered nurse. A registered nurse (RN) is one who has completed course requirements from an approved school of nursing and has passed a national licensure examination from the state board. The RN uses specialized judgement and skill through required competency and course evaluation (Texas Board of Nursing, 2013).

Turnaround time. Turnaround time is defined as the average time it takes to complete a process (Pati & Singh, 2014).

Chapter Summary

The purpose of this project was to evaluate a process change in which an RN began performing creatinine POCT at the bedside in the ED instead of using standard laboratory serum testing of creatinine. I sought to determine if there was a decrease in turnaround time for CT exams with IV contrast. If the null hypothesis is verified, the secondary effect will be improved patient flow through the ED. For this project, I utilized a three-part conceptual model: input, throughput, and output.

Chapter 2: Literature Review

This chapter includes the theoretical framework and a review of the literature as it relates to using creatinine POCT to improve CT exams with IV contrast. For the purposes of this project, it is imperative to lay out several operational and concept definitions.

Theoretical Framework Discussion

There are multiple moving parts and processes that occur simultaneously in the care of patients through an ED. Efficiency and quality are paramount. In order to assist hospital administrators and policy makers in understanding the causes and development of solutions to ED overcrowding, Asplin et al. (2003) identified a three-part conceptual model that evaluates input, throughput, and output.

This model was used to determine how to improve the quality of care delivered by understanding the metrics and how operations flow through the ED. This model was developed with the hope that hospital administrators and leaders could implement and eventually develop improvements in ED throughput and hospital patient flow (Asplin et al., 2003). This three-part model to improve patient flow for the operations of the organization as well as development of policy and practice was useful in guiding this evidence-based practice project.

According to the model, the input is defined as an element that competes for demand of ED services. This could be patients who arrive via ambulance, ambulatory through the lobby, dialysis providers, outpatient IV therapy after hours, or patients sent to the ED from urgent care. Throughput is defined as the elements of care provided while the patient is in the ED, which utilize resources and contribute to the length of stay in the ED. Examples of throughput would be registration, evaluation by a provider, and laboratory and/or diagnostic testing. Finally, the output is the disposition of the patient, whether the patient is discharged home, transferred to a higher level of care, or admitted to the facility. Inadequate disposition can lead to boarding of patients in the ED, hence the need to provide efficient, quality care to provide adequate disposition. This conceptual model was used to create a conceptual rendition as described in Figure 1. The relevance to the project is also defined in the conceptual framework discussion.

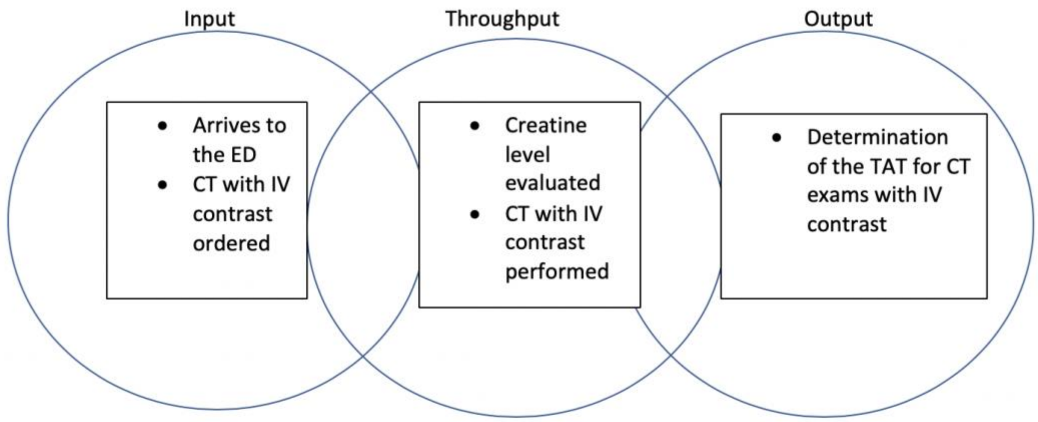

Figure 1. The conceptual framework. This figure shows a rendition of the input, throughput, and output theoretical framework.

Conceptual Framework Discussion

Input. This refers to patients who arrive via ambulance or ambulatory through the ED lobby and have an order for a CT exam with IV contrast that has been put into the system.

Throughput. Throughput refers to all of the action that occurs between the time the patient arrives and the time the patient is dispositioned. For this project, the throughput was the assessment of creatinine levels either by POCT or retrospective chart review of basic serum laboratory testing and CT with IV contrast turnaround time.

Output. Output is the disposition of the patient either by discharging the patient home or by admitting the patient to the hospital for further care but transferring them to another unit. For the purposes of this project, the output was defined as the completion of the CT exam and determination of the turnaround time from the time of order to the time of completion.

Instrument

Queuing Theory (QT) describes what happens when a number of tasks or jobs produce long wait times or delays in care, using principles much like supply and demand. QT can be used to estimate how long each task will take based on the resources available versus those required. ED operations require queues; therefore, QT can be applied when certain queues appear within the system (Asplin, 2003).

I conducted a comprehensive literature review to determine the evidence around using QT to improve ED outcomes. I performed a search of peer-reviewed journal articles in the Abilene Christian University (ACU) online library, PubMed, and ScienceDirect databases. The keywords I used were *queuing theory*, *patient flow* or *patient throughput*, and *emergency department*. Originally, I retrieved 52,426 studies. I narrowed the search to include peer-reviewed journal articles between 2013 and 2017. This reduced the retrieval to 654 studies. A further reduction to articles that appeared in ScienceDirect and were published in the English language brought the search to 178 studies. Of those, I reviewed 14. Of the 14, I identified three level 2 systematic reviews, two qualitative studies, three level 1 articles, and two randomized controlled trials. The remaining four were a mixture of reviews. In all of the studies I evaluated, QT was used to look at a number of different queues within the ED to improve patient satisfaction and decrease wait time.

Rationale and Evidence

Upon evaluating the evidence related to improving ED wait times, I found that using QT to apply the three-part conceptual model to measuring improvement was the most relevant instrument of choice. In a study conducted utilizing QT, Lin, Patrick, and Labeau (2014) evaluated the specific queues of the access point to the ED (the input) and access to the inpatient unit (the output). In this particular study, researchers evaluated multiple aspects of patient flow including patient acuity level and provider preference. Wait times were estimated using QT to determine resource needs for the ED and inpatient units when the ED was at capacity (Lin et al., 2014). By using QT, researchers can estimate wait times for diagnostic testing, laboratory results, and peak volume by time of day—all of which contribute to the length of stay in the ED.

Haghighinejad et al. (2016) conducted a cross-sectional study in an Iranian ED using QT to determine wait time, the number of patients waiting, and utilization of ED resources. In a one-month period, 4,088 patients were treated and discharged, and 1,238 were queued waiting for a bed. By using QT, the observers determined their output was due to bed capacity on the inpatient units. By increasing their bed capacity from 81 to 179, they decreased the number of patients waiting to 586 from 1,238 (Haghighinejad et al., 2016).

In another study conducted to use QT to investigate patient access (the input) and patient flow (the throughput) in the ED, Laskowski, McLeod, Friesen, Podaima, and Alfa (2009) evaluated numerous agents such as treatment area, nursing flow, patient care points, and waiting time. In this evaluation, QT provided real-time data to better refine and optimize hospital operations (Laskowski et al., 2009).

Advantages and Disadvantages

The advantage of using a combination of the three-part conceptual model and QT is that it gives credit to what happens in the throughput. Evaluating only two parts (input and output) neglects the most critical piece: the ingredients of care. QT provides concrete data because information technology and tracking systems can be used to capture accurate times for each queue and concept measured (Xie, Cao, Huang, & Ong, 2016). QT can reveal the areas of needed resources based on supply and demand.

The disadvantage is that it is difficult to use QT and the three-part model to conceptualize the many different internal and external variables that affect the timing and flow through the ED. What sounds simple, decreasing wait time, is actually a monumental undertaking because of the added factors. Therefore, QT could potentially underestimate delays and deliver inaccurate results because it does not factor in congestion (Hu, Barnes, & Golden, 2018).

Relevance

QT can also be utilized to estimate wait times between normal lab tests and results compared to POCT. In this case, when the CT exam with IV contrast was ordered, the second queue was the testing and evaluation of creatinine values. The third queue was the time at which the diagnostic exam was completed. Hence, QT and the three-part conceptual model were a necessary part of the evaluation.

IV contrast is needed for the accuracy of evaluation during a diagnostic CT. Without the use of IV contrast, inaccurate readings or impaired ability to view the scan could result. Patients with elevated creatinine are at high risk for contrast-induced nephropathy (CIN). CIN can lead to acute kidney injury and cause long-term damage to one’s kidney function, which can lead to more extended hospital stays, readmissions, and mortality (Martínez Lomakin & Tobar, 2014). This diagnosis can also cause lasting patient effects such as peritoneal dialysis or hemodialysis, hence the reason for creatinine testing before ordering CT with IV contrast.

Search Strategy

Literature to determine the evidence around using POCT to improve ED flow metrics was reviewed. Using the ACU online library to access peer-reviewed journal articles, I performed a search of PubMed and ScienceDirect. The keywords I used were *point-of-care testing* and *CT exams*, and *patient flow* or *patient throughput* and *emergency department*. Originally, I retrieved 1,916,461 items. Then I narrowed the search to include peer-reviewed academic journal articles between 2013 and 2018. This reduced the retrieval to 98,583. I added the keywords *computed tomography exams* and *creatinine* to the search fields. This narrowed the search to 11,996 results. A further reduction to ScienceDirect and English-language articles only brought the search to 2,237 peer-reviewed journal articles. Of those, I reviewed 10 based on topic specificity.

Synthesis

I found consistent reports across the literature of improvement of patient flow through the POCT in the ED. These researchers evaluated different types of POCT in the ED such as troponin, creatinine, and glucose, as well as urine POCT. The systematic review showed that the accuracy of POCT is comparable to that of standard laboratory testing. The review also showed an improvement in patient flow (Fermann & Suyama, 2002). The researchers analyzed different types of POCT such as cardiac enzymes, urine analysis, and creatinine. Regardless of the type of POCT, the outcomes were similar. The barriers and challenges proved to be similar as well among the studies, resulting in the need for staff education and regulatory requirement expectations.

Two of the articles were nonresearch articles that evaluated barriers to POCT implementation based on accreditation requirements and standards. Six of the articles had problem statements or purposes related to the effects of POCT and its correlation to standard laboratory testing. For two of those articles, the researchers reviewed the impact of turnaround time for procedures as well as ED length of stay. The independent variables that the reports had in common were POCT testing, laboratory testing, and the location of either the ED or radiology. In a retrospective chart review of patients seen in the ED, Juliano and Wason (2017) found POCT to be accurate and to have a significant correlation to laboratory testing; therefore, it was just as clinically accurate and safe as laboratory testing.

Evidence-Based Table

I compiled the articles I reviewed into an evidence-based table to summarize their design, results, strengths, weaknesses, and levels of evidence. Of the 10, six of the studies provided level 3 evidence, one provided level 1 evidence, one provided level 2 evidence, one provided level 4 evidence, and one provided level 5 evidence. In all of the studies that I evaluated, researchers reviewed the use of POCT to improve wait times for exams in both radiology and the ED (see Appendix A).

Critique

In a quantitative study conducted using a before-and-after design to determine the effect of POCT on patients in the ED, Singer, Williams, Taylor, Le Blanc, and Thode (2015) reported favorable results. By implementing a comprehensive POCT method, the hospital reduced turnaround time for CT results by 81 minutes (Singer et al., 2015).

In a level 3 analytical comparison study, Kemper et al. (2017) found POCT of cardiac troponin to be an accurate method of collection and determination in order to improve the flow of chest pain patients through the ED. Although the researchers evaluated a different type of POCT than evaluated in this study, they still found it improved patient flow for a specific patient population.

Singer et al. (2015) chose to compare the accuracy of POCT performed in the emergency room versus a primary laboratory test using a retrospective chart review method. Results were favorable. The researchers found a high correlation between five different types of POCT and confirmed the hypothesis that POCT would decrease wait times in the ED, improve CT turnaround time, and decrease length of stay (Singer et al., 2015). POCT provided accurate results within seconds compared to the minutes or even hours standard laboratory results required.

In a systematic review, Martínez Lomakin and Tobar (2014) found that the time for a diagnosis to be delivered decreased from 38.5 to 4.9 minutes with the use of POCT. This research supports the hypothesis of this study because if CT with IV contrast is completed in a timely fashion, diagnosis and a plan of care are not delayed.

The majority of articles I found compared POCT and primary laboratory testing values. The majority of the findings were similar. POCT values correlated to laboratory testing values, and POCT improved turnaround time for patient care and patient flow. For studies in which a retrospective review was completed, it would have been beneficial to have details on data collected, time of day, and day of the week. It also would have been beneficial to know the external variables, which seemed to be lacking in the majority of the articles. Such external variables may have included volume in the department, staffing availability, number of lab orders at a given time, and/or volume of CT orders.

Impression

IV contrast is needed for accurate evaluation during a diagnostic CT. Without the use of IV contrast, inaccurate readings or impaired ability to view the scan may result. Patients with elevated creatinine are at high risk for CIN. CIN can lead to acute kidney injury and long-term damage to kidney function, which can lead to extended hospital stays, readmissions, and mortality (Martínez Lomakin & Tobar, 2014). This diagnosis can also cause effects such as peritoneal dialysis or hemodialysis. Hence, creatinine testing is essential before ordering a CT exam with IV contrast. One quantitative study showed an increase in CIN with patients who had creatinine in the upper limits (Wacker-Gußmann et al., 2014), hence the need to determine creatinine levels prior to administration of IV contrast.

Practice Comparison

A number of the articles reviewed indicated barriers related to the research. One study that evaluated troponin POCT noted a small sample size, whereas another was performed at a hospital that had a population of primarily physically fit patients (Juliano & Wason, 2017). During my systematic review, I found barriers to implementing POCT. The most prevalent issues noted were adherence to regulatory requirements and quality assurance. Researchers also noted information technology barriers as well as the increased cost of consumables. Several articles mentioned obstacles related to quality control (QC) checks and lack of staff competency on the equipment, thus leading to nonadherence to the standard-of-care practices (Quinn, Dixon, & Meenan, 2016). Given the scope and limitations of this particular project, the barriers noted above could be foreseen for this particular project as well given the rural nature of the organization.

There are several cause-and-effect relationships related to efficiency in the ED. There is no “one-size-fits-all” solution to improve patient flow. There are usually multiple factors and multidisciplinary team members involved. CMS has required hospitals to report five ED crowding measures under the Inpatient Quality Reporting (IQR) program since 2013 (QualityNet, n.d.). Numerous studies have shown that overcrowding produces less-than-adequate quality of care. Since 2014, hospitals have been required to report the median time from ED arrival to ED departure for admitted patients (McHugh et al., 2011). For hospitals that participate in the IQR program, the data for these elements are publicly displayed on the Hospital Compare website.

Financial Impact

To improve patient care and experience and provide patient-centered care, it is important to improve turnaround times for CT exams (Solheim, Storm, & Whitney, 2018). Given the added goal of becoming a high-reliability organization (HRO), patient flow falls into the HRO category of areas of improvement. The plan to address this challenge is to leverage patient flow as an opportunity for improvement as well as to determine the possible increase in revenue by improving patient flow through the ED.

The estimated annual cost of materials and supplies for POCT is $20,000 per year. The costs to educate staff on an annual basis must be taken into consideration as well. There are 45 FTEs in the ED who require 2 hours of annual education on POCT. The cost of education was estimated at $3,600 per year in labor. Therefore, total spending was estimated at $23,600 annually. On average, four patients per day left the ED without being seen, at a cost of $500 per patient based on history of reimbursement at the organization in which the study was conducted (C. Jeffress, personal communication, February 1, 2019). Therefore, if the data showed an improvement in the flow of patients in the ED due to the improvement in turnaround time for CT exams with IV contrast, the potential savings per day would be $2,000, with an annual savings of $730,000.

Chapter Summary

The literature review provides compelling evidence that POCT can improve patient flow. When POCT is combined with patient-centered care, overcrowding in the ED is reduced and outcomes are both directly and indirectly improved (Rooney & Schilling, 2014). Organizations must overcome challenges related to accreditation and regulatory requirements such as quality controls and infection control standards (Shaw, 2016). Prior to implementation of any POCT method, a plan for rollout and education of staff must be adequately prepared. When proper education takes place and an extensive rollout plan is established, quality outcomes are likely. Through the use of POCT in the ED, research shows that flow is improved, and the accuracy of POCT and standard laboratory testing is the same (McIntosh et al., 2018). In a randomized control trial, clinical decision time was shortened with the use of a basic POCT chemistry test (Lee et al., 2011). Physicians are primary stakeholders and end users; their buy-in is crucial because it requires workflow changes (Goldstein, Wells, & Vincent-Lambert, 2018). Perception is important: If providers feel that they have had a voice in the implementation of POCT, the adjustment to change and operating as a team will be much smoother.

Chapter 3: Research Method

The intent of the methodology chapter is to describe the type of project conducted, including the methods of data collection and analysis. A project task force was implemented that consisted of multidisciplinary stakeholders who met for two hours weekly to develop timelines, polices, procedures, education, and evaluation of POCT in the ED. The stakeholders consisted of physicians and team members from radiology, nursing, laboratory, and executive administration. The team developed policies for the new practice and education modules for staff. A project timeline can be reviewed in Appendix F. Education on competencies for staff was conducted as well as nursing town halls to communicate the practice change. Once the practice change was implemented on-site, observations during day shift, night shift, and midshift occurred.

Project Setting

The project was conducted at a not-for-profit, faith-based, rural, community hospital with a 30-bed level III trauma ED. The average daily volume of patients seen in this ED was 100 patients per day. The hospital was founded in the 1940’s. According to a 2019 report from the study site, in the early 1980s, one of the prominent chemical companies in the community donated 25 acres to the hospital. The hospital was relocated there with a 15-bed ED. In 2016 the community hospital aligned with a faith-based national health care system. Later in 2016, the organization opened a new 30-bed ED. The population consists mainly of middle-class workers employed in industry and chemical plants in a port city. A formal letter of approval to conduct the project was obtained from the hospital president of the local facility (see Appendix D).

Organizational Culture

The national faith-based health care system investigated in this study consists of 107 hospitals. The nonnegotiable goals that have been established for each organization are related to service, quality, safety, and stewardship and include being in the top quartile for all four metrics. As discussed in Chapter 1, patient flow through an organization, including the ED, is significant to all four metrics: customer service, quality of care, safety, and costs of goods provided. Therefore, this study is in alignment with the goals and strategic initiatives of the organization. The culture of the organization is in a transformational stage from one of mediocrity to one of excellence. Therefore, several internal factors drove the performance of this project due to change processes involving multiple competing priorities and reductions in staff. The nursing leadership structure in the ED initially consisted of one ED nurse director and one ED nurse manager. However, the ED manager position fell vacant just prior to the start of the project. Staffing in the unit consisted of two providers and one midlevel practitioner, a charge nurse, RNs, ED technicians, and a triage nurse. The staffing is flexible according to volume with a 1:4 nurse-to-patient ratio.

Influences of the Project

The internal and external factors that might have influenced the project were identified. On January 31, 2019, the 107 faith-based national health care system hospitals aligned with another health care ministry, making it the largest faith-based not-for-profit health care system in the country. In order to align the two health care organizations, the system placed a moratorium on any new supplies or contracts until March 31, 2019. The intent was to create standardization and an HRO. The equipment to perform POCT on creatinine was already available and on-site at the facility, so no capital expense or new contract was required. However, new supplies were needed to start the project, such as cartridges and disposables that the machine required. The project's approval did not interfere with the moratorium, and the supplies were ordered once the moratorium was lifted. Training on the equipment and processes for the RNs to collect the sample was conducted before the implementation of the project along with competency education on quality checks and machine maintenance. The laboratory department experienced a loss in volume from the creatinine draws. This led to decreased buy-in from laboratory personnel for POCT in the ED.

Key Stakeholders

The key stakeholders consisted of ED leadership, ED staff, ED physicians, and midlevel providers. Leaders from the laboratory and radiology departments were also stakeholders in the project. Buy-in from senior leadership was imperative as this team was instrumental in moving the project forward given the internal factors that could affect the outcomes. The chief financial officer (CFO), vice president of nursing, and the chief executive officer (CEO) agreed to push the project forward and support the effort to reach the project goals.

Resources Needed

The resources needed for this project were the disposable goods to carry out the POCT, educational services to provide competency assessment and education on the equipment before the project, and labor dollars related to employee time required to complete the education. A cost-benefit analysis for the project was crucial in order to obtain buy-in from the key stakeholders. Information technology was utilized to create reports from the electronic medical records and to complete the data analysis.

Education and Training

Many of the articles reviewed showed challenges related to regulatory requirements and ability to meet standards of care. In a systematic review, the most prevalent issues noted were adherence to regulatory requirements and quality assurance. Information technology barriers were also noted, as were the increased cost of consumables. In this review, I found articles that addressed obstacles related to QC checks and lack of staff competency on the equipment, thus leading to nonadherence to the standard-of-care practices (Quinn et al., 2016).

The mitigation of risk for this challenge was to leverage the education department as well as laboratory services and the quality department. By involving these multidisciplinary departments, we ensured competencies were properly assessed and documented.

Sample Population

A retrospective chart review and consecutive sampling were used for this study. The inclusion criteria were male and female patients aged 18 or older who presented to the ED and had a CT exam with IV contrast completed with a creatinine lab value. The exclusion criteria were pediatric patients and those less than 18 years of age. Outpatient scheduled CT exams were excluded. CT exams with IV contrast that did not have a creatinine lab value were excluded. A power analysis to determine the sample size reduced the likelihood of type II errors. By using a G*Power 3.1 analysis tool, I set the effect size to 0.3 with a power of 0.8. Using a priori sample size calculation given the power and effect, I calculated a total sample size of 64 (see Appendix B). Type II errors occur when there is a difference between the two interventions—in this case, POCT versus standard labs—but the researcher does not show that one exists due to limited sample size (Melnyk & Fineout-Overholt, 2014).

Institutional Review Board

Approval from the institutional review board (IRB) was required before the start of this project, and a letter of approval was granted (see Appendix E). A local facility IRB was not necessary. Federal law requires that people completing studies or projects have approval to do so by the IRB to maintain protection of human subjects. There are two required courses for students to complete before submitting a project to the IRB, which I completed: (a) the Protecting Human

Subjects module and (b) Ethics CORE (see Appendix C; *personal communication*, 2018). The IRB had an opportunity to review the project proposal after the proposal defense. Following the proposal defense approval and approval from the IRB, the process for data collection by the RNs for creatinine POCT began. Data were collected until the desired sample size was reached. A retrospective chart review for the same time frame the year prior, before implementation of creatinine POCT, was completed. Individual consent was not needed because this project used only timed data.

Intervention and Data Collection

The ratio data were abstracted in report format in Excel through retrospective chart review and consecutive sampling. There were no patient identifiers in the report; therefore, consent was not required. The privacy of the participants was protected during the collection process and throughout the duration of the project. The report was limited to need-to-know information only. The report was created in an electronic format in Excel and stored accordingly. The data were stored electronically on a secure server. The patients' privacy was protected according to Health Insurance Portability and Accountability Act (HIPAA) requirements. The data were used to assess the effectiveness of the intervention, which was POCT performed by RNs at the bedside.

Data were collected for the month of September 2019 to determine the sample size, and the desired sample size was reached. Therefore, no further data were collected past September 2019. The sample size was 64, both consecutively and retrospectively. The report was compiled to include demographics such as age (18–30, 31–40, 41–50, 51–60, and over 61), gender (male or female), and the time the CT exam with IV contrast was ordered and completed. The results were analyzed using descriptive statistics and *p* values to verify the null hypothesis. There was no survey tool utilized for this study.

Data Analysis

A paired *t* test was used to determine statistical significance. There was an increase in the generalizability of this evidence-based practice project due to the population and sample size. The data was analyzed using descriptive statistics in Microsoft excel. While the results did not reveal statistically significant results, the explanation of the data is provided in the results.

Risks/Benefits

For those involved in this project, there were no direct risks to the participants. The benefits of the project were improved turnaround time and quicker results and treatment. The other benefit was an overall decrease in patients' ED wait time. The potential benefits to the organization are fewer LWBSs and improvement in patient flow. It is possible that other risks and benefits could occur, and additional data collection may be required to determine those benefits.

Chapter Summary

This quantitative analysis utilizing a retrospective chart review and consecutive sampling was conducted in a rural community hospital with a 30-bed level III trauma ED and an average volume of 100 patients per day. For this study, I compared two interventions: creatinine POCT performed by RNs at the bedside and standard laboratory serum creatinine testing to determine whether or not there was a difference in turnaround time for CT exams with IV contrast. I analyzed the data to determine statistical significance. A project timeline and task list is found in Appendix F.

Chapter 4: Results

The intent of this chapter is to present the results of the data analysis of the quantitative retrospective chart review as well as the sampled population post intervention (creatinine POCT) to determine if there was a difference in turnaround time for CT exams with IV contrast.

Purpose of the Project

Significant wait times for standard lab test results were found to impede patient flow. The purpose of the project was to evaluate the use of creatinine POCT in the ED on patients who had a CT exam with IV contrast completed to determine if there was a decrease in turnaround time compared to those who had standard laboratory testing. In reviewing the problem of interest, I found it related to lengthy turnaround times for CT exams with IV contrast due to extended wait times on serum creatinine results. The hypothesis was that implementation of POCT for creatinine in the ED would eliminate the wait time for lab values, thereby decreasing the turnaround time for CT exams with IV contrast. The scope of the project was limited to patients aged 18 or older who presented to the ED and had a CT exam with IV contrast completed.

Project Analysis

I conducted a retrospective chart review of 64 charts from September 2018 using standard laboratory testing. The results showed that the average turnaround time for CT exams with IV contrast was 161 minutes using a standard laboratory draw for serum creatinine. In September 2019, 1,678 CT exams were completed, and 654 met the inclusion criteria. I used a consecutive sampling methodology to reach a total sample size of 64. The mean turnaround time for CT exams with IV contrast using creatinine POCT was 95 minutes ($SD = 89.04$). This represented a decrease in average turnaround time of 66 minutes ($t(63) = 0.008$, $p > .05$) but was not statistically significant.

Next, I conducted a power analysis to determine the sample size and reduce the likelihood of type II errors. By using a G*Power 3.1 analysis tool, I set the effect size to 0.3 with a power of 0.8. Using a priori sample size calculation given the power and effect, I calculated a total sample size of 64 (see Appendix B). Type II errors occur when there is a difference between the two interventions—in this case, POCT versus standard labs—but the researcher does not show that one exists due to limited sample size (Melnyk & Fineout-Overholt, 2014).

I analyzed the ratio data using Excel and a statistical analysis formula within the Excel program. A paired *t* test showed the results lacked statistical significance.

Sample Size and Demographics

There were 3,608 CT exams for the month of September 2018 and 3,119 CT exams for the month of September 2019. I used only those electronic reports that met the inclusion criteria of patients aged 18 or older who had completed a CT exam with IV contrast in the ED. The reports included the following time stamps:

1. Time the creatinine level was obtained and method of collection
2. Time the CT with IV contrast was completed

The reports were reviewed and analyzed using a statistical analysis system and a paired *t* test. The final sample size was 128, which included a total sample size of 64 for the retrospective chart review and of 64 for the consecutive sampling of POCT. A paired *t* test was used to compare the mean turnaround time for CT exams with IV contrast utilizing a standard laboratory test and the mean turnaround time for CT exams with IV contrast utilizing creatinine POCT. The mean on the standard lab tests was 161 minutes ($SD = 67.16$), and the mean for CT exams with IV contrast using creatinine POCT revealed an average turnaround time of 95 minutes ($SD = 89.04$). This resulted in a decrease in average turnaround time of 66 minutes ($t(63) = 0.008$, $p >$

.05) but was not statistically significant. A Pearson correlation coefficient (r = –0.12) was used to look at the two tests (time for CT using standard laboratory testing versus time using POCT), which showed a negative correlation between the two (see Table 1 for analysis of descriptive statistics and Table 2 for t test results). Demographics in the retrospective review with standard laboratory testing revealed an average age of 44. The population was 65% females and 35% males. Demographics of consecutive sampling of POCT revealed an average age of 45. The population was 30% females and 70% males. It is unclear if there was any significance to the gender differences or why there were more males in the consecutive sampling process (see Table 3 for demographic data).

Table 1

Descriptive Statistics for CT Turnaround Time

Descriptive statistic	Value
Standard lab testing	
Mean	161.59375
Standard error	8.395178804
Median	160.5
Mode	138.0
Standard deviation	67.16143044
Sample variance	4,510.657738
Kurtosis	–0.706759949
Skewness	0.064986963
Range	275.0
Minimum	14.0
Maximum	289.0
Sum	10,342.0
Count	64
Confidence level (95.0%)	16.77642617
Creatinine POCT	
Mean	95.46875

(table continues)

Descriptive statistic	Value
Standard error	11.13049331
Median	56.0
Mode	44.0
Standard deviation	89.04394648
Sample variance	7,928.824405
Kurtosis	12.39593214
Skewness	3.010028568
Range	541.0
Minimum	30.0
Maximum	571.0
Sum	6,110.0
Count	64.0
Confidence level (95.0%)	22.24251604
Difference between the two groups	
Mean	66.125
Standard error	14.76595687
Median	92.0
Mode	133.0
Standard deviation	118.1276549
Sample variance	1,3954.14286
Kurtosis	4.811436988
Skewness	–1.689114583
Range	680.0
Minimum	–456.0
Maximum	224.0
Sum	4,232.0
Count	64.0
Confidence level (95.0%)	29.50741025

Table 2

Results of Paired t *Test for Means*

Descriptive statistic	Variable 1	Variable 2
M	161.59375	95.46875
Variance	4,510.657738	7,928.824405
Observations	64.0	64.0
Pearson correlation	–0.126637121	
Hypothesized mean difference	66.0	
Df	63.0	
t	0.008465418	
P (T <= t) one-tail	0.496636202	
t critical one-tail	1.669402222	
P (T <= t) two-tail	0.993272404	
t critical two-tail	1.998340543	

Table 3

Demographic Data

	September 2018 standard laboratory test		September 2019 creatinine POCT	
Gender	Percentage of sample	Average age	Percentage of sample	Average age
Males	35	41	70	46
Females	65	45	30	43

Limitations

Although there was a methodical approach to determining the sample size of 64, data may need to be collected for a longer period. Due to the high volume of CT exams in the ED, the sample size could easily be reached in one month's time. The POCT was implemented in August 2019, and the data were collected in September 2019. The nursing staff and physicians still may require education and training. The retrospective chart review was conducted using data from September 2018. The purpose of this was to review data from the same time each year to eliminate any volume-related seasonal fluctuations.

Challenges

As predicted in several research articles and the literature review, laboratory buy-in to POCT in the ED was difficult, and there was pushback during the implementation process. This could have been related to some of the variability in longer versus shorter turnaround times. The change process of implementing a new testing system created employee conflicts between the two departments: laboratory and ED. Quinn et al. (2016) described obstacles to implementing POCT related to QC checks and maintaining staff competency in order to meet regulatory guidelines. The major concern of the laboratory department was relinquishing quality control testing and checks as well as blood draws and analysis to nursing personnel, which led to a fragmented launch of POCT. There was concern with maintaining regulatory requirements and the role of responsibility for maintaining competencies. Although the education department was utilized to assist with training and competencies for nursing staff were documented, tension between departments remained a concern.

Interpretations and Inferences of Findings

According to the American Statistical Association (ASA, 2016), the *p* value is not intended to validate or prove research inadequate. While academically the *p* value has become a "gatekeeper" for research, it is often misused. The *p* value does not provide a good description of hypothesis relevance, nor does the *p* value measure probability or random chance (ASA, 2016). Taking this information from the ASA into account, I concluded that the *p* value result for this study of $p > .05$ did not discredit the hypothesis nor did it indicate inadequate research. The goal of proving a decrease in turnaround time for CT exams with IV contrast using creatinine POCT was achieved with the decrease in turnaround time of 66 minutes.

Chapter Summary

This quantitative study utilizing a retrospective chart review and consecutive sampling was conducted in a 30-bed ED with an average volume of 100 patients per day. I compared two interventions creatinine POCT and standard laboratory serum creatinine to determine whether or not there was a difference in turnaround time for CT exams with IV contrast. I analyzed and compared the data for statistical significance and correlation. While I found an improvement in turnaround time, the results were not statically significant or correlated. The statistics do not control for time of day in the reporting of analysis. Chapter 5 contains a discussion of the findings and recommendations for leaders in health care. The next chapter also contains a discussion of the American Association of Colleges of Nursing (2006) Doctor of Nursing Practice (DNP) essentials.

Chapter 5: Discussion, Conclusions, and Recommendations

The aim of this project was to determine if there was a decrease in turnaround time for CT exams with IV contrast by using POCT for creatinine rather than standard laboratory testing. The overall purpose of the project was to improve patient flow through the emergency room. While there are multiple factors that affect patient flow, the intent was to focus on the effect of a single change in process on flow through the ED.

Implications and Analysis for Leaders

This research adds insight into the nursing profession by exploring ownership and accountability in patient flow through the ED. Nursing science is innovative; it involves process changes and uses evidence to make strides in providing quality care. It is imperative that nurses understand the input, throughput, and output of the processes they are part of as well as multiple moving factors such as lab and radiology. Recognizing turnaround time as a major part in ensuring that patients receive timely care in a safe, efficient manner is crucial to nursing science and health care.

Evidence-Based Practice Findings and Relationship to DNP Essentials I–VII

Essential I: Scientific underpinnings. This project reflects the practice of nursing at the doctoral level as the literature review guided the practice to improve care. The literature review provided a foundation for a discussion of the practice of care as it relates to patient flow in the ED and POCT for patient care. The outcomes of the project fit well with the theoretical framework of Asplin et al. (2003), who used a three-part conceptual model to evaluate input, throughput, and output, to determine how to improve the quality of care delivered by understanding the metrics and how operations flow through the ED. The relationship of patient flow in the ED, arrival time, and completion of diagnostic testing mirrored the conceptual framework on input, throughput, and output.

The input was patients who arrived via ambulance or ambulatory through the ED lobby and had an order for a CT exam with IV contrast that was put into the system. The throughput included the drawing of creatinine levels, whether by POCT during consecutive sampling or by basic serum laboratory testing in a retrospective chart review, and turnaround time for a CT exam with IV contrast. Output was the completion of the CT exam and determination of the turnaround time from the time of order to the time of completion.

The nursing knowledge used to guide the project as it relates to its scientific underpinnings was the actual evaluation of the research. The theoretical framework used for this project created an awareness of constant involvement with those in the environment and surroundings.

Essential II: Systems leadership and systems thinking. In this project, I considered the larger organizational goal of improved ED throughput to decrease LWBSs, improve patient satisfaction, and decrease costs. CMS has required hospitals to report five ED crowding measures under the IQR program since 2013. Numerous studies have proved that overcrowding produces less-than-adequate quality of care. Since 2014, hospitals have been required to report the median time from ED arrival to ED departure for admitted patients (McHugh et al., 2011). The process flow improvements that were conducted in this project were a small piece of change for a greater purpose. Through this project, I reviewed regulatory requirements and organizational and system policy as it related to competency, education, and maintenance of laboratory equipment in the ED that the nurses were responsible for. The nursing staff and physicians became more aware of the systems that drive performance expectations such as external regulatory bodies and leadership. There is also acute awareness of the processes within the system such as patient flow and information technology that drive the change processes.

Essential III: Clinical scholarship and analytical methods for evidence-based practice. The findings of this project met this essential through the completion of a comprehensive literature review (see Appendix A). I conducted a comparison of the findings, evaluated the study design, and identified methods of improvement. I used information technology to extract data both consecutively and retrospectively and reviewed the data to inform and guide practice. The evidence from the literature review supported the change in practice from standard laboratory testing to POCT in the ED. The POCT testing results of this project proved a decrease in turnaround time yet did not yield statistical significance. Given the concept from the literature that the p value should not be used to identify the relevance of the hypothesis or measure probability, the p value result of $p > .05$ did not discredit the hypothesis for this particular research.

Essential IV: Information systems and transformation. I measured the project outcomes by extracting data from patients' electronic health records (EHRs) and compiling reports with specific information related to the project in order to analyze the outcomes of the evidence-based practice project. Once I had extracted the data from EHR into an Excel file, I used the software to manipulate the data, to compile descriptive statistics, and for analysis and measurement.

Essential V: Health care policy. Chief nursing officers (CNOs) focus on improving processes, eliminating waste, and providing patient-centered care. The patients and community deserve to have a right to access to safe, quality care at a low cost. The Texas Nurses Association (TNA) is an organization that promotes safe staffing and a just culture. The policy statement released by the TNA (n.d.) informed the public that it promotes positive practices and advocacy for patients.

This project focused on clinical outcomes that improve processes to provide patient-centered care. Not only did patients experience decreased wait times, but they also received their test results faster, which allowed for treatment sooner. As a nursing leader, there is a profound responsibility to the public to advocate for evidence-based practice research at the state and federal levels. It is important that state legislatures and federal policy makers for health care understand the importance of evidence-based practice for funding, staffing, and education decisions. It is also important for nursing leaders to speak to regulatory bodies that write the specifications for quality control and environmental maintenance standards. In the literature review for this project, the challenges were concerns with regulatory requirements, which led to push back from laboratory departments. This project was no different in that the ED under investigation experienced the same challenges. Therefore, if the POCT is a patient-centered module of care, there must be a way to make it more efficient and less complicated to manage so as to maintain patient centeredness but not add undue stress to the staff.

Essential VI: Collaboration for improving outcomes. The stakeholders who made up the high-functioning team in this study included the ED director, the CNO, the ED medical director, RNs in the ED, physicians, and midlevel providers in the ED, radiology department, laboratory department, education, finance, and clinical informatics. This project required a multidisciplinary effort and teamwork. While there were challenges related to relinquishing control, the team functioned well. The change in process resulted in a decrease in turnaround time of 66 minutes.

This essential is paramount for nursing leaders. In order for the processes to become hardwired and sustained as part of the culture, there must a be a culture of communication and teamwork. A culture of trust is needed to ensure productivity and extension of duties. This project related to this essential through the collaboration of team members with different roles and responsibilities. Part of our responsibility as leaders is to ensure effective and clear communication with expectations.

Essential VII: Clinical prevention and population health. The demographics and population data aggregated for this project showed differences between the samples, but there was not a clear reason why. The demographics in the 2018 retrospective review with standard laboratory testing revealed an average age of 44 and a gender breakdown of 65% females and 35% males. Demographics of consecutive sampling of POCT 1 year later, in 2019, revealed an average age of 45 and a gender breakdown of 30% females and 70% males. The average age of those receiving a CT exam with IV contrast was 44–45. While there were more females in 2018 versus in 2019, it is unclear if there was any significance to the gender differences.

As the health care industry begins to change its focus to postacute care, it is imperative that nursing professional research and clinical outcomes consider population health as a focus in implementing evidence-based practices in the acute care setting. In order to improve the nation's health, nursing professionals must understand the clinical comorbidities patients experience as well as their aging processes.

Essential VIII: Advanced nursing practice. This project allowed for the refinement of guiding, mentoring, and supporting other nurses to create systems thinking. This project allowed for education and delivering and designing evidenced-based practice to improve outcomes while coaching a team through process changes. For nursing leaders, the abilities to communicate effectively, develop trust, and coach and mentor other nursing staff and leaders are hallmark traits. This project allowed for the development of those traits.

Recommendations for Future Research and Clinical Practice

It is recommended in the future that researchers consider staffing challenges and education on new process changes for both nurses and physicians. Due to the implementation of POCT in the ED, ongoing education will be required to hardwire the processes and determine any other tests of change that may be required due to the process change of POCT. Given the tension that occurred between the laboratory department and the ED, education on change theory as well as teamwork could benefit the organization in terms of helping it achieve its broader goal. Change theory encompasses a variety of assumptions, actions, and outcomes by assessing their relationships and how they intermix. The key principle of change theory is having a group that is affected by the process change commit to making the change (Armitage et al., 2019). In this particular case, the ED is the most affected department of this particular method of change.

It is recommended in the future that researchers collect data for a longer period to ensure the sustainability of the decreased turnaround time for CT exams with IV contrast and to determine that the process has been hardwired. It is recommended that RNs play a significant part in providing patient-centered care. "Patient-centered" means putting the patients' needs and care first and working around that thought process. Therefore, POCT in the ED is patient-centered because it decreases wait time. While this process may create additional work for RNs, as they are now responsible for processing lab results and maintaining competency, education, and quality controls on the equipment, it is the most patient-centered approach.

In the future, researchers could consider using cost analysis to determine return on investment for POCT in relation to costs of education for staff and improvement in measures related to value-based purchasing. The cost of POCT cartridges is estimated at $20,000 per year. Other factors to consider are education and training for staff, patient satisfaction, and LWBS metrics.

Conclusion

The aim of this project was to reduce turnaround time for CT exams with IV contrast through POCT in the ED to provide patient-centered care while improving patient flow. The findings of the project included a decrease in turnaround time of 66 minutes. However, this finding was not statistically significant, so the null hypothesis was not rejected. The literature regarding statistical significance and *p* values discredited using the *p* value as a means of rejecting the null hypothesis and validating research. Although the *p* value showed statistically insignificant results, it should not be used to provide a scientific conclusion or to prove or disprove the hypothesis (American Statistical Association, 2016). There are factors other than POCT that affect patient flow. Actual delays in patient care could be related to staffing, high volume, or the CT machine being out of service. Numerous other delays affect patient care. When considering the results shown for POCT, clinical significance is paramount.

Communication and education are essential to creating a high-functioning team to accomplish the desired outcomes. In the future, ongoing data collection and education are recommended to prove processes and tests of change have been hardwired and that results are sustained. The development of trust across multidisciplinary departments and providers is paramount to create a high-functioning team and improve communication. Education on change theory prior to implementation of a new process change could be beneficial to the stakeholders and team members involved in the change process to create awareness of barriers and challenges both seen and unseen.

The findings of this evidence-based practice project can be disseminated at the facility, division, and national levels within the organization. This can be accomplished through poster presentations at conferences, round table discussions, leadership panels, and patient flow meetings. The findings may also be published in a journal to disseminate the results. It is the responsibility of executive health care leaders to disseminate the results and outcomes through existing methods to further the practice of research and improve nursing science and patient care.

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Appendix A: Evidence-Based Table

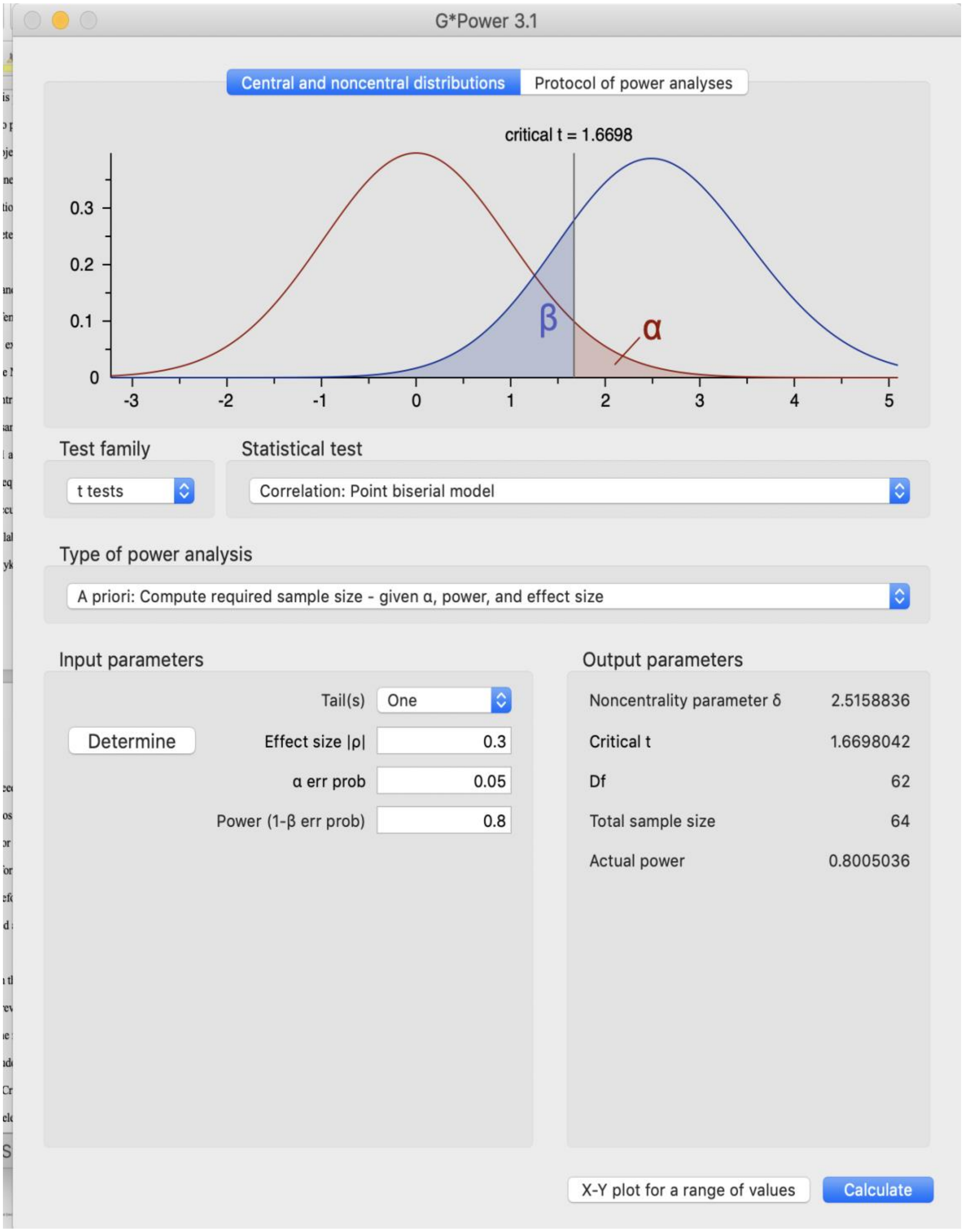
Citation	Purpose	Design	Sample size	Independent variables	Dependent variables	Statistical tests	Results	Strengths	Weakness	Clinical outcomes	AACN level of evidence
McIntosh et al. (2018)	To evaluate whether POCT reduces lab turnaround time (TAT) and improves timely diagnosis and management	Prospective observa-tional study	50	Blood sample, laboratory versus POCT	TAT	A. Pearson's correlation coefficients B. Lin concordance coefficients C. Bland-Altman plots	0.84–1.00, 95% CI. In 3 of 400 measurements, the difference between POCT and core lab tests exceeded the maximal clinically acceptable deviation.	Statistically significant results that provide confidence to the ordering physician	Limited to one type of POCT device and eight specific analytes. Findings cannot be generalized. Small *n* and completed at a highly trained facility with POCT experts.	Bedside POCT by ED nurses is reliable and accurate and does not deviate significantly from core laboratory testing by qualified technicians.	III
Kemper et al. (2017)	To evaluate whether POCT of cardiac troponin with adequate analytical performance has the potential to improve chest pain patient flow in the ED.	Analytical comparison studies	138	POCT	Laboratory values	Bland-Altman plots	Limit of the blank, limit of detection, and limit of quantitation at 20% coefficient of variation (CV) were 8.5 ng/L, 18 ng/L, and 38 ng/L, respectively, without significant differences between whole blood and plasma.	Requires minimal blood sample, can be done at the bedside, and is patient-centered	N/A	The Minicare cTnI assay is a sensitive and precise, clinically usable test for deter-mining cTnI concentra-tion that can be used in a near-patient setting as an aid in the diagnosis of acute myocardial infarction.	III

Citation	Purpose	Design	Sample size	Independent variables	Dependent variables	Statistical tests	Results	Strengths	Weakness	Clinical outcomes	AACN level of evidence
Juliano and Wason (2017)	To compare the results of cardiac troponin I POCT and lab analysis as a way to show that the results are interchangeable.	Retrospec-tive chart review	189	Blood sample, laboratory versus POCT	TAT	Descriptive statistics and McNemar's	High correlation between POC tests and lab analysis	High CI. All statistical data and ranges for sensitivity, specificity, and NPV improved when a higher cutoff value for troponin was utilized.	Small sample size from a large population of active-duty military members and their dependents who are young and fit	Rapid identifica-tion of evidence of cardiac injury and assurance the results are accurate	III
Singer et al. (2015)	To determine the effects of comprehensive bedside POCT in critically ill or injured ED patients on test TAT, length of stay (LOS), and time to completion of CT with IV contrast	Before-and-after study	1,405 and 901	Lab tests, POCT, blood sample	LOS, CT TAT	Binary data reviewed, chi-squared tests, nonparametric tests	POCT reduced ED LOS by 33 min. Use of basic metabolic panel, POCT cut the median time to completion of CT with IV contrast by 81 min.	16% of nurses did not feel that POCT expedited the care of the patient.	Results for LOS were not statistically significant.	Significant reductions in time to completion of CT imaging and ED LOS in all patients requiring IV contrast	III
Solheim et al. (2018)	To improve the intersecting points of care between radiology and ED to ensure seamless patient care	Journal article reviewing care between multidisci-plinary ED and radiology	Un-known	Order entry, transporta-tion TAT, study initiation to completion, preliminary report TAT	N/A	N/A	N/A	N/A	N/A	The two departments must work together to work efficiently and identify the needs of both departments.	IV

Citation	Purpose	Design	Sample size	Independent variables	Dependent variables	Statistical tests	Results	Strengths	Weakness	Clinical outcomes	AACN level of evidence
Bershad et al.	To evaluate time of arrival to completion and reporting of CT head results for stroke patients.	Retrospec-tive cross-sectional analysis of the GWTG database	1,123 (stroke patients and 685 non-stroke)	Protocol on head CT times in acute stroke patients with considera-tion of tissue plasminogen activator	N/A	N/A	Median time was 20 min. for patients with a diagnosis of stroke.	N/A	Prospective studies needed to determine if protocol works in other places.	Possible dissemina-tion of stroke protocol	III
Fermann and Suyama (2002)	To investigate POCT in the ED as it relates to implementation, maintenance, and regulations	Systematic review	Studies in a 10-year time frame	Lab TAT, ED LOS, and POCT TAT	Evaluation of POCT in the ED	N/A	POCT is just as accurate as regular laboratory testing.	No actual results tabled in a summary fashion concerning regulatory standards and mainte-nances	Numerous types of POCT addressed	A steering committee should be developed to evaluate dif-ferent types of ED POCT, focusing on quality and efficient patient care.	I
Bargnoux et al. (2018)	To evaluate creatinine on the ABL800 FLEX blood gas analyzer for screening of preexisting renal impairment before radiographic contrast administration in the ED by comparing with standard practice using central lab testing	Two parts: 1. Analytical performance in the lab 2. ED review to determine the impact of POCT on TAT for CT	6 whole heparin-ized blood and 6 plasma pools (*n* = 15) replicates at 4 °C, and *n* = 30 repro-duces for repeat analysis at –20 °C 55 patients	Blood samples on the ABL 800	POCT testing in the ED	Linear regression analysis, Mann-Whitney test to compare time before CT exam between two periods, Bland-Altman plot	Implementation of POCT for creatinine in the ED signific-antly reduced patient waiting times for contrast-enhanced CT (1.73[0.75–3.01] vs. 2.57 [1.53–3.48] hours, for a period with and without ABL800, respectively, $p = 0.04$).	The organi-zation had a dedicated POCT team and the study showed statistically significant results.	Monocentric study. Aspects of theABL800 do not make it an ideal point-of-care analyzer. Requires substantial maintenance and trouble-shooting. The study design did not allow investigation of the monetary aspect.	The ABL800 assay is com-parable with central lab reference. Im-plementation of creatinine POCT re-duces delay in results, potentially allowing ED clinical staff to make more rapid clinical decisions and reduce patient waiting time.	II

Citation	Purpose	Design	Sample size	Independent variables	Dependent variables	Statistical tests	Results	Strengths	Weakness	Clinical outcomes	AACN level of evidence
Rooney and Schilling (2014)	To promote patient-centered care by exploring how POCT can be used to directly or indirectly improve outcomes	Review	N/A	Point-of-care analysis	Core laboratory analysis	Sensitivity and specificity	When used effectively and in the appropriate context, POCT reduces delays in treatment, improves outcomes, and increases discharge rates.	Internal quality control methods and assessment requirements	Costs of POCT. Barriers due to staffing. Multiple lab types for different POCT were analyzed, which made the article confusing.	Decreased LOS, timely discharge needs	III
Shaw (2016)	To identify challenges with compliance and accreditation standards related to POCT	Journal article	N/A	N/A	N/A	N/A	N/A	Accredita-tion standards for POCT can be challenging to meet.	N/A	N/A	V (expert opinion and case report)

Appendix B: G*Power Analysis



Appendix C: Human Subject Research

CERTIFICATE

Shannon Haltom

is awarded this Certificate of Completion
for training in

Human Subject Research Protections

by the Abilene Christian University Institutional Review Board

Authorized by Megan K. Roth, ACU IRB Chair

Awarded January 30, 2019
Expires January 30, 2023

Appendix D: Facility Letter

[redacted]

[redacted]

January 27, 2019

Abilene Christian University
Abilene, TX. 79699

Dear Abilene Christian University:

The purpose of this document is to provide a letter of support for Shannon Haltom. [redacted] supports the patient flow initiative regarding improving the turnaround time for CT exams with IV contrast as Shannon's doctoral project.

Sincerely,

[redacted]

Appendix E: IRB Approval

ABILENE CHRISTIAN UNIVERSITY
Educating Students for Christian Service and Leadership Throughout the World

Office of Research and Sponsored Programs
320 Hardin Administration Building, ACU Box 29103, Abilene, Texas 79699-9103
325-674-2885

August 27, 2019

Shannon Haltom

Department of NUrsing

Abilene Christian University

Dear Shannon,

On behalf of the Institutional Review Board, I am pleased to inform you that your project titled "The effect of point of care testing of creatinine on turnaround time for CT exams with IV Contrast",

(IRB# 19-066)is exempt from review under Federal Policy for the Protection of Human Subjects.

If at any time the details of this project change, please resubmit to the IRB so the committee can determine whether or not the exempt status is still applicable.

I wish you well with your work.

Sincerely,

Megan Roth, Ph.D.
Director of Research and Sponsored Programs

Appendix F: Project Timeline and Task List

January 2019–March 2019	Recruit stakeholders for POCT initiative Design project implementation
April–May	Continue design phase for project implementation
June–August	Education provided to staff on POCT change process by the Organization. Receipt of IRB approval
September	Begin consecutive data collection
October	Close data collection as sample size is reached. Complete retrospective review of data for September 2018.
November	Complete retrospective review of data for September 2018.
December 2019–January 2020	Consult with statistician to review results
February 2020–March 2020	Terminate study with IRB Submit final paper for editorial review

Task	Jan. ’19	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. ’20	Feb.	Mar.
Recruit stakeholders for POCT initiative	■	■	■												
Design project implementation			■	■	■										
Education provided to staff by facility						■	■	■							
Receipt of IRB approval								■							
Begin Consecutive Data Collection									■						
Close Data Collection; Sample size met										■					
Complete Retrospective Review										■	■				
Consult with Statistician												■	■		
Terminate Study with the IRB														■	
Submit Final Paper for Editorial Review														■	■