The Effect of Emergency Department Waiting Time

by

Evelyn Alvarez

Capstone Project submitted to

American Sentinel University

February 11, 2018

AMERICAN SENTINEL UNIVERSITY

The DNP Project Committee for the Capstone Project of

Evelyn Alvarez

Effect of Emergency Department Waiting Time on the Patient

DNP Project Chair: Jimmy Reyes, DNP, AGNP, RN

Committee Member: Ami Bhatt, DNP, MBA, MSN, BSN

Date of Final Defense: March 19, 2018

Abstract

Emergency department (ED) establishment is crucial, particularly concerning the overpopulated healthcare centers. One of the major factors which have contributed to prolonged waiting time in the ED is triage. The responsibility of the ED is to accept a patient, triage, stabilize and execute treatment with different conditions which could require immediate, urgent or semi-urgent attention. Triage is the prioritization of patient considering sickness/harm, seriousness, diagnosis, and service accessibility. The project aim was to determine the effect on waiting time after implementing a new triage system. In 2017, the hospital ED started a new triage system; Emergency Severity Index (ESI). The five-level system categorizes ED patients by acuity, and resource needs (AHRQ, 2012). The expectation with this quality improvement project was to improve the effectiveness of triage process. The study design is a quantitative, retrospective, comparative study which used electronic health record data of a pre-implementation period from July through September 2016, and a post-implementation period from July through September 2017 after implementing ESI triage system. MANOVA has the power to detect significant group variances along a mixture of dependent variables. The tests of between- subjects' effects output indicate acuity level has a significant effect on the dependent variable of total time with a df = 4, F= 4.9, *p*= .001. The output also indicates significance in the corrected model source, a df =8, F= 4.8, *p*= .000, and intercept show a df =8, F=234.1, *p*=.000. Minimizing the time spent by patients in the ED sustain that ESI five-level acuity system improved the efficiency of triage process as well as enhanced patient's overall experience in the ED.

Keywords: Emergency Department, Emergency Severity Index, Triage

Table of Contents

SECTION I: INTRODUCTION……1

Background of the Problem……...3

Review and Summary of relevant Literature…….5

Statement of the Problem……...9

Purpose……11

Research Question……11

Significance of the Study……. 12

Nature, Scope, Limitations, and Delimitations of the Project……. 15

Variables……...20

Theoretical Framework…… 20

Definitions……21

Summary……. 22

SECTION II: METHODS……. 23

Introduction……. 23

Project Design……. 23

Sample and Setting……. 24

Instrumentation……26

Data Collection……27

Data Analysis Method…….28

Data Management Method……. 29

Ethical Considerations…….30

Internal and External Validity……. 31

Summary…… 32

SECTION III: RESULTS AND DISCUSSION OF FINDINGS…… 33

Introduction……...33

Summary of Methods and Procedures…… 34

Summary of Sample and Setting Characteristics…… 36

Major Findings…… 38

Implications for Nursing Practice…….40

Recommendation…… 41

Discussion…….42

Conclusions……. 43

References…… 45

Tables……..... vii

Figures……. viii

Appendix A……... 50

Appendix B……... 51

Appendix C……52

Appendix D……53

Appendix E……54

Appendix F……55

Appendix G……...…….56

Appendix H……57

Appendix I…….58

Appendix J…….59

Appendix K……...60

Appendix L……61

Appendix M……...62

Appendix N……... 63

Appendix O……....64

Appendix P……65

Appendix Q……66

Appendix R……67

Appendix S……68

Appendix T……...…….69

Appendix U……70

Appendix V……71

Appendix W……...72

List of Tables

Table 1. Demographics Characteristics.....52

Table 2. Comparison of Emergency Department Operational Performance…….....53

Table 3. Emergency Severity Index (ESI) July through September 2017 ……... 54

Table 4. Gender Frequencies Statistics 59

Table 5. Age Group Frequencies……...62

Table 6. Time of Emergency Department Visit…… 63

Table 7. Patient First Visit Frequencies…….65

Table 8. Patient Disposition frequencies...…… 66

Table 9. Total Sample Frequencies of Outcome Variables……68

Table 10. Comparison of Triage Performance Metrics 2016 and 2017....…….69

Table 11. MANOVA Test of Between Subjects Effects……71

Table 12. Multivariate Analysis of Variance of Dependent Variable Total Time…….72

List of Figures

Figure 1. Sample Size Calculator 2016..... 49

Figure 2. Sample Size Calculator 2017..... 50

Figure 3. Theoretical Framework……..... 54

SECTION 1: INTRODUCTION

The world's population growth rate in the past decades has been increasing with a very significant percentage. The United States (US) Census Bureau predicts that the American population will grow by an estimated rate of over 41% in the next four decades (Palin, Espinola, & Camargo, 2014). The expectation is that the growing number of the elderly population will translate into an increasing number of older patients seeking care in the emergency department (ED) (Albert, McCaig, & Ashman, 2013). The impact of the aging population calls for the government to federally qualified health centers to cater for the increasing population. In consequence, failure to act may result in overcrowding within the health services centers ED. Research studies evidence that crowd management in the ED is a problem for all hospitals across the United States and can also have an adverse impact on patient satisfaction and quality outcomes (Sayah, Rogers, Devarajan, Kingsley-Rocker, & Lobon, 2014). Patel, Combs, and Vinson (2014) also observe that extended wait times in the emergency department do not only lead to ED congestion. Also increased morbidity and mortality rates, ambulance diversion, increased numbers of patients who go home without being treated, higher costs of care, and delayed care including longer periods of stay for other patients who need urgent medical attention.

Emergency department establishment is crucial especially in consideration of the overpopulated healthcare centers. The attention a patient receives in the ED considerably affects the quality of care and satisfaction of patients. Patient's expectations regarding health services continue to increase, and their interest is to receive attention promptly. The responsibility of the ED is to accept a patient, triage, stabilize and execute treatment with different conditions which could require immediate, urgent or semi-urgent attention. Triage is the prioritization of patient

consideration in light of sickness/harm, seriousness, diagnosis, and service accessibility. Therefore, patients are treated depending on the urgency of their cases. The intention for triage is to identify patients requiring immediate attention to supply the correct level of care and treatment, set priorities and transfer the patient within a short time (Reza, Khorasani, Azizi, Ali, & Rahgozar, 2013).

According to Welch, Asplin, Stone, Davidson, Augustine, and Schuur (2010), EDs, hospitals, and health systems work to enhance courses of events and effectiveness of emergency care. Welch et al., (2010) also suggest that health centers should utilize standard wording and measurements to quantify and benchmark execution. Moreover, ED patient flow principles form part of the achievement measures and accreditation programs of various administrative bodies such as the Center for Medicare Services (CMS) and The Joint Commission (TJC) (Welch et al., 2010). For this reason, further administrative stipulations use parameters created by specialists from inside the specialty who comprehend the practice and implications of ED procedures. Lowering interruptions and verifying that patients get the right care at the exact moment of the situation will eventually have a favorable critical impact on the nature of considering the patient and was enhance persistent results and diminish the expense.

The purpose of this project is to evaluate the background and sources of data to maintain quality and the integrity of service at the Emergency Department. A data analysis of trends will be presented; performance indicators are also an accurate form of measurement to assess efficiency, service, and effectiveness. The focus on the emergency department has arisen due to increased population and also the growth in demand due to various disasters across the world. The health system has the responsibility of developing the emergency department so as to help curb the problem of parading patients within the waiting room.

The healthcare sector needs to recognize waiting time in the emergency department as a problem so that they can be able to work on potential policy remedies. Therefore, healthcare centers need to study different projects which in many cases make up the emergency department. Recognizing the origin of the problem is essential as this helps to find the best ways on how to curb the problem. Evaluating this concern before initializing the implementation of the program make the goal simple, achievable and specific. Comparison with other emergency departments which are believed to be doing well may also help obtain background information about the problems. Moreover, consideration of scholarly articles which are dealing with this situation is very critical in determining the requirements of EDs in U.S. healthcare facilities. Furthermore, the above research should be conducted to make sure that the project is catered for and all the requirements availed. The impartiality of the research should be an expounding on the causes, benefits and also the procedure which is required to conquer this adversity within the United States health care center.

Background of the Problem

Congestion in emergency departments in the United States has developed into a national epidemic; this situation is getting worse. As identified by George and Eviridiki (2015), ED crowding in the U.S. hospitals continues to negatively affect patients through long wait time and length of stay. Additionally, overcrowding in EDs creates both logistic and operational problems that adversely affect staff, patients, and hospitals. Moreover, congested EDs have an adverse effect on the Institute of Medicine's six measurements of quality which are "safety, effectiveness, efficiency, equity, patient-centeredness and timelines" (George, & Eviridiki, 2015, p.2). Besides, the increased utilization of the ED has affected the ability of EDs to provide efficient and effective services to communities.

As identified by Barata, Brown, Fitzmaurice, Griffin, and Snow (2015), the increased number fragmentation and a shortage of crucial subspecialists have not only led to ED overcrowding, but also to ambulance diversion. When emergency department is crowded in the U.S. every minute, an ambulance is diverted. Over the past ten years, patients who show up in the ED have experienced a long wait time to be attended, and a greater extent of ED visit length (Horwitz, Green, & Bradly, 2010, p.2). Patients with acute disease and accidents are said to be the victims of this crisis. The maximum waiting time recommended for an ED provider to see a patient is 15 minutes. Back in 2006, the waiting time for the patients who were in the need of ED service was 37 minutes which is a very long period for such patients. A study carried out by United States Government Accountability (GAO) asserts that prolonged waiting time within healthcare centers reduces their responsiveness (Horwitz, Green, & Bradley, 2010, p.2).

Another study conducted by Sayah et al., (2014) indicate that extended times waiting to receive attention in the emergency department have demonstrated diminishing patient satisfaction and quality of care outcomes. EDs across the nation are facing delays in evaluating patients. These delays do not only affect patient safety but also their privacy and confidentiality (Oredsson, Jonsson, Rognes, Lind, Goransson, Ehrenberg, Asplund, Castren, & Farrohknia, 2011).

Healthcare institutions have developed various strategies to improve ED patient evaluation processes such as increasing bed capacity in the ED, improving patient throughput and disposition. The ED is a complex system and being efficient in providing emergency care has become a critical issue for healthcare organizations (Krall, Cornelius, & Addison, 2014). A critical element in improving patient experience is the amount of time a patient spends in the ED. Krall et al., (2014) identify factors that may influence ED movement including department size,

some emergency physician (ED), nursing, and auxiliary services. EPs are an essential element of the assessment process. Doctors regulate the time necessary for their directed assessment, and patient disposition. ED performance metrics are important in identifying the linkages between the times a patient arrives at the ED to the time he is treated and discharged from the ED.

Review and Summary of Relevant Literature

The American Hospital Association (AHA, 2002, April) found that nurses in many healthcare centers in the United States worked beyond their capacity. The rise in ED utilization indicates that healthcare centers are overpopulated leading to low-quality services offered to ED patients. In the year 2002, the number of emergency department patients had increased by 23% which was marked by a population of 110 million (Arkun, Briggs, Patel, Datillo, Bove, & Birkhaln, 2010). Arkun et al. (2010) also acknowledge that the current environment of the emergency department reduces the quality of attention given to patients. Many of the ED centers in the U.S. have been closed as a result of decreased funds and personnel. Therefore, patients who were to visit such EDs are force to move to other available ED centers, thus leading to prolonged waiting time due to the high population within in ED. In the United States, there were more than 5000 centers in 1991. In 2006, the centers were identified to be fewer than 4000, yet the number of visits has increased in the same period (Arkun et al., 2010).

There are a few factors that are related to waiting time in ED healthcare, for instance, staffing shortages, lack of patient flow management, and less availability of beds. Statistics from previous research indicate that there is an increase in the number of ED patients (Barata, Brown, Fitzmaurice, Griffin, & Snow, 2015; George, & Eviridiki, 2015; Patel, Combs, & Vinson, 2014; Sayah et al., 2014; Vezyridis, & Timmons, 2014).

Arkun et al. (2010) conducted a prospective cross-sectional cohort study to investigate the factors that influence crowding in the ED. The explicit purpose of the survey was to evaluate the time a patient arrives until the time he is seen by a doctor as well as the overall time taken by the patient in the ED. In contrast to the McCarthy et al. (2011) study, this research includes only adult patients who were evaluated only during the weekdays from morning till 8 pm due to patient volume. Like the previous study, ED measures included daily census. Findings from this study demonstrate an average of 85% ED capacity, and boarding was an average of 27%. The median time from when a patient arrives until the time being seen by a doctor was 1.8 hours and the total of time patient remains in the ED was 5.5 hours. In this study, the effect of crowding was related to ED occupancy due to physical space, and ED process efficiency. Another factor that contributed to crowding in EDs is the wait times that saw patients in hallways thus affecting the provision of care and quality outcomes.

One of the major factors which have contributed to prolonged waiting time in ED is triage. There has been discrimination of the patients as the order of first come first serve is not attended. Thus, patients who have been in the waiting room for a certain period end up staying there for some more hours. For this reason, it is essential to plan provision of quality services depending on patients' needs.

Barrett, Ford, and Ward-Smith (2012) conducted a quality project to evaluate and improved overcapacity of emergency department. A multidisciplinary group worked together to evaluate the problem of patient flow. After implementing a bed management strategy, the authors decided to assess improvement using a pre-and post-implementation chart review. The project used data from six months before implementing the strategy and six months after the implementation. The authors monitor data to measure the average time from ED arrival to

departure to inpatient room; the median time from the selection to transfer from emergency care unit to an inpatient care unit; and the average time from patient entrance to discharge from the ED. The study results successfully improved the average time admitted in the ED expecting transfer from 216 minutes to 103 minutes (52%). Barret et al., (2012) study improved the ability to avoid overcrowding by moving the patient earlier from ED, enhanced patient satisfaction with care, and also increased ED revenue.

Burstrom, Starrin, Engstrom, and Thulesius (2013) performed a qualitative study to examine waiting time at a Swedish ED from 2009 until 2011. The authors used grounded theory to compare on ED group data which was obtained by observation and literature data. Later a comparison was done with two other Swedish ED groups. This study aimed at reducing unacceptable waiting time in the ED. The authors highlight ED unacceptable conditions such as physical crowding, contact searching, and high demand of critical situations. Accordingly, when staff cannot decrease unacceptable waiting time, this situation causes staff irritation, embarrassment, and finally termination. Burstrom et al., (2013) recommend managing waiting time by improving patient movement through ED as well as talking and calming patients' which help in changing patients' waiting experience.

In 2009, Reza, Khorasani, Azizi, Ali, and Rahgozar (2013) conducted a quasi-experimental design study to determine triage effect on the wait and patient satisfaction after receiving treatment. This study divided the population into two groups namely experiment and control groups and applied a t-test. Findings demonstrate a difference between wait time in the control group which was 10.69 minutes, and the result from experiment group was 8.91 minutes. Patient satisfaction revealed little satisfaction in the control group and triaged patients had a high satisfaction score. Reza et al., (2013) suggest that educating nursing staff role in ED triage, and

acceleration in providing ED service may enhance the quality-of-care service and therefore, patient satisfaction.

Sayah, Rogers, Devarajan, Kingsley, and Lobon (2014) performed a research study to examine waiting times, patient movement and care experience in the ED. The authors of this study carried out a pre-and post-intervention analysis to investigate the response of ED services to operational changes introduced to improve the ED process. In this case, ED staff embraced new collaborative processes to ensure the prioritization of patient experience. The summary of this study shows a significant improvement in emergency transportation to the hospitals. The emergency transport time of departure demonstrates decreased from a mean of 148 hours to 0 hours. A reduction in the length of stay was also noticed. Furthermore, quality improvement was experience as well as a reduction of the number of patients who went home without being seen. The study by Sayah et al., (2014) proof that healthcare facilities do not have to incur high expenses when developing new strategies to improve ED efficiency; there are cheaper approaches that can create milestones in the ED.

Bleustein, Rothschild, Valen, Valaitis, Schweitzer, and Jones (2014) performed a study aimed at examining the effect of waiting time on patient satisfaction as well as their perception regarding physician abilities and the quality of care. The researchers administered anonymous surveys to a sample of 11,352 patients. Longer wait times, as identified by Bleustein et al., (2014) have a significant negative effect on patient satisfaction which in turn affects patients' confidence in the abilities of care providers as well as the quality of care.

Disasters are increasingly occurring. Therefore, there could be prolonged waiting time as the facilities within healthcare centers are not able to administer services to high numbers of patients. Every day, the emergency department's ability to handle patients is overstretched. For

this reason, the emergency medical system was unable to take in a suddenly increased demand for medical help after a natural disaster, a widespread disease, or a terrorist attack due to lack of workers in general, which lead patients to wait in the emergency department. One issue that ED services face is the high number of patients that seek care for non-urgent problems.

Statement of the Problem

Overpopulation in emergency departments is a global dilemma (Erenler, Akbulut, Guzel, Cetinkaya, Karaca, Turkoz, & Baydin, 2014). Some points during the day are busier than others, depending on where an emergency department is found; some patients have to wait longer than others (ACEP, 2015). EDs are taken into consideration to be an excessive-risk and excessive-pressure environment (McHugh, Van Dyke, McClelland, & Mass, 2011). If the capacity of the patients stays exceeded, there is a likelihood of an error occurring within the ED. Longer waiting periods in the ED or ambulatory diversions have the potential of compromising the Institute of

Medicine's six measurements of quality which are "safety, effectiveness, efficiency, equity, patient-centeredness and timeliness" (George & Evridiki, 2015, p.2). Various studies conducted over the past few years show that crowding in the ED significantly leads to reduced quality of health care (Sun, Hsia, Weiss, Zingmond, Liang, Han, McCreath, & Asch, 2013, p.7).

Improving patient flow through the ED has both positive and negative effects. One positive effect is the reduction of waiting time while one negative effect could be an increase of operational costs. Implementing appropriate solutions benefits to a great extent minimize boarding and improve patient flow in the ED. ED crowding is in most cases associated with long waiting periods and increased numbers of patients who show up at the ED with non-urgent cases that should be treated in primary care settings. The impact on this trend goes beyond the ED as previously mentioned this is a sign of patients' dissatisfaction by the performance of the

healthcare sector. The study by Sayah et al., (2014) indicates that extended waiting time in the emergency department and patient return times have demonstrated a reduction in patient satisfaction and quality of care. ED centers across the nation are confronting delays in evaluating patients. Time to obtain a proper treatment compromises patient safety, privacy, and confidentiality (Oredsson et al., 2011). Hospital organizations have developed strategies to improve ED patient evaluation process by enhancing be capacity in the ED and improving patient throughput and disposition (Krall, Cornelius, & Addison, 2014).

The hospital included in this capstone study has a history of an extended length of stay in the ED as a result of the increasing number of patient visits, Fast Track (FT) not being used, and the diminishing opportunity for an emergency physician (EP) to evaluate the patient. In 2014, the total time spent in the ED (from arrival in the ED to departure/admission time) was 210 minutes (64.3%) higher than the national average which is 135 minutes. In 2015, ED waiting time was 255 minutes (17.6%) higher than 2014 and 47% higher than the national average. Waiting time is still increasing; as a result, patient satisfaction has decreased, and consequently, the quality-of-care outcomes. According to Khurshid et al., (2014), the length of stay (LOS) in the ED is a step of the time between when a patient is first registered, and the time the patient physically leaves the ED.

The triage process at the facility requires a systematic process. One of the biggest problems is not having patient auto registration connected to the hospital electronic health record (EHR). This procedure causes the nurse to enter the time of patient arrival manually to Meditech® EHR. Triage metrics of the time of arrival are not reliable because sometimes the RN forgets to register the arrival time in Meditech®. The absence of a systematic method to facilitate patient experience at the right time needs attention to improve patient care.

Purpose

The primary objective of this quantitative retrospective comparative study was to measure the performance of emergency department wait-time and length of stay of triage and determine the effect of waiting time on the patient. Triage assessments are typically performed by Register Nurses (RN's), and they decide the patients' acuity-level concerning the seriousness of a person that requires medical care. Göransson, Ehnfors, Fonteyn, and Ehrenberg (2008) assert that triage setting requires a nurse with high clinical thinking and accurate judgment skills. The hospital ED priority is patient welfare and patient safety. Accurate decisions made by triage RNs concerning patient acuity-level is vital for the benefit of patient condition (Göransson et al., 2008). Erroneous triage acuity-level judgment may result in unfavorable proceedings and even provoke patients' deaths because of the extended delay in the attention needed with patients encountering serious life changes in the well-being statuses (Gilboy, Tanabe, Travers, & Rosenau, 2012).

In 2017, the hospital ED started a new triage system; Emergency Severity Index (ESI). This system categorizes ED patients by patient acuity, and patient resources need (AHRQ, 2012). The researcher performed a post-implementation analysis to evaluate the effectiveness of triage intervals after the implementation of triage five-level acuity system. This study also examined the efficiency of the triage process. Data regarding the group's experiences, traits and characteristics were collected. The study used descriptive statistics including mean, median, mode, maximum, and minimum, to summarize the data obtained from the population studied.

Research Question

PICO is a strategic process to assist in identifying the research question. PICO question is a mnemonic word that aide to relate the clinical question to recognize the problem (Glasper, &

Rees, 2013). In the PICO question's patient population refers to the participants or subjects of the particular issue (Melnyk & Fineout-Overholt, 2011). The intervention is an actual change or improvement process (Glasper & Rees, 2013). The comparison outcome portion of the PICO is similar to the measurable goals (Glasper, & Rees, 2013). Also, the PICO question aide with related literature in narrowing down the search terms and relevant articles (Glasper, & Rees, 2013). The PICO mnemonic for this study is described as:

(P)- Population: Emergency department EHR adult population 18>.

(I) - Intervention: Evaluate post-implementation results of the new triage system.

(C)- Comparison: Pre-and post-ESI implementation.

(O)- Outcome: Triage waits times.

(T)- Time: July, August and September 2016 compared to the same period of 2017.

The capstone project addressed the following research question: Is there a difference in wait times after the implementation of the emergency acuity five level (ESI) triage system? The hypotheses are:

H_0: There is no difference in wait times in ESI triage five-level system when compared to triage four-level system.

H_1: There is a difference in wait times in ESI triage five-level system when compared to triage four-level system.

Significance of the Study

Waiting time determines the satisfaction of patients in the ED. People are experiencing standard transformation in the health-related mindset whereby the focus is shifting from the importance of the disease to the importance of the patient. In other words, the healthcare system is now becoming more patient-centered as opposed to its previous focus on disease. The

evolution of the health care delivery system in the ED requires the need to provide precise information regarding the effect of ED on the quality of healthcare services provided. If the ED does not satisfy society, trust is wrecked. If hospitals' emergency departments are improved, society greatly benefited from the ED since all the services may be available and the urgency needed by the ED patients is met. Aforementioned an ED is a crucial part of a hospital organization considering the fact at once influences directly affecting the quality of services provided at a hospital.

An improved ED is crucial to a hospital organization. Emergency departments can increase the capacity of their services by rearranging their ability to move patients through the acute ED areas where the clinical team can evaluate and treat the patient. In addition, nurses do not have to work beyond their capacity as they can attend all the patients at the specified time.

The quality of the ED is rated alongside the waiting time of the patients. Patient satisfaction is likely to increase if the quality of the ED services is improved. There is an expectation of high turn up of ED patients if the ED is developed. The society's health status and also the nurses' environment working standards are liable to rise due to the availability of certified equipment. This concern confirms the importance and the requirement of improvements within the EDs of United States healthcare institutions. Welch et al., (2010) highlight that hospitals' EDs work to enhance the time of attention and productivity of emergency care; more importantly, critical to use approved terminology and metrics to measure performance. Clinical decision-making utilized in ED intervals of care is to ensure that each patient presenting various complaints receives appropriate care promptly.

Emergency department leaders are always facing challenges with implementing better performance measures. To master quality improvement initiatives and benchmarks, ED leaders

should successfully deliver patient care and satisfaction as well as achieve service initiatives. Also, emergency physicians are required to perform patient care services efficiently, safely, timely and profitably. Metrics are employed to assess efficiency, performance, and progress of a process which in this study is ED triage waiting time intervals. ED metrics are important in establishing a relationship between the arrival time of patients to the time the patient is treated, and the time for disposition (Welch et al., 2010).

This project is similar to Oredsson et al., (2011) study that seeks improvement at the time a patient steps into triage and develops evidence-based practice meant to facilitate the flow of patients in the ED. This project is also similar to Sayah et al., (2014) in which the researchers evaluate a pre-and post-intervention analysis for an ED process improvement project. Horwitz et al., (2011) research study also utilized similar methods of measurement and compares outcome variables that include a triage assessment variable and independent variables. In contrast, this study is dissimilar to Sun et al., (2012) research study that utilized a retrospective method to examine the effect of crowding on patients admitted in the ED.

The capstone project is significant to the current hospital under study. The project focused how to implement strategies to decrease ED waiting time phases. The goal was to improve performance through the involvement of ED leaders, physicians, and employees, with the main goal of ensuring their full participation and ownership of the process. The plan was to create protocols, increase the utilization of Fast Track and improve triage acuity system to facilitate triage efficiency and timelines. All of these changes finally ensured that the project goals are accomplished.

Nature, Scope, Limitations, and Delimitations of the Project

Triage process evaluation was conducted to determine the effect after changing hospital emergency department triage four-level assessment system to Emergency Severity Index (ESI) which is a five-level acuity system tool. The expectation with this quality project was to improve the effectiveness of triage process. Data collection provided waiting time measures, and pre-and post-implementation analysis of ESI. The ESI process offers a method for categorizing ED patients by both acuity and resource needs. The ESI triage algorithm establishes clinically relevant categorization of patients into five groups, from level 1(most urgent) to level 5 (least urgent).

A process implementation evaluation is a steady, continuous collection and analysis of data to monitor how properly the ESI system is working (CDC, 2017). The process assessment provides an early warning for any issues which can arise. This descriptive quantitative retrospective comparative study explains the strength and predicts the relationship between variables. The quantitative project design selected is the best to answer the research question, because throughout the study quantitative research questions and hypotheses do no longer change and this makes the project more deductive. This design estimates the significance and distribution of effects. The study compares two groups to determine if there were differences between the outcomes obtained after being exposed to a new triage system (Creswell, 2012). This type of descriptive study provides valuable information regarding the specific population group. As previously mentioned, this quantitative research collects numeric data and describes tendency by comparing previous research.

Meditech® is the electronic health record (EHR) of the hospital. Meditech® system extracts the information automatically and responds prompts quickly with reliability and

security. Emergency department medical records data were abstracted and harvested from the system by hospital's Information Technology (IT) staff and was validated using a logical spot check by a second abstraction to make sure that the data is precise. The data was downloaded by the hospital IT staff and transfer by email to the researcher. The investigator transferred all data to the Codebook (Excel spreadsheet). Meditech® ED tracker was used to oversee patient flow and wait times across the department from a single portal. The EHR supplied the documents and reports needed to satisfy quality measures for ED throughput.

The outcome variables of the sample population comprise visit characteristics and patients' socio-demographic factors presented using descriptive statistics. Analytical statistics contains monthly averages for each triage classification level. Occasionally, some days are busier than others, depending on where the emergency department is located thus leading to an increase in patients' length of stay and delay in treatment (ACEP, 2915). Evidence from previous studies shows that the implementation of fast track among patients with non-urgent symptoms leads to reduced waiting time, reduced length of stay and reduced numbers of patients leaving without being seen. Additionally, a team triage which has a physician tend to achieve reduced waiting time and length reduced numbers of patients leaving without being attended (Oredsson et al., 2011, p.7).

Scope

The extent of the project is to determine the effect of waiting time and length of stay in the ED. Inefficiencies in ED performance and slow provision of care have the potential to affect patients experience negatively. This quality improvement project was embracing those activities that seek to improve services for the future. Examples of such activities include developing ED

clinical protocols for patient-specific complaints to help accelerate the delivery of care and decrease waiting time.

Moran, Burson, and Conrad (2014) indicate that carefully integrated clinical evidence provided by socially and technically skilled personnel, accompanied by accountability and excellent communication is a critical element in improving operational efficiency in the ED. Being able to improve ED movement process, and place the patient first, was certainly improve ED operational efficiency. A non-probability consecutive sampling method was used in the study for every ED patient during the determined selected period. Non-probability sampling was done by choice or discretion in the selection process (Tappen, 2011). Also, non-probability sampling is the most commonly employed when data are skewed or when data are scarce (Sylvia, & Terhaar, 2014). A limitation in non-probability sampling is that not every element has an equal chance of selection.

Creative Research Systems (2016) survey software sample size calculator was used to determine the number of medical records needed for before and after implementation of Emergency Severity Index (ESI) five-level system. The research study was performed during the seasonal period from July, August and September 2016 and 2017. The sample size calculator confidence level was 95%, with a confidence interval of 5 for both years. The total population from July through September 2016 was 3824, the sample size was 348 (see, Appendix A). The total population from July through September 2017 was 4143, the sample size was 352 (see, Appendix B). This study used a total sample of 700 EHR retrospective review data. The accessible target population for the study involved general adult population who attend the emergency department. The participants were male and female adult patients above the age of 18 years, with triage assessment conducted in the ED setting and completed by the nurse. Each

participant should be able to speak Spanish and English, should have any physical or behavioral health condition. External validity can be influenced by the quality of the sample. The characteristics of the sample represent the population, the finding of the study can be generalized.

Limitations

This study has several limitations. First, the project took place in one single rural community hospital which is quite different from a hospital in an urban setting. For instance, the results of the study may not relate to other clinical centers as they may have a different nursing workforce and patient demographics. The second limitation is that the results may be inapplicable in hospitals whose ED or inpatient volumes differ from those of this hospital. The target population included adult emergency department patients. The third limitation is that this study did not include pediatric patients due to low patients' volume through ED. The reason is that there are two pediatric hospitals nearby the institution.

The fourth limitation is regarding the quantitative design used which might lead to data compression that could, in turn, result in the loss of crucial information. In quantitative design, research methods are rigid since the instruments cannot be modified once the study begins, and the administration of a structured questionnaire creates a bizarre situation that may isolate participants. Fifth, this retrospective study includes the use of existing data from the electronic

health record previously taped for research purpose. The sixth limitation is that the sampling method is a nonprobability consecutive sampling, which means that the sample was non-randomly sorted. Consequently, there is the probability of the results being influenced.

Delimitations

The study was conducted at a nonprofit community hospital and located in the West-Coast of Puerto Rico. The uniqueness of the subject could have been lost when the electronic health record aggregates data. In spite of the facility previous triage four-level system was changed to a five-level system the theoretical framework of Kurt Lewin theory which is a three-step change model was not chosen, because this model required nursing staff to reject learning (Kritsonis, 2011). Instead, Donabedian's model was preferred for this study to evaluate the outcomes after the implementation of a new triage acuity system. This framework was expected to demonstrate improvement of evidence-based practice (EBP) ESI triage system. The framework did not address causes of waiting time in the ED, which delimits the study.

The study did not include ancillary services (Laboratory, Radiology, and Respiratory Therapy) turnaround time that could have impact emergency department clinical service. Research questions focus on wait times after the implementation of the new triage acuity system. The research question didn't study factors of emergency care related to a person movement in the emergency care area. Descriptive parameters were used to describe the sample population. Major findings that support the theoretical framework of Donabedian's model demonstrate through Multivariate Analysis of Variance (MANOVA) test. MANOVA test studies group variances using a mixture of numerous dependent variables (Kim & Mallory, 2014). The interest of this research is to explore simultaneously the effect of time after the application of a new triage acuity system.

Mann-Whitney U test is a nonparametric test that was recommended for this study to establish differences between two independent groups and compare the medians values of the samples. Mann-Whitney transforms the scores on the continuous variable to ranks across the two

groups. Mann-Whitney was not the right statistical test to answer the proposed research question and when there are more than two continuous variables. One acuity score was a four-level system and the second was a five-level system.

Variables

The independent variables of the sample population including visit characteristics and patients' specific socio-demographic factors are described using descriptive statistics. Analytical statistics includes means for each focal point of ED triage times. Demographic characteristics include gender, age, the time of visit, the patient first ED visit, living location, and patient disposition (see, Appendix C). The study includes emergency department outcome variables for triage intervals: a) arrival time to triage time; b) triage completion time; c) arrival time to physician time; d) disposition order time to discharge home time, and e) disposition order time to departure to admitted time. This study compares retrospective data to evaluate quality measures before and after the implementation of ESI triage system (see, Appendix D). Emergency department efficiency of care include outcomes variables after the implementation of ESI triage acuity system and presents the volume of patients that was assessed by a nurse in each level: Level 1 (resuscitation); Level 2 (very vital); Level 4 (regular); and Level 5 (non-vital) (see, Appendix E).

Theoretical Framework

Quality is the central concern in healthcare institutions. Donabedian (1980) presented a model for classifying a different method to evaluate the quality of health care in a given scenario. Donabedian's model is a conceptual model that offers a background for probing health services and examining the quality of health care (Liu, Singer, Sun, & Camargo, 2011). Donabedian model has produced an excellent framework to apply quality concepts in a long way and

categorized measures to determine the quality of care. To make a distinction the model design uses three features of care: Structure-Process-Outcome (Sollecito, & Johnson, 2013).

This project uses Donabedian's model to evaluate a post-implementation process of a new triage assessment system (see, Appendix F). The framework was used to examine the quality of care for triage patients into a three-part approach, "Structure-Process-Outcome." The structure may refer to characteristics of a setting, human resource or an institution. The process is what is done to give or take, and influences the third step, outcomes, and this can be related to the health condition (Liu, Singer, Sun, & Camargo, 2011).

The analyst was applied Donabedian's model to outline the results of implementing best triage practices usage. In this research, the initial step of the design structure refers to the characteristics of the setting in which care is provided, ED standing order protocols for triage, how the nurse organizes, and nurse qualifications. The process was attributed to nursing assessment, which includes triage system placed in the correct level of care needed within an appropriate time frame (Eitel et al., 2003). Outcomes refer to the result of triage intervals time, ED performance metrics, and the effect on time after the implementation of ESI triage acuity system.

Definitions of Terms

Wait time: refers to the duration of time a patient waits in the emergency department before being seen by one of the ED medical staff (Horwitz et al., 2010).

Intervals: defined as the period between care points (Reza, Khorasani, Azizi, Ali, & Rahgozar, 2013).

Donabedian's model: a conceptual model that assesses the quality of care into three fundamental parts of healthcare: "Structure-Process-Outcome." (Liu, Singer, Sun, & Camargo, 2011).

Emergency Severity Index (ESI): is an instrument used in the emergency department to evaluate patient acuity level in triage and determine the amount of resource require for care (AHRQ, 2012).

Triage: is a process used to classify and prioritize patient condition at the time patient arrives to provide suitable care (Reza, Khorasani, Azizi, Ali, & Rahgozar, 2013).

Acuity: is defined as the level of health care problems or severity of an illness in a person (AHRQ, 2012).

Summary

The response to the increasing demand for indicators of ED performance assists hospitals achieve ED length of stay and improve triage timelines and the quality of care. With insufficient ED performance measures, there is no way to measure the effect of new interventions, strategies, or tools. Having standardized performance measures offers common terminology and provides an opportunity for comparison and improvement. Because the healthcare environment is constantly changing, organizations must take decisions daily, and it is imperative to make adequate decisions to achieve the health care institution goals. The issues of ED congestion should be urgently addressed through cooperation among administrators, emergency physicians, and healthcare personnel to implement the vital systems for ensuring safe access to emergency services and enhance patient flow in the ED.

SECTION II: METHODS

Introduction

The aim of this quantitative, retrospective, comparative study was to investigate the effectiveness of a pre-and post-implementation analysis project in a local hospital emergency department (ED) and assess the effect of ED wait time. The project design help learn more about means of decreasing patient turnaround time, assess staff behavior and develop interventions to enhance overall emergency department throughput. This design is appropriate for measuring improvement of ED triage wait times after implementation and evaluating performance.

This study compares groups to determine if there are differences between the outcomes obtained after being exposed to ESI implementation (Creswell, 2012). This quality improvement project uses data-based methods. Data collection process involves evaluation of data repository from electronic health record (EHR) of the emergency department. The intent of this project is to evaluate the background and sources of data to maintain quality and integrity of emergency department service. A data analysis of trends is presented; performance indicators were also used as an accurate form of measurements to assess efficiency, service, and effectiveness.

Project Design

This quantitative, retrospective, comparative study determines the effectiveness of a pre- and post-implementation analysis to measure the effect of emergency department (ED) waiting time. Quantitative research was used to established trends or when explanations need to be made. This design helps establishes the importance of the central idea “wait time” and this researcher relies on the statistical breakdown of the data for quality outcomes. The quantitative methods for analysis explain the strength and predict the relationship between variables. This study compares groups to determine if there are differences between the outcomes obtained after being exposed

to ESI implementation (Creswell, 2012).

Quantitative design address objectivity desired when evaluating a new triage acuity system. The independent variables of the sample population including visit characteristics and patients' specific socio-demographic factors are described using descriptive statistics. Analytical statistics were completed using monthly averages for each focal point of ED triage times, and patient outcomes. The CMS and TJC recommends EDs to compare their standards with those of their local counterparts to measure their performance

After analyzing the findings and methods to improve each interval wait time, this author focuses on how to implement strategies to decrease waiting time periods. The goal is to improve performance through the involvement of ED leaders, physicians, and employees, to ensure that they have participation and ownership of the process. The plan is to create protocols, increase the utilization of Fast Track and improve triage acuity system aimed at facilitating triage efficiency and timelines.

Sample and Setting

The project was conducted at Bella Vista Hospital at Mayaguez, Puerto Rico. The hospital is a 158-bed rural non-for-profit acute care community facility. The emergency department has 41 stretchers' which include three isolation rooms and eight admission beds, one triage room and one Fast-Track area with four recliners. The ED provides treatment for approximately 22,264 patients annually, with an average ED length of stay of 308 minutes. In March 2015, the hospital administration hired a highly talented and committed Emergency Physicians group. This move was aimed at increasing the confidence of the community in the hospital as well as to strengthen the position of the emergency department within the hospital. The clinical staff of the ED consists of 47 registered nurses. South-West Emergency Physician

group consists of 18 doctors. Permission was obtained from the study setting (see, Appendix G), and from the Director of Information Management Department to access data from EHR (see, Appendix H). The institution does not have an Institutional Review Board (IRB). In addition, permission was obtained from the American Sentinel University IRB to start the capstone project (see, Appendix I).

Non-probability consecutive sampling methods of every ED patient during the selected period of research was being included in the study. Non-probability sampling is done by choice or discretion in the selection process (Tappen, 2011). Also, non-probability sampling is the most commonly employed when data are skewed or when data are scarce (Sylvia, & Terhaar, 2014).

First, this author got the sampling frame organized. In order to achieve this process, the institution EHR was used in identifying every individual pre-and post-implementation specified periods and produces a list of patients.

Creative Research Systems (2016) survey software sample size calculator was used to determine the number of medical records needed for before and after implementation of Emergency Severity Index (ESI) five-level system. The research study was performed during the seasonal period from July, August and September 2016 and 2017. The sample size calculator confidence level was 95%, with 5 as a confidence interval for both years. The total population from July through September 2016 was 3824; the sample size for the first period is 348. The total population from July through September 2017 was 4143; the sample size for the second period is 352. This study used a total sample of 700 retrospective review data from the electronic health record.

The target accessible population for the study involves general adult population who attend the emergency department. The participants are male and female adult patients above the

age of 18 years, with triage assessment conducted in the ED setting and completed by the nurse. Each participant should be able to speak Spanish and English, should have any physical or behavioral health condition. Exclusion criteria would be patients triaged by ED doctors and pediatric patients. This study does not include ancillary services (laboratory, Radiology, and Respiratory Therapy) turnaround time that may impact emergency department clinical service. External validity may be influenced by the quality of the sample. The characteristics of the sample represent the population, the findings of the study can be generalized.

Instrumentation

For this study, the researcher used the electronic health record (EHR) as a tool to manage the complexities of healthcare data (Moran, Burson, & Conrad, 2014). EHRs include the functionality that supports constant quality improvement, utilization review, risk management, and monitoring of performance (Tappen, 2011). Meditech® has been the hospital electronic health record since 2010. Meditech® provides an integrated set of tools for sharing functionality and information between inpatient, practice, and ED setting, as well as features specifically around ED workflow.

The EHR helps with: Triage, Patient Tracking, Clinical Documentation, and Centralized Discharge. A multidisciplinary discharge tool provides the entire care team within a single location to manage the discharge process. When patients are admitted from the ED, all information including orders, results, and documentation are automatically shared with the acute side in real time. The emergency department data is also available for inclusion in the inpatient discharge packet.

Data Collection

This quality improvement project uses data-based methods. The researcher used the EHR as a tool to manage the complexities of healthcare data. Meditech® the facility EHR is designed with the reliability and security required to support excellent patient care. The author did not collect any identifying information of the patient, ensuring the protection of the rights and well-being of the human subjects. The study includes data of a pre-implementation period from July through September 2016, and a post-implementation period from July through September 2017. Demographic data describe using descriptive statistics, gender and age, time of ED visit, patient first visit, living location, and patient disposition.

The specified time and patient volumes were chosen to provide an adequate sample size, and seasonality which is referred as any predictable change or sample in a time collection that recurs or repeats over a one-year length to demonstrate the effect of waiting time in the ED. Demographic characteristics include gender, age, the time of visit, patient first ED visit, living location, and patient disposition.

Performance data include outcome variables for triage intervals wait times: a) arrival time to triage time; b) triage completion time; c) arrival time to physician time; d) disposition order time to discharge home time, and e) disposition order time to departure to admitted time. This study compared retrospective data to evaluate quality measures before and after the implementation of ESI triage system. Emergency department efficiency of care includes subject variables after implementation of ESI triage acuity timelines by level: Level 1 (resuscitation) target time to be seen immediately; Level 2 (very vital) Level 4 (regular), and Level 5 (non-vital).

According to Moran, Burson, and Conrad (2014), the action-oriented aspect of a research project involves collaboration and teamwork. The research project data collection process include collaboration from IT department. The hospital IT employee assigned to this project removed all subjects' identifiers and assigned a numerical code identifier. Prior to data collection instructions for the IT employee related to the study was discussed. The IT employee provided assistance with raw data abstraction, and download. The researcher transfer data to a codebook (Excel spreadsheet) which summarizes variables characteristics. The creation of the codebook helped with data filing and minimizes error with data entry.

Data collected was being stored in a hospital-encrypted flash drive, and the flash drive was registered and stored in the organization's information system where a user-generated password was required each time it is accessed by the researcher. To ensure that the organizations' data is safeguarded, documents on paper were kept in a sealed filing cupboard in the information management department. All electronic and paper documents, including hospital-encrypted flash drive, was be safely stored for five years and afterward destroyed by the hospital's IT department.

Data Analysis Method

This study used data from retrospective EHR review to examine demographics and to manage the complexities of healthcare data. Frequencies distribution procedure was performed to obtain descriptive statistics. Statistical Package for Social Sciences (SPSS v.21) was used to analyzed data (Pallant, 2014). Those gone deprived of being seen, left out being triaged, or against doctors' advice were excluded from analysis due to difficulty in measuring resources used. Descriptive statistics were used to describe the sample population and involved the use of

median, mode, mean, range, minimum, and maximum. A measure of central tendency was used to compare the average of all values in the data set of triage acuity systems of 2016 and 2017.

Mann-Whitney test which is a nonparametric method of analysis that compares two independent groups changed. The Statistician recommendation was to use Multivariate analysis of variance (MANOVA) test, the multivariate procedure is used when there is a need to utilize multiple independent variables to investigate simultaneously. Total time was the dependent variable used for this test. Quantitative design addressed objectivity desired when evaluating the new triage acuity system. The independent variables of the sample population including visit characteristics and patients' specific socio-demographic factors are described using descriptive statistics. Analytical statistics includes means for each focal point of ED triage times.

After analyzing the findings and methods to improve each interval wait time, this author focuses on how to implement strategies to decrease waiting time periods. The goal is to improve performance through the involvement of ED leaders, physicians, and employees, to ensure that they have participation and ownership of the process. The plan was to create protocols, increase the utilization of Fast Track and improve triage acuity system aimed at facilitating triage efficiency and timelines.

Data Management Method

Hospital IT employee assigned to this project removes all participant identifiers and assigns a numerical code identifier. Prior to data collection instructions for the IT employee related to the study was discussed. The IT employee provides assistance with raw data abstraction, and download. The researcher transfer data to a codebook (Excel spreadsheet) which summarizes variables characteristics. The creation of the codebook helped with data filing and minimizes error with data entry.

Data collected was stored in a hospital-encrypted flash drive, and the flash drive was registered and kept in the organization's information system where a user-generated password is required each time to be accessed by the researcher. To ensure that the organization's data is safeguarded, documents on paper were kept in a sealed filing cupboard in the information management department. All electronic and paper documents, including hospital-encrypted flash drive, was safely stored for five years and afterward destroyed by the hospital's IT department.

Ethical Considerations

The purpose of the Institutional Review Board (IRB) committee is to review and approve research and make sure that participants' rights are protected. IRB members are committed with the guidelines of ethical principles (Creswell, 2012). A researcher that follows these guidelines assures that individuals uphold their autonomy. Obtaining the approval from IRB requires from this researcher a summary of the procedures and evidence that the project protected the participants. This researcher identifies the level of risk experienced by the participants is less than minimal.

The healthcare institution where the project took place does not have an IRB. To respect the site in which the research was held, the researcher obtained a written permission from the study setting (see, Appendix G). A written permission was obtained from the Director of Information Management Department to access data from electronic health record (see, Appendix H). Data collection process should be less disturbing as little as possible during the study. This study is not collecting any identifying information of the patient, ensuring the protection of the rights and well-being of human subjects. This is a retrospective comparative study and participant consent is waived. Data was collected from electronic health records. A unique code was set off to de-identified health information. The process of de-identification

mitigates privacy risks to individuals and thereby supports the secondary use of data for comparative effectiveness studies.

The result from this capstone project was shared with: a) the DNP student's Capstone chair and committee members; b) American Sentinel University Institutional Review Board; c) regulatory officials from the organization where the project was carried out. The project findings were reported in a systematic fashion, starting with a description of the sample characteristics and the clinical setting for a quality improvement report. The results present data outcomes, organized over the clinical question and the improvement process.

All data collected was stored in a hospital-encrypted flash drive, and the flash drive was being registered and stored in the organization's information system where a user-generated password is required each time to be accessed by the researcher. To ensure that the organization's data is safeguarded, documents on paper were kept in a sealed filing cupboard in the information management department. All electronic and paper documents, including hospital-encrypted flash drive, was safely stored for five years and afterward destroyed by the hospital's IT department.

Internal and External Validity

This study process evaluation measures the effect of the new triage system using statistical methods to try locating causal relationships between this system and the outcome measures. In this study, quality measurements may directly influence the strength of findings. Internal validity may be at risk by a confounding factor. Additionally, given that data was derived from non-randomized sampling, this project is likely to be influenced by potential biases and confounding factors. If the statistics results are significantly different, then gender could be the confounder that impacts the results of the post-implementation on the outcome variable. External validity may be influenced by the quality of the sample. Caution must be taken before

generalizing, due to the condition of the pre-implementation period and the post-implementation period interventions conditions of work change. The main aspect that can affect external validity is whether the sample is representative of the general population alongside relevant dimensions.

Summary

In summary, this project study is designed to learn more about methods of minimizing the total time spent by the patient in the ED as well as enhancing patients' overall experience in the emergency department. Learning more about ways to reduce patient waiting time in the emergency department may help decrease patient dissatisfaction and improve quality of care. The hospital goal is to reduce the average waiting time of patients in the emergency department. This is a safety issue because a patient needs to proceed to the designated area within the shortest time possible to receive care. Despite saving time, improving patient movement through the emergency department often adds substantial costs. In deciding, where to allocate resources and how to maximize quality care and revenue, the facility must accurately measure and take into account the opportunity loss and potential economic cost of time spent in the ED. The results of implementing ESI five-level acuity system statistical test are described in Section 3. This researcher summarized the results to provide a complete view of findings and recommendations for future studies.

SECTION III: RESULTS AND DISCUSSION OF FINDINGS

Introduction

Overpopulation in emergency departments is a global dilemma (Erenler, Akbulut, Guzel, Cetinkaya, Karaca, Turkoz, & Baydin, 2014). Some points during the day are busier than others, depending on where an emergency department is found; some patients have to wait longer than others (ACEP, 2015). EDs are taken into consideration to be an excessive-risk and excessive-pressure environment (McHugh, Van Dyke, McClelland, & Mass, 2011). If the capacity of the patients stays exceeded, there is the likelihood of an error occurring within the ED. Emergency department establishment is crucial, particularly concerning of the overpopulated health care centers. One of the major factors which have contributed to prolonged waiting time in ED is triage. The responsibility of ED is to accept a patient, triage, stabilize and execute treatment with different conditions which could require immediate, urgent or semi-urgent attention. Triage is the prioritization of patient consideration in light of sickness/harm, seriousness, diagnosis, and service accessibility. Therefore, patients are treated depending on the urgency of their cases. The intention for triage is to identify patients requiring immediate attention to supply the correct level of care and treatment, set priorities and transfer the patient within a short time (Reza, Khorasani, Azizi, Ali, & Rahgozar, 2013).

The primary objective of this quantitative retrospective comparative study is to measure the performance of emergency department waiting time and length of stay of triage and determine the effect of waiting time. Therefore, triage process evaluation was conducted to determine the effect of changing hospital emergency department triage four-level assessment system to Emergency Severity Index (ESI) five-level acuity system tool. The expectation with this quality project is to improve the effectiveness of triage process. Data collection from the

hospital electronic health record (EHR) Meditech® was done, which include a sample of 700 subjects from July to September 2016 and 2017 pre- and post-implementation of ESI.

The intent of this section is to provide data analysis of trend, discuss performance metrics, and suggest improvement strategies. A description of the sample and the setting characteristics are included, also a discussion of the major findings that estimate the significance and the effect of implementing ESI new triage system. The implication for nursing practice is presented, recommendations for the hospital and for future studies.

Summary of Methods and Procedures

This quantitative, retrospective, comparative study determines the effectiveness of a pre- and post-implementation analysis to measure the effect of emergency department (ED) waiting time. Quantitative research was used to establish trends. This design help established the importance of the central idea “wait time” and this researcher rely on the statistical breakdown of the data for quality outcomes. The quantitative methods for analysis explained the strength and predict the relationship between variables. This study compared groups to determine if there were differences between the outcomes obtained after being exposed to ESI implementation (Creswell, 2012).

Hospital Information Technology (IT) department employee assigned to this project removed all participant identifiers and assign a numerical code identifier. Prior to data collection, instructions for the IT employee related to the study were discussed. The IT employee provided assistance with raw data abstraction, and download. The researcher transfer data to a codebook (Excel spreadsheet) which summarizes variables characteristics. The creation of the codebook helped with data filing and minimizes error with data entry.

This study used data from retrospective EHR review to examine demographics and to manage the complexities of healthcare data. Frequencies distribution procedure was performed to obtain statistical details of the sample. Statistical Package for Social Sciences (SPSS v.21) was used to analyzed data (Pallant, 2014). Those gone deprived of being seen, left out being triaged, or against doctors' advice were excluded from analysis due to difficulty in measuring resources used. Descriptive statistics were used to describe the sample population and involved the use of median, mode, mean, range, minimum, and maximum. A measure of central tendency was used to compare the average of all values in the data set of triage acuity systems of 2016 and 2017.

Mann-Whitney test which is a nonparametric method of analysis that compares two independent groups changed. The statistician recommendation was to use Multivariate analysis of variance (MANOVA) test. The multivariate procedure is used when there is a need to utilize multiple independent variables to investigate simultaneously. Total time was the dependent variable used for this test. Quantitative design addressed objectivity desired when evaluating the new triage acuity system. The independent variables of the sample population including visit characteristics and patients' specific socio-demographic factors are described using descriptive statistics. Analytical statistics includes means for each focal point of ED triage times.

After analyzing the findings and methods to improve each interval wait time, this author focuses on how to implement strategies to decrease waiting time periods. The goal is to improve performance through the involvement of ED leaders, physicians, and employees, to ensure that they have participation and ownership of the process. The plan is to create protocols, increase the utilization of Fast Track and improve triage acuity system aimed at facilitating triage efficiency and timelines.

Summary of Sample and Setting Characteristics

The capstone project was conducted at Bella Vista Hospital at Mayaguez, Puerto Rico. The hospital is a 158-bed rural non-for-profit acute care community facility. The emergency department has 41 stretchers' which include three isolation rooms and eight admission beds, one triage room and one Fast-Track area with four recliners. The ED provides treatment for approximately 22,264 patients annually, with an average ED length of stay of 308 minutes. In March 2015, the hospital administration hired a highly talented and committed Emergency Physicians group. This move was aimed at increasing the confidence of the community in the hospital as well as to strengthen the position of the emergency department within the hospital. The clinical staff of the ED consists of 47 registered nurses. South-West Emergency Physician group consists of 18 doctors. Permission was obtained from the study setting, and from the Director of Information Management Department to access data from EHR. The institution does not have an Institutional Review Board (IRB). In addition, permission was obtained from the American Sentinel University IRB to start the capstone project.

Creative Research Systems (2016) survey software sample size calculator was used to determine the number of medical records needed for before and after implementation of Emergency Severity Index (ESI) five-level system. The research study was performed during the seasonal period from July, August and September 2016 and 2017. The sample size calculator confidence level was 95%, with 5 as a confidence interval for both years. The total population from July through September 2016 was 3824; the sample size for the first period is 348. The total population from July through September 2017 was 4143; the sample size for the second period is 352. This study used a total sample of 700 retrospective review data from the electronic health record.

The target accessible population for the study involves general adult population who attend the emergency department. The participants are male and female adult patients above the age of 18 years, with triage assessment conducted in the ED setting and completed by the nurse. Each participant should be able to speak Spanish and English, should have any physical or behavioral health condition. Exclusion criteria were patients triaged by ED doctors and pediatric patients. This study does not include ancillary services (Laboratory, Radiology, and Respiratory Therapy) turnaround time that may impact emergency department clinical service. The characteristics represent the population; the findings of the study can be generalized.

Descriptive statistics indicate that the sample includes 403 females (57.6 %) and 297 males (42.4 %) (see, Appendix J); a histogram shows the scores for gender frequencies (see, Appendix K). The variable age ranges from 18 to 98 years, showing a mean of 55.01 and a standard deviation of 20.5; a histogram shows the scores are reasonable normally distributed with most scores occurring in the center tapering out towards the extremes (see, Appendix L). The sample size was divided by age group: young adult from 18 to 35 (21.4 %), middle-aged adult from 36 to 55 (28.4%), and older adult from 56 + higher (50.10) which represent half of the population that visit the emergency department during July through September 2016 and 2017 (see, Appendix M). Descriptive statistics for continuous variables show 255 (36.4 %) participants visit the ED during the evening, 237 (33.9%) visit ED during the morning and 208 (29.7%) visit ED at night (see, Appendix N). The variable time of visit mean was 1.96 with a standard deviation of .79; a histogram demonstrates the scores (see, Appendix O). The months of July through September 2016 and 2017, 85 (12.1%) patients visit the ED for the first time (see, Appendix P). Patient disposition descriptive output indicates 510 (72.9%) participants were discharged to home from ED, and 190 (27.1%) were admitted to the hospital (see, Appendix Q).

Data of living location in an urban area showed 354 (50.6%) and the data of living location in a rural area demonstrate 346 (49.4) the scores are presented in a bar chart (see, Appendix R).

Major Findings

The first step in data analysis was to evaluate the distributions of the dependent variable time and the outcome variables which are gender, age, arrival, triage, provider, discharge, and disposition to the floor, total time, acuity level, and a group of age. Appendix S shows the frequencies distribution of the outcome variables demonstrate for the total sample of 700 subjects a mean of 1.42 for gender which represents the average female population of all values in this data set and the mean for age is 55.0 (see, Appendix L). The seasonal periods from July through September 2016 and 2017 the total average time for triage process by intervals show a mean of 6.9 from arrival to triage; a mean of 28.7 of triage completion; a mean of 87.3 from door to provider; a mean of 47.5 from discharge to home; and a mean of 120.7 from disposition to floor. The acuity level mode is 3 which is the most frequently occurring number in this data set. The age group means is 2.29 which stand for middle adult age from 36 to 55 years.

A comparison of emergency department triage performance findings shows from July through September 2016 the arrival to triage time a mean of 7.9; triage completion a mean of 30.66; door to provider show a mean of 105.61; time to discharge home a mean of 42.11; and time to departure to floor show a mean of 148.84. When compare from July through September 2017 the arrival to triage time decrease to a mean of 6.04; triage completion decreases to a mean of 26.7; door to provider show reduction to a mean of 69.33; time to discharge home a mean of 52.9; and time to departure to floor show reduction to a mean of 93.0 with an improvement of 55.8% (see, Appendix T).

Triage performance comparison indicates that out of five triage intervals four of them were higher from July through September 2016 than 2017 (see, Appendix U). The highest score for triage intervals during the study period of 2016 was patient to be seen by a provider with a mean of 105.6, and disposition to floor with a mean of 148.8. Triage performance of July through September 2017 had the highest score in one interval discharge home with a mean of 52.9: a difference of 10.81.

The distribution of ESI acuity levels of 352 subjects after implementation from July through September 2017 selected by nurses was the following: ESI 1 (Resuscitation) 5 subjects; ESI 2 (Very Vital) 81 subjects; ESI 3 (Urgent) 113 subjects; ESI 4 (Regular) 81 subjects; and ESI 5 (Non-Vital) 72 subjects (see, Table 3). The outcome of the distribution discloses an opportunity to diminish patient congestion in the ED by utilizing the Fast Track (FT) area for ESI 4 and 5 level, which represents a total of 153(43.1%) subjects. Since the ESI acuity-level 4 and 5 are stable with no life-threatening condition and don't need urgent care, these patients can wait to be seen at FT and can be treated with minimum resources needed.

Multivariate Analysis of Variance (MANOVA) has the power to detect significant group variances along a mixture of dependent variables. The tests of between- subjects' effects output indicate acuity level, has a significant effect on the dependent variable of total time with a df = 4, F= 4.9, p= .001. The output also indicates significance in the corrected model source, a df =8, F= 4.8, p= .000, and intercept show a df =8, F=234.1, p=.000 (see, Appendix V). There is a difference in wait times in ESI triage five-level system when compared to triage four-level system which means that the null hypothesis is rejected.

Major findings that support the theoretical framework of Donabedian's model is demonstrated through (MANOVA) test. A one-way between-group was performed to investigate

differences in acuity systems. Descriptive statistics of output generated from MANOVA present that N values correspond to the sample population. There is no violation of the normality of variance. When comparing total means, 2016 for acuity four-level system was 335.11 higher than 2017 for acuity five-level system was 248.06 (see, Appendix W). The difference indicates that there is an improvement in changing triage acuity assessment system from four-level to five-level.

Implications for Nursing Practice

The project used Donabedian's model to evaluate a post-implementation process of a new triage assessment system. The framework examines the outcomes for triage patients into a three-part approach, "Structure-Process-Outcome." The structure was the characteristics of triage setting and human resource. The process was done to give or take, and influenced the third step, outcomes, which relates to patient wait time after receiving treatment in the ED. Triage process demonstrates in 2017 an improvement in four levels of triage intervals (Arrival to Triage, Triage Completion Time, Door to Provider, and Disposition to Floor). Discharge disposition to home interval needs improvement. The difference of time was observed during the length of time patients experience for the initiation of treatment which starts after the provider evaluation, and a second observation was a delay of the provider re-evaluation for discharge home.

The capstone project addressed the following research question: Is there a difference in wait times after the implementation of the emergency acuity five level (ESI) triage system? The answer is yes. There is a difference in wait times in ESI triage five-level system when compared to triage four-level system, the null hypothesis is rejected due to differences. The ESI process provides a method for categorizing ED patients by both acuity and resource needs. The ESI triage algorithm establishes clinically relevant categorization of patients into five groups, from

level 1(most urgent) to level 5 (least urgent). Twenty ED nurses have received certification of ESI training. After the implementation of ESI, triage nurses have demonstrated the skills to select the appropriate ESI acuity level and the resources needed to accomplish patient care.

Recommendations

A recommendation for nursing practice is to persistently use triage tracking system form the electronic health record Meditech ® which provides an integrated set of tools for sharing functionality and information between inpatient, practice, and ED setting, as well as features specifically around ED workflow. Also, standardized triage order sets to improve the efficiency of patient care services. Nursing staff and medical staff work with collaboration to support each other and provide the best service to all patients that arrive at the emergency department.

Another recommendation is that emergency department EHR add Emergency Severity Index template to nursing notes. Nursing informatics team consider the development of a triage section note to be used when patient acuity-level change while a patient is waiting to see the provider. The documentation should include the reason for changing ESI level. A general recommendation is to provide annual education of ESI for all ED nurses and ED physicians to reassure precision and appropriate use to maintain an efficient triage process.

Emergency department Nurse Navigator (NN) role was initiated in June 2017, this program is practically new. ED Nurse Navigator role is done by four experienced RNs during 12-hour shift, 24/7. In the attempt to improve patient care, the Nurse Navigator can help follow up with triage workflow and discharge process. ED Nurse Manager should stimulate team participation. A motivational technique is a way of encouraging actions that will assist others in meeting their needs while helping achieve patient care objectives. The nurse leader who comprehends motivational technique has a potent force available for use. To help stimulate

nursing team participation the nurse leader should generate opportunities for group communication throughout the day, handoffs, end-of-day question, and week by week assemble gatherings to fortify working connections.

Discussion

The response to the increasing demand for indicators of ED performance help hospitals achieves ED triage timelines and length of stay in the emergency department. Having standardized performance measures offers common terminology and provides an opportunity for comparison and improvement. Because the healthcare is constantly changing, organizations have to take adequate decisions to achieve the institution goals. These study results indicate that the decision to change triage process from a four-level acuity system to a five-level acuity system was a correct choice. Findings of this study indicate that further clinical research can provide valuable evidence and clinical applications.

One limitation of the project was physicians' lack of interest in knowing the new triage system. Understanding the importance of identifying the acuity of a patient upon arrival and using the correct resources not only prevent a patient potential threat to patient life, also help with ED operational performance. However, findings of triage interval show from door to the provider before ESI implementation a mean of 105.61 in 2016, and after the implementation a decrease in time with a mean of 69.33 in 2017. The continuing improvement is essential to sustain efficiency in triage process. ED physicians have the aptitude and control over the time a patient wait to be evaluated by a provider.

The results of this study are similar to Sayah, Rogers, Devarajan, Kingsley, and Lobon (2014) performed a research study to examine waiting times, patient movement and care experience in the ED. The authors of this study carried out a pre-and post-intervention analysis to

investigate the response of ED services to operational changes introduced to improve the ED process. The summary of this study shows a significant improvement in emergency transportation to the hospitals. The emergency transport time of departure demonstrates decreased from a mean of 148 hours to 0 hours. A reduction in the length of stay was also noticed. The study by Sayah et al., (2014) proof that healthcare facilities do not have to incur high expenses when developing new strategies to improve ED efficiency; there are economical approaches that can create milestones in the ED.

The results of this study are similar to Barrett, Ford and Ward-Smith (2012) the authors conducted research to evaluate from a chart review patient flow, and the time patient wait to obtain a bed after admission. The authors monitor data before and after implementing bed management strategy to measure the period from ED entrance to leaving to inpatient room and the period from the choice to transfer from ED to an inpatient unit. This study successfully improved the average time admitted in the ED expecting transfer from 216 minutes to 103 minutes (52%). Barret et al., (2012) study improve the ability to avoid overcrowding by moving the patient earlier from ED, enhanced patient satisfaction with care, and also increased ED revenue.

Conclusions

The primary objective of this quantitative retrospective comparative study was to measure the performance of emergency department wait time and length of stay of triage and determine the effect of waiting time on the patient. The findings demonstrate a positive effect after ESI five-level acuity system implementation. The capstone project provides evidence to sustain that ESI five-level acuity system improves the efficiency of triage process by decreasing triage intervals wait time from July through September 2017. The issues of ED congestion must

be urgently addressed through cooperation among administrators, emergency physicians, and healthcare personnel to ensure safe access to emergency services and enhance patient experience in the ED.

References

Agency for Healthcare Research and Quality (2011). *The need to address emergency department crowding.* Rockville, MD. Retrieved from http://www.ahrq.gov/research/findings/final- reports/ptflow/section1.html

Albert, M., McCaig, L.F., & Ashman J.J. (2013). Emergency department visits by persons aged 65 and over: United States, 2009-2010. *National Center for Health Statistics, data brief, 130*. Hyattsville, MD: National Center for Health Statistics 2013.

American College of Emergency Physicians (2008). *Emergency department crowding: -Impact solutions, 1.* Retrieved from www.acep.org/workarea/DownloadAsset.aspx?id=50026

Arkun, A., Briggs, W., Patel, S., Datillo, P., Bove, J., & Birkhahn, R. (2010). Emergency department crowding: Factors influencing flow. *Western Journal of Emergency Medicine, XI* (1), 10-15.

Barata, I., Brown, K. M., Fitzmaurice, L., Stone, E., & Snow, S.K. (2015). Best practices for improving flow and care of pediatric patients in the emergency department. *American Academy of Pediatrics, 135*(1), 274-279.

Barrett, L., Ford, S., Ward-Smith, P. (2012, Mar/Apr). A bed management strategy for overcrowding in the emergency department. *Nursing Economics,* 82(5), 116.

Bleustein, C., Rothschild, D. B., Valen, A., Valaitis, E., Schweitzer, L., & Jones, R. (2014). Wait times, patient satisfaction scores, and the patient perception of care. *American Journal of Managed Care, 20* (5), 393-400.

British Columbia Medical Association (2011, July). *Emergency department overcrowding.* Retrieved from http://www.bcma.org

Burstrom, L., Starrin, B., Engstrom, M., & Thulesius, H. (2013) Waiting management at the emergency department-a grounded theory study. *BMC Health Services Research, 13*(95), 1-9.

Center for Disease Control (2017). *Types of Evaluation*. Retrieved from http://www.cc.gov/std/Program/pupested/Typesofevaluation.pdf

Creative Research Systems (2016). *Confidence level and confidence interval, sample size calculator.* http://www.surveysystem.com/sscalc.htm

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* (4th ed.). Boston, MA: Pearson Education, Inc.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches.* (4th ed.). Thousand Oaks, CA: SAGE Publications

Department of Health & Human Services (2015). *The Belmont report: Basic ethical principles.* Retrieved from http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html

Erenler, K., Akbulut, S., Guzel, M., Cetinkaya, H., Karaca, A., Turkoz, B. & Baydin, A. (2014, June). Reasons for overcrowding in the emergency department, *Turk J Emerg Med, 14*(2), 59-62.

FitzGerald, G., Jelinek, G.A., Scott, D., & Gerdtz, M.F. (2010). Emergency department triage revisited. *Emergency Medicine Journal, 27* (2), 86-92.

Glasper, A. & Rees, C. (2013). *How to write your nursing dissertation.* (1st ed.). Ames, Iowa: Wiley-Blackwell.

Horwitz, L., Green, J., & Bradley, E. (2010). United States emergency department performance on wait time and length of visit. *Annals Emergency Medicine, 55*(2), 133-

141.

Khurshid, R., Ashraf, M., Pandita, K., Bhat, M., Farooq, A., & Khan, S. (2014). Utilization of emergency services of a tertiary care hospital: Workload, time trends, common disease, length of stay and admission pattern. *Scholars Journal of Applied Medical Sciences.* 2(4C), 1325-1329.

Kim, M. & Mallory, C. (2014). *Statistics for evidence-based practice in nursing.* Burlington, MA: Jones & Bartlett Learning.

Krall, S., Cornelius, A., & Addison, J. (2014). Hospital factors impact variation in emergency department length of stay more than physician factors. *West Journal Emergency Medicine, 15*(2), 158-164.

Kristonis, A. (2011). *Change theory Kurt Lewin*. Retrieved from http://currentnursing.com/nursing_theory/change_theory.html

Liu, S.W. Singer, S.J., Sun, B.C., Camargo, C.A. (2011). A conceptual model for assessing quality of care for patients boarding in the emergency department: Structure-process-outcome. *Acad Emer Med, 18* (4), 430-435.

Lucas, Raymond (2009, Mar/Apr). Measuring the opportunity loss of time spent boarding admitted patients in the emergency department: a multihospital analysis. *Journal of Healthcare Management, 117(24),* discussion 124-5.

Marco, C.A., Mostop, J.C., Schears, R.M., Hommedeieu, J.L., Bookman, K.J., Padela, A.I., Baine, J., & Bryant, E. (2012). The ethics of health care reform: Impact on emergency medicine. *Journal of the Society for Academic Emergency Medicine, 19*(4), 461-466.

McCarthy, M.L., Ding, S.R., Pines, J.M., & Zeger, S.L. (2011). Comparison of methods for measuring crowding and its effects on length of stay in the emergency department.

Society for Academic Emergency Medicine, 18 (12), 1269-1276.

McHugh, M., Van Dyke, K., McClelland, M., & Mass, D. (2011, October). Improving patient flow and reducing emergency department crowding: A guide for hospitals. *Agency for Healthcare Research and Quality, 11*(12)-0094, 1-43.

Meditech Consulting and Technology Solutions (2015) Retrieved from http://www.dell.com/learn/us/en/04/healthcare/meditech-solution

Melnyk, B. & Fineout, E. (2011). *Evidence-based practice in nursing and healthcare: A guide to best practice.* Philadelphia: Lippincott William & Wilkins.

Moran, K., Burson, R., & Conrad, D. (2014). *The doctor of nursing practice scholarly project.* Burlington, MA: Jones & Bartlett Learning.

Oredsson, S., Johnsson, H., Rognes, J., Lind, L., Goransson, K., Ehrenberg, A., Asplund, K., Castren, M. & Farrohknia, N. (2011). A systematic review of triage-related interventions to improve patient flow in emergency departments. *Journal of Trauma, Resuscitation and Emergency Medicine, 19*(43), 1-6. Retrieved from http://www.sjtrem.com/content/19/1/43.

Pallant, J. (2014). *SPSS survival manual.* (5th ed.). New York, NY: McGraw Hill International

Pallin, D.J., Espinola, J.A., & Camargo, C.A. (2013). US population aging and demand for inpatient services. Journal of Hospital Medicine, 00(00), 1-4. Retrieved from www.journalofhospitalmedicine.com.

Patel, P. B., Combs, M. A., & Vinson, D. R. (2014). Reduction of admit wait times: The effect of leadership-based programs. *Academic Emergency Medicine, 21* (3), 266-273.

Reza, H., Khorasani, D., Azizi, F., Ali, M., & Rahgozar, M. (2013, Jan-Feb). Triage effect on wait of receiving treatment services and patients' satisfaction in the emergency department. *Iran Journal Nursing Midwifery, 18* (1), 79-93.

Sayah, A. Rogers, L., Devarajan, K., Kingsley, L. & Lobon, L. (2014). Minimizing ED waiting times and improving patient flow and experience of care. *Emergency Medicine International, Article ID981472*, 1-7.

Sollecito, W.A., & Johnson, J.K. (2013). *Continuous quality improvement in health care* (4th ed.). Burlington, MA: Jones & Bartlett Learning.

Sylvia, M. L. & Terhaar, M. F. (2014). *Clinical analytics and data management for the DNP*. New York, NY: Springer Publishing Company, LLC

Sun, B.C., Hsia, R.Y., Weiss, R.E., Zingmond, D., Liang, L.J., Han, W., McCreath, H., & Asch, S. (2013, June). Effect of emergency department crowding on outcomes of admitted patients. *Ann Emerg Med, 61* (6), 605-611.

Tappen, R.M. (2011). *Advanced nursing research: From theory to practice.* Sudbury, MA: Jones and Bartlett Learning.

The Joint Commission (2015). *Patient flow through the emergency department.* Retrieved from www.jointcommission.org

Trochim, W.M. (2006). *Sampling.* Retrieved from http://www.socialresearchmethods.net/kb/sampling.php

United States Government Accountability Office (2009, April). *Hospital emergency departments: Crowding continues to occur and some patients wait longer than recommended time frames.* Vol GAO-09-347.

Welch, S., Asplin, B., Stone, S., Davidson, S., Augustine, J., & Schuur, J. (2010). Emergency department operational metric, measures and definitions: Results of the second performance measures and benchmarking summit. *Annals of Emergency Medicine, 20*(10), 1-6.

Appendix A

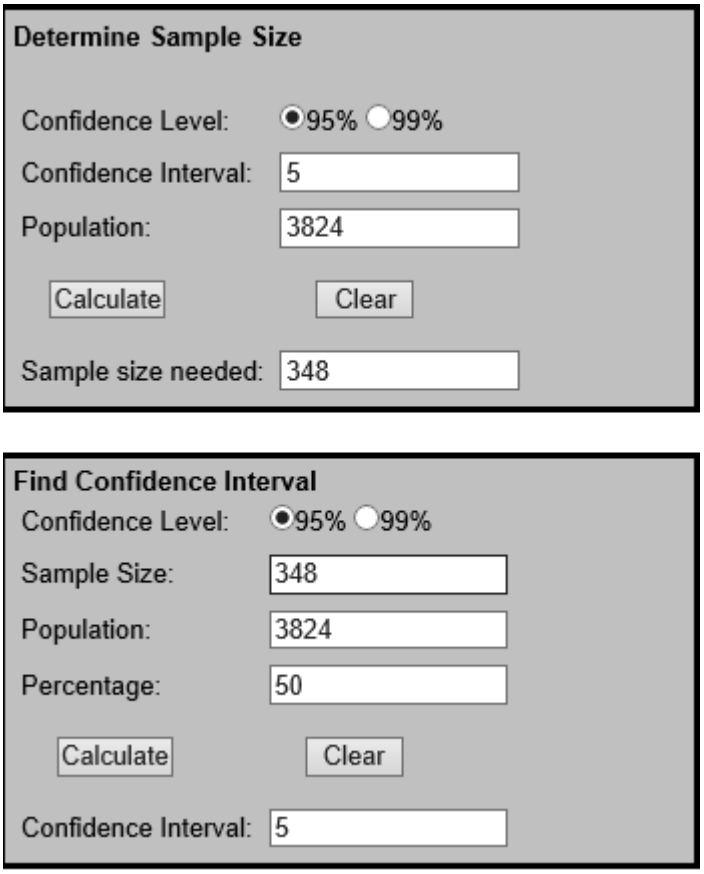


Figure1. Sample Size Calculator from Creative Research System, 2016.

Appendix B

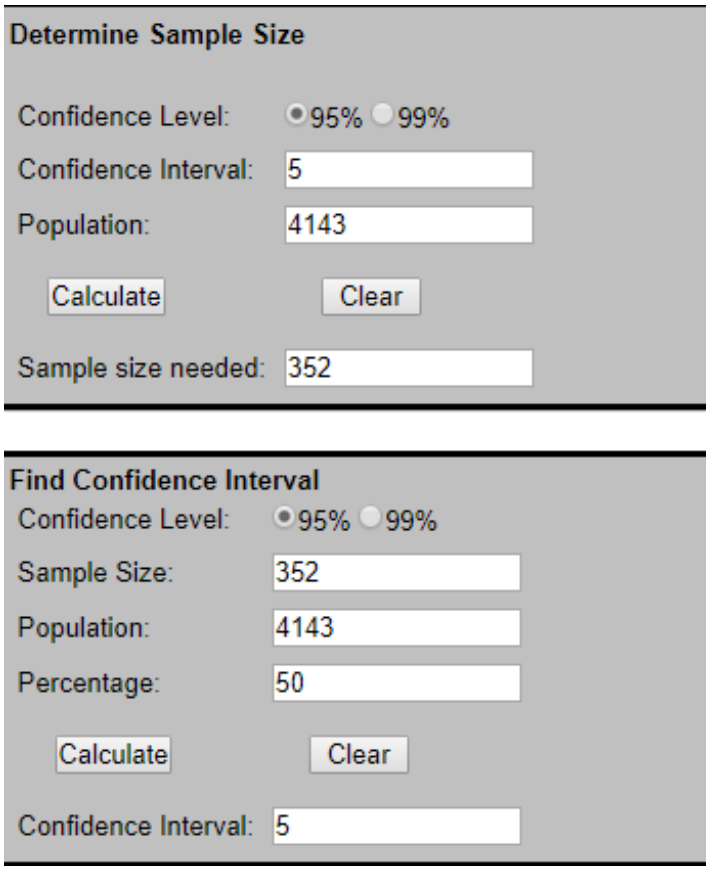


Figure 2. Sample Size Calculator from Creative Research System, 2017.

Appendix C

Table 1

Demographic Characteristics

Population-Specific Demographic N=700	*Frequency*	*Percent*
Gender		
Female	403	57.6%
Male	297	42.4%
Age by group		
18-35 Young Adult	150	21.4%
36-55 Middle Adult	199	28.4%
56 > Older Adult	351	50.1%
Time of visit		
Morning	237	33.9%
Evening	255	36.4%
Night	208	29.7%
Missing	0	0
Patient's first visit		
Yes	85	12.1%
No	615	87.9%
Living location		
Urban	354	50.6%
Rural	346	49.4%
Missing	0	0
Patient's disposition		
Discharge	510	72.9%
Admission	190	27.1%
Expired	0	0

Appendix D

Table 2

Comparison of Emergency Department Operational Performance

ED Triage Intervals	2016		2017	
	Mean	SD	Mean	SD
Arrival-to -triage time	7.9	10.6	6.4	7.8
Triage completion time	30.66	31.4	26.7	24.8
Door-to-provider	105.61	118.5	69.33	68.0
Disposition				
• Discharge	42.11	183.9	52.9	150.4
• Departure to admitted	148.84	304.7	93.0	254.6

Appendix E

Table 3

Emergency Severity Index (ESI) July through September 2017

Category	**Acuity**	**N= 352**
ESI 1	Resuscitation	5
ESI 2	Very Vital	81
ESI 3	Urgent	113
ESI 4	Regular	81
ESI 5	Non-Vital	72

Appendix F

Theoretical Framework

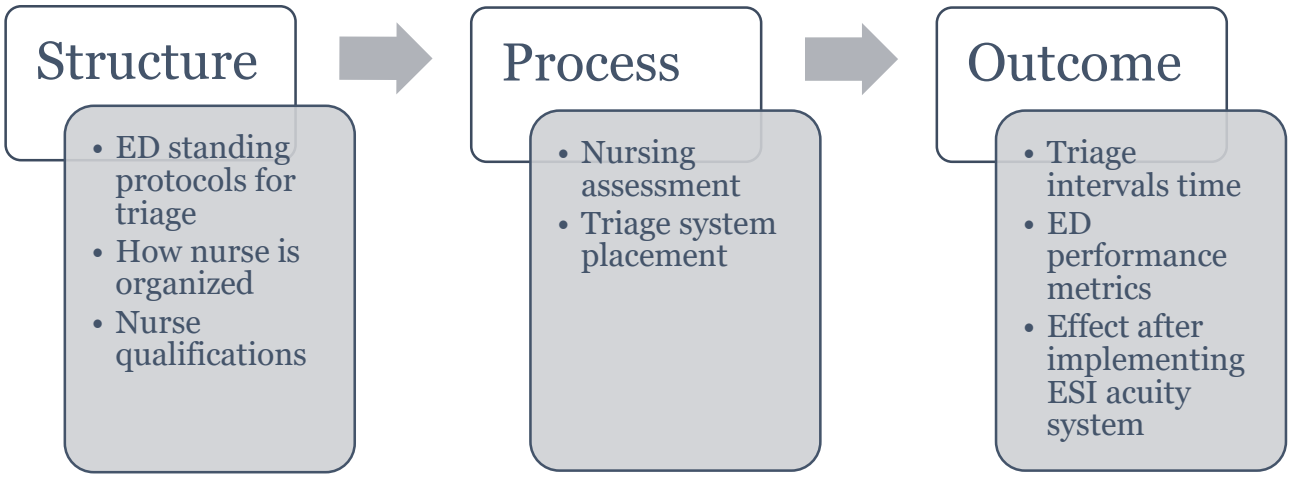
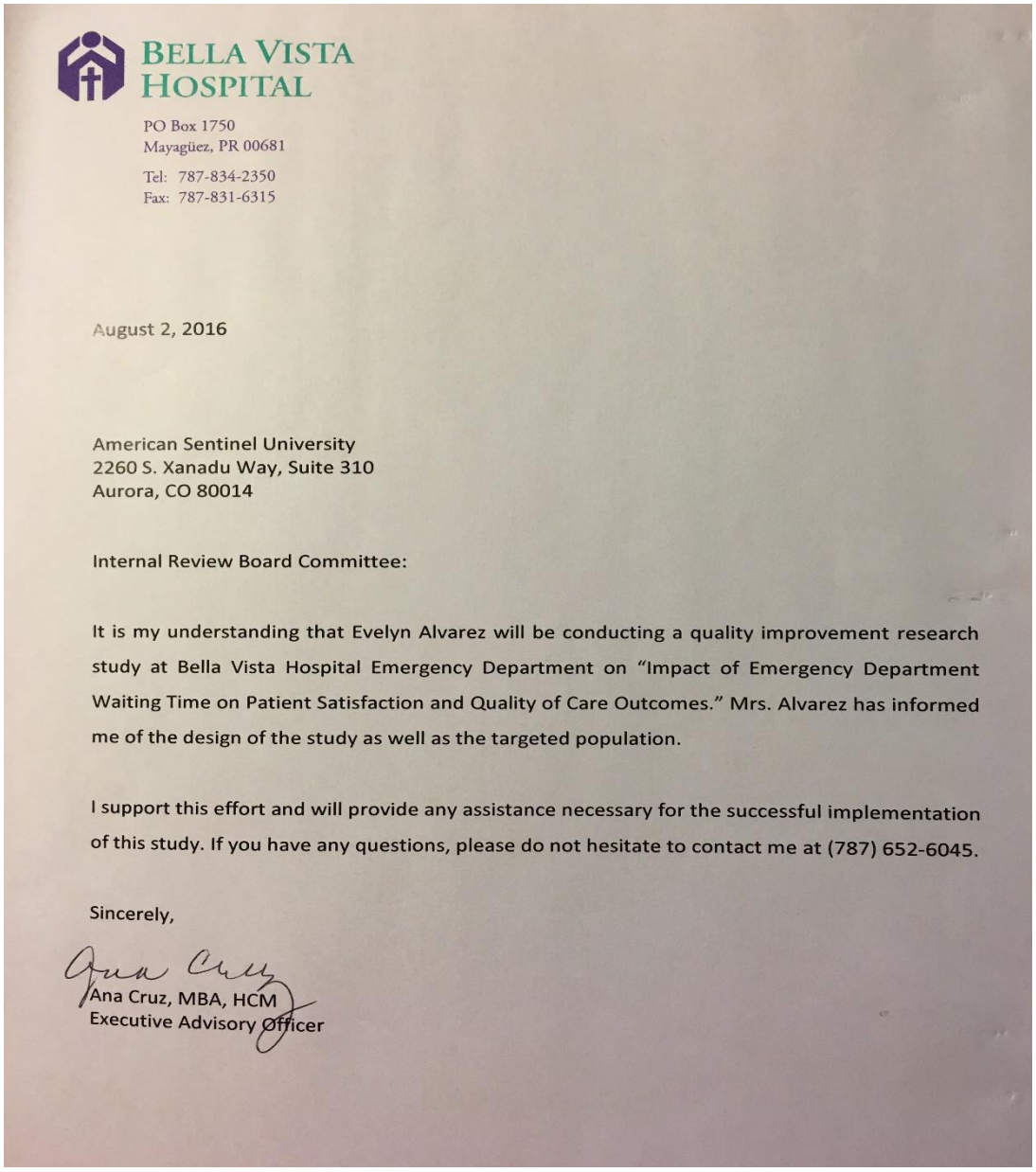


Figure 3. Donabedian's Model, 1966 (Adapted for Capstone Project, 2016).

Appendix G

Permission from the Study Setting



BELLA VISTA HOSPITAL

PO Box 1750
Mayagüez, PR 00681
Tel: 787-834-2350
Fax: 787-831-6315

August 2, 2016

American Sentinel University
2260 S. Xanadu Way, Suite 310
Aurora, CO 80014

Internal Review Board Committee:

It is my understanding that Evelyn Alvarez will be conducting a quality improvement research study at Bella Vista Hospital Emergency Department on "Impact of Emergency Department Waiting Time on Patient Satisfaction and Quality of Care Outcomes." Mrs. Alvarez has informed me of the design of the study as well as the targeted population.

I support this effort and will provide any assistance necessary for the successful implementation of this study. If you have any questions, please do not hesitate to contact me at (787) 652-6045.

Sincerely,

Ana Cruz, MBA, HCM
Executive Advisory Officer

Appendix H

Permission to Access Data

HOSPITAL BELLA VISTA
PO Box 1750
Mayagüez, PR 00681
Phone: 787-834-2350
Fax: 787-831-6315

February 9, 2017

American Sentinel University
2260 S. Xanadu Way, Suite 310
Aurora, CO 80014

Internal Review Board Committee:

The purpose of this letter is to authorize Mrs. Evelyn Alvarez to access data from EHR for the retrospective quality improvement research study at Bella Vista Hospital on "Impact of Emergency Department Waiting Time on Patient Satisfaction and Quality of Care Outcomes."

I understand this study is anonymous and will not be collecting or retaining any information about patient identity. Therefore, I give permission to Mrs. Alvarez to access all data needed for this study.

Sincerely,

Nereida Rivera, MS, RHIA
Director of Information Management Department
(787)834-2350, ext. 16205
Fax (787)831-6315

Appendix I

Institutional Review Board Approval

AMERICAN SENTINEL UNIVERSITY

May 30, 2017

Evelyn Alvarez
DNP Student
American Sentinel University

Re: Effect of Emergency Department Waiting Time

Dear Ms. Alvarez:

On May 30, 2017, the American Sentinel University Institutional Review Board reviewed the research proposal entitled "Effect of Emergency Department Waiting Time." The purpose of this project is to compare pre- and post-implementation of a new emergency department triage system to determine if there are differences obtained in patient wait times and outcomes. The contingencies have been addressed and the IRB **approves** the protocol. Work on this project may begin. This approval is for a period of one year from the date of this letter and will require continuation approval if the research project extends beyond **May 30, 2018**.

If you make changes to the protocol during the period of this approval, you must submit a revised protocol to the American Sentinel University IRB for approval before implementing the changes.

If you have any questions regarding the IRB's decision, please contact me through irb@americansentinel.edu.

Sincerely,

B. F. Petrie, Ph.D.
Chair,
American Sentinel University IRB

c Jimmy Reyes– Chair

Appendix J

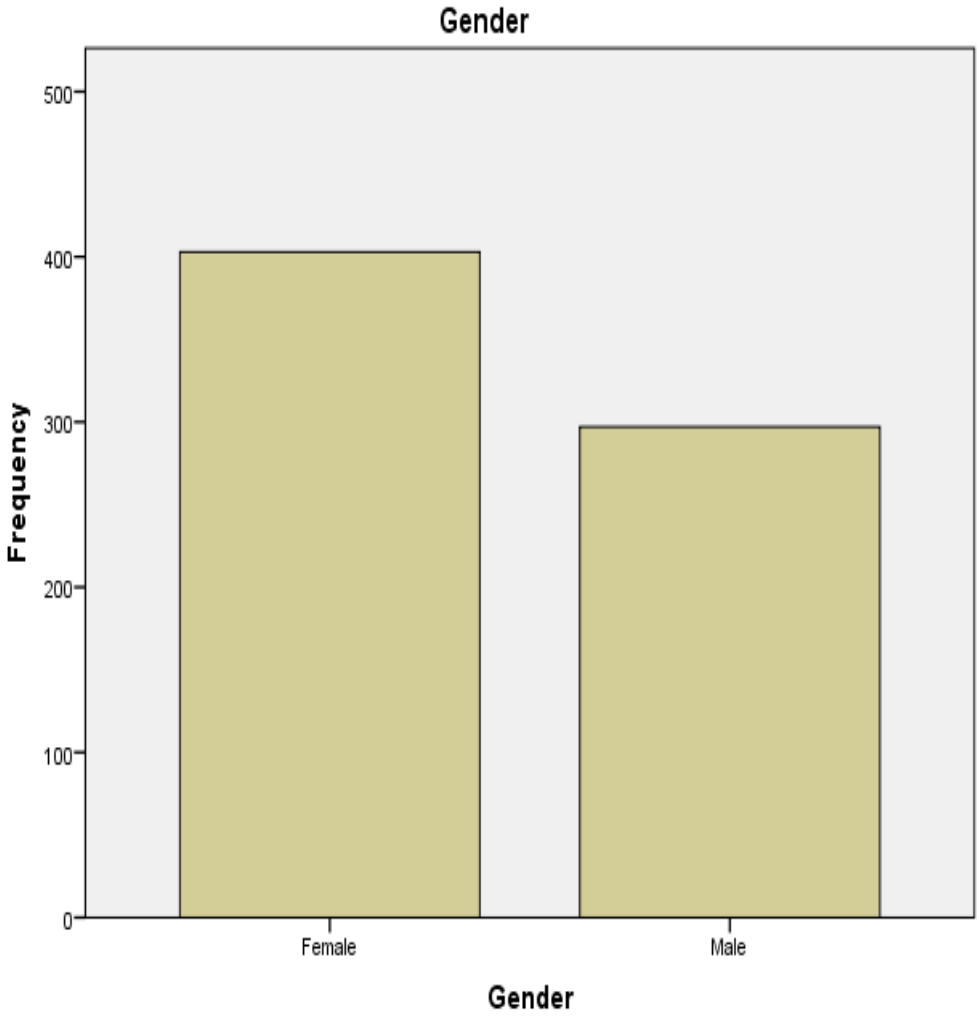
Table 4

Gender Frequencies Statistics

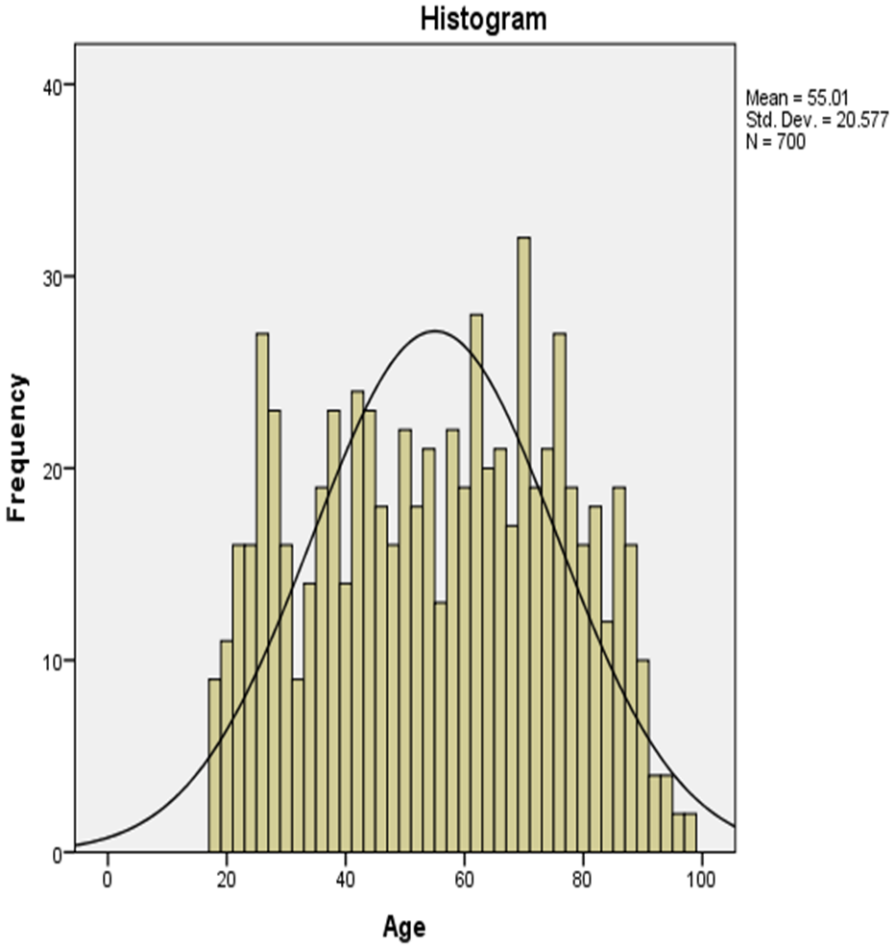
Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Female	403	57.6	57.6	57.6
	2 Male	297	42.4	42.4	100.0
	Total	700	100.0	100.0	

Appendix K



Appendix L


Histogram
Mean = 55.01
Std. Dev. = 20.577
N = 700
Frequency
Age
0
10
20
30
40
0
20
40
60
80
100

Appendix M

Table 5

Age Group Frequencies

Age Group

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	18-35 Young Adult	150	21.4	21.4	21.4
	2	36-55 Middle Adult	199	28.4	28.4	49.9
	3	56> Older Adult	351	50.1	50.1	100.0
	Total		700	100.0	100.0	

Appendix N

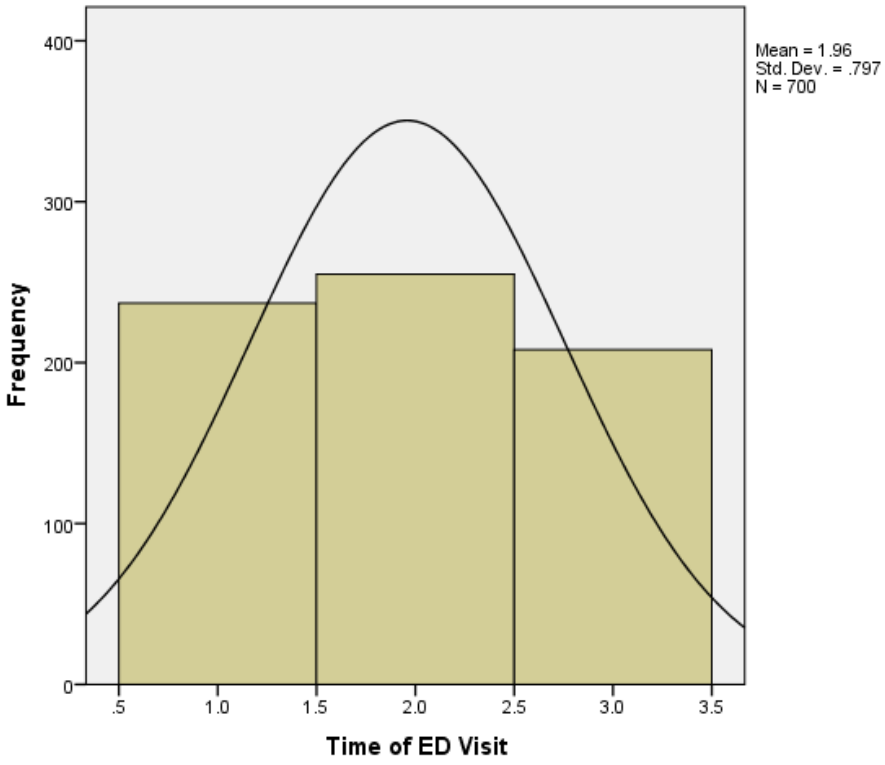
Table 6

Time of Emergency Department Visit Frequencies

Time of Visit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Morning	237	33.9	33.9	33.9
	2 Evening	255	36.4	36.4	70.3
	3 Night	208	29.7	29.7	100.0
	Total	700	100.0	100.0	

Appendix O


Mean = 1.96
Std. Dev. = .797
N = 700
Frequency
400
300
200
100
0
.5
1.0
1.5
2.0
2.5
3.0
3.5
Time of ED Visit

Appendix P

Table 7

First Visit Frequencies and Statistics

First Visit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 Previous	615	87.9	87.9	87.9
	1 First	85	12.1	12.1	100.0
	Total	700	100.0	100.0	

N	Valid	700
	Missing	0
Mean		.12
Median		.00
Mode		0
Std. Deviation		.327
Variance		.107
Minimum		0
Maximum		1

Appendix Q

Table 8

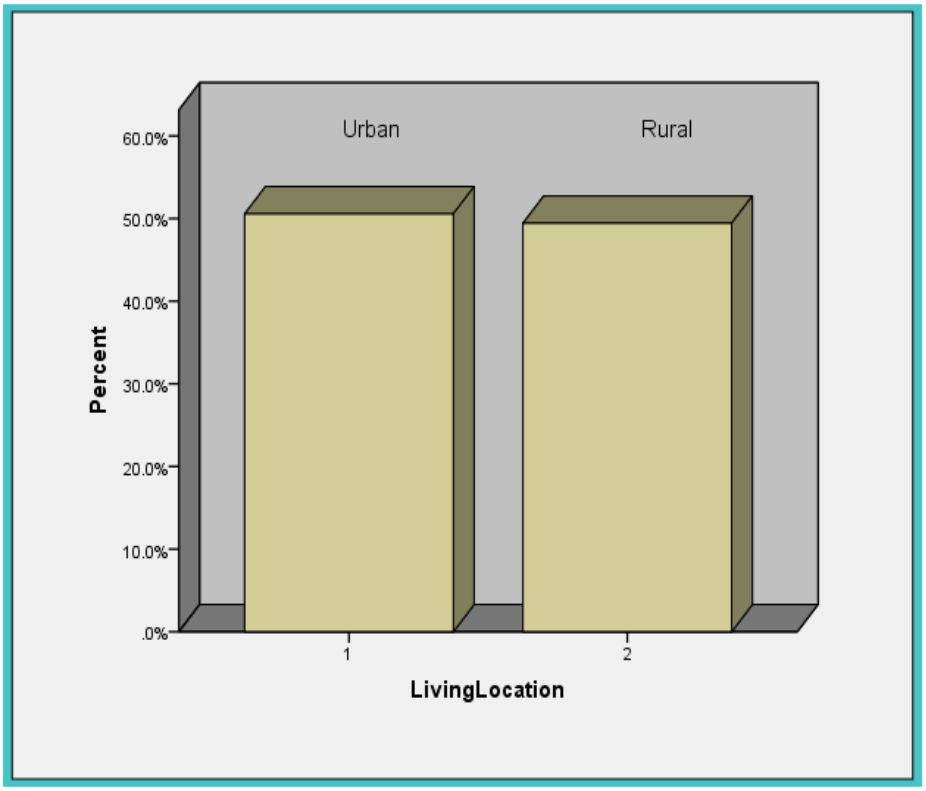
Patient Disposition

Discharge Home

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	Admit to Floor	190	27.1	27.1	27.1
	1	Discharge Home	510	72.9	72.9	100.0
	Total		700	100.0	100.0	

Appendix R

Living Location Bar Chart



Appendix S

Table 9

Total Sample Frequencies of Outcomes Variables Statistics

	N					
	Valid	Missing	Mean	Median	Mode	Std. Deviation
Gender	700	0	1.42	1.00	1	.495
Age	700	0	55.01	56.00	70	20.577
Arrival	700	0	6.96	4.00	3	9.369
Triage	700	0	28.70	17.00	9	28.395
Provider	700	0	87.37	63.00	9[a]	98.153
Discharge	700	0	47.54	10.00	0	167.906
Disp. Floor	700	0	120.76	.00	0	281.872
Total Time	700	0	291.34	186.00	102	327.532
Acuity Level	700	0	3.18	3.00	3	.979
GP Age	700	0	2.29	3.00	3	.796

a. Multiple modes exist. The smallest value is shown.

Appendix T

Table 10

Comparison of Triage Performance Metrics

Descriptive Statistics

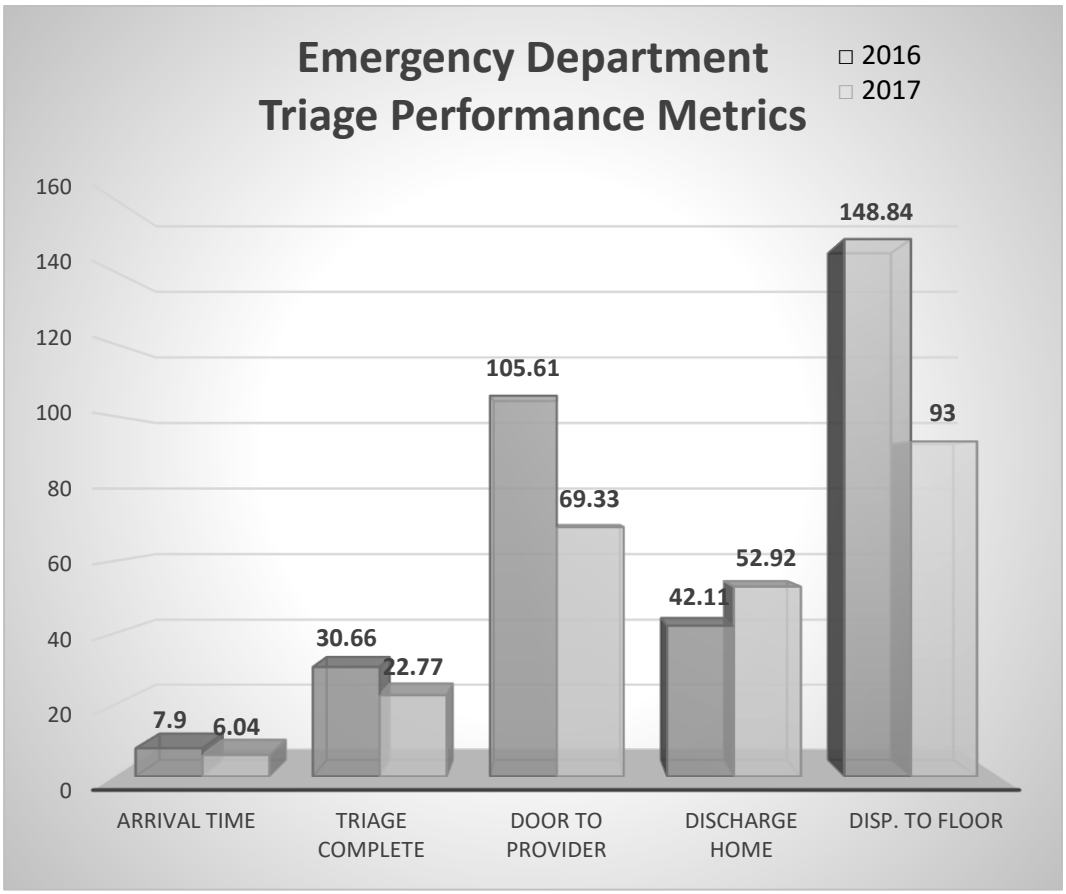
July through September 2016	N	Minimum	Maximum	Mean	Std. Deviation
Time Arrival	348	1	76	7.90	10.641
Time Triage	348	2	264	30.66	31.487
Time to Provider	348	0	793	105.61	118.554
Time discharge	348	0	2880	42.11	183.913
Time departure	348	0	2520	148.84	304.784
Valid N (list wise)	348				

Descriptive Statistics

July through September 2017	N	Minimum	Maximum	Mean	Std. Deviation
Time Arrival	352	1	61	6.04	7.820
Time Triage	352	2	122	26.77	24.860
Time to Provider	352	3	564	69.33	68.076
Time discharge	352	0	2021	52.92	150.488
Time departure	352	0	2686	93.00	254.628
Valid N (list wise)	352				

Appendix U

Comparison Bar Chart



Appendix V

Table 11

MANOVA Tests of Between-Subjects Effects

Dependent Variable: Total Time

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3971612.086[a]	8	496451.511	4.831	.000
Intercept	24067221.058	1	24067221.058	234.182	.000
Year	89141.653	1	89141.653	.867	.352
Acuity Level	2043087.682	4	510771.921	4.970	.001
Year * Acuity Level	592544.440	3	197514.813	1.922	.125
Error	71015202.673	691	102771.639		
Total	134401529.000	700			
Corrected Total	74986814.759	699			

a. R Squared = .053 (Adjusted R Squared = .042)

Appendix W

Table 12

Multivariate Analysis of Variance (MANOVA)

Descriptive Statistics				
Dependent Variable: Total Time				
Year	Acuity Level	Mean	Std. Deviation	N
2016	1	482.89	305.790	9
	2	348.03	303.771	89
	3	355.53	408.924	154
	4	276.52	339.532	96
	Total	335.11	364.134	348
2017	1	485.60	395.410	5
	2	369.79	368.961	81
	3	228.14	259.951	113
	4	197.15	247.610	81
	5	183.17	151.113	72
	Total	248.06	280.673	352
Total	1	483.86	325.042	14
	2	358.40	335.573	170
	3	301.62	358.624	267
	4	240.20	302.766	177
	5	183.17	151.113	72
	Total	291.34	327.532	700