2011

The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients

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THE EFFECT OF EMERGENCY DEPARTMENT LENGTH OF STAY ON CLINICAL OUTCOMES FOR CRITICALLY ILL OR INJURED PATIENTS

by

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A thesis submitted to the faculty of
Gardner-Webb University School of Nursing
in partial fulfillment of the requirements for the
Degree of Master of Science in Nursing

Boiling Springs

2011

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Abstract

The purpose of the study was to identify the effects of the emergency department length of stay on clinical outcomes for critically ill or injured patients in the regional referral community hospital. Delays in transfer have been associated with increased mortality rates, prolonged length of stays, and poor outcomes. Emergency departments are designed to respond to immediate life or limb threatening emergencies.

A quantitative, descriptive, retrospective design was used in this study. Data was collected from APACHE II, trauma databases, and ED logs. The study was conducted in a 752 bed hospital in the western North Carolina. Data was analyzed from 1520 patients.

Critically ill or injured patients who stayed in the ED greater than 3 hours and less than 6 hours were more likely to die in the critical care unit ($n = 46$, $p = 0.033$). Five patients developed a ventilator associated pneumonia ($p = 0.042$).

The study results suggest significant effects on mortality when transfer to the critical care unit is delayed 3-6 hours. The delay in implementing best clinical practices affects the patient outcomes as suggested from the significance of the ventilator associated pneumonia rates.

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Chapter I

Introduction

Statement of Problem

Emergency departments (ED) are designed to provide emergent stabilization and initial therapy for critically ill or injured patients. This is evidenced by the improved and evidence-based care of the patient who presents with an acute myocardial infarction, acute stroke, sepsis, or trauma. Upon arrival of critically ill or injured patients to the emergency department, life or limb saving treatment is rendered. Those patients are then transferred to the operating room, cardiac catheterization laboratory, or a critical care unit. In some instances; however, patients must receive intensive care in the emergency department while waiting for a bed in the critical care unit. Most emergency departments, however, do not have the resources or physical space to provide longitudinal critical care such as 1:1 nursing care or hemodynamic monitoring (Cowan & Trzeciak, 2005). Patients are more likely to be surrounded by highly specialized trained nurses and intensivists once they arrive in the intensive care unit. If critically ill or injured patients remain in the emergency department for extended periods of time, further life-threatening conditions or comorbidities may ensue (Clark & Normile, 2007a). However, the nature of the illness or injury defines the need for critical care, not the geographical location. There is a direct correlation between inpatient census and emergency department length of stay; as the inpatient occupancy rates increase so does the emergency department length of stay (Forster, Stiell, Wells, Lee & Walraven, 2003).

Overcrowding in the emergency department (ED) has become a daily challenge. Visits to the emergency department continue to increase due to changes in healthcare coverage and difficulties in accessing primary care. The Centers for Disease Control reported 123 million

persons visited the emergency department in 2008. This represented an increased volume of up to 20 percent in emergency departments nationwide (Braun, 2011). Approximately two million of those patients were admitted to the critical care unit (CDC, 2011). The provision of critical care in the emergency department is largely increasing due to overcrowding and lack of critical care beds (Cowan & Trzeciak, 2005).

Background

The emergency department (ED) is a high risk environment that threatens patient safety and outcomes when the emergency department is unable to provide services and quality care. Clark and Normile (2002) found in a survey that 59 percent of respondents had difficulty in transferring critically ill or injured patients from the emergency department to the critical care unit. The Institute of Medicine (2004) states patients must rely on health care professionals and institutions for their safety and well-being. Nursing was recognized by the 2004 Institute of Medicine report "Keeping Patients Safe" as having a critical role in patient safety.

When critical care beds are unavailable, patients must wait in the emergency department. According to the 2003 U.S. General Accounting Office study, 20 percent of the emergency departments surveyed were holding patients for 8 hours or longer. Staff-to-patient ratios change with the increasing number of patients and the risk for error and adverse outcomes increases. Most ED nurses are assigned to three to four rooms. Each room could have one to two stretchers; therefore, the registered nurse could potentially have six to eight patients. One of those patients could be a patient awaiting transfer to a critical care unit. The nurse must prioritize the delivery of care to the patients. This scenario is typical of an assignment in the emergency department. A

delay in transfer of the patients puts the patient at risk, as well as the nurse caring for the patient (Braun, 2011).

Research studies conducted in the 1990s from urban United States emergency departments reported that more than 150 days of critical care time were provided in the emergency department on an annual basis (Cowan & Trzeciak, 2005). Chalfin et al. (2007) suggested emergency nurses are not trained properly to provide the appropriate level of care to critically ill or injured patients. The ED is a busy environment requiring simultaneous responsibilities of varying degrees by healthcare providers. As a result of a delayed transfer, a patient may suffer complications along with increased mortality rate and increased length of stay (Yurkova & Wolf, 2011).

Purpose of the Study

The purpose of the study was to determine the effects of the emergency department length of stay on clinical outcomes for critically ill or injured patients. Boarding in the ED can delay time-sensitive therapies for those patients who present with cardiogenic shock, severe sepsis and the golden hour of trauma care. Those delays could potentially represent a threat to patient safety (Cowan & Trzeciak, 2005). Critically ill or injured patients have special needs that are not always available outside of the critical care unit. Due to the limited resources and lack of critical care nursing skills in the emergency department, further life-threatening conditions and co-morbidities may occur (Clark & Normile, 2007a).

Significance to Nursing

Evaluating the quality of nursing care began with Florence Nightingale and her identification of the nurse's role in the delivery of care (Montalvo, 2007). Quality has evolved over the years and in 1998, the American Nurses Association (ANA) established the National

Database of Nursing Quality Indicators (NDNQI) to further develop the correlation of nursing care and quality indicators (Montalvo, 2007). Nurses are responsible for measuring, evaluating, and improving practice as written in *The Code of Ethics for Nurses with Interpretative Statements* and *Nursing: Scope of Standards of Practice* (2008).

Critical care nursing is a growing proportion of emergency nursing. Critical care nursing begins immediately upon recognition of the critically ill or injured patient (Cowan & Trzeciak, 2005). As scientific knowledge continues to increase, nurses must keep current with these changes. It is essential that the nurse use available technology and scientific knowledge to meet the patient's needs and improve outcomes. Nurses are an integral part of decision making, clinical practice and patient outcomes (Kuriakose, 2008). The American Nurses Association (ANA) Code of Ethics (2008) implies the nurse is ethically and professionally responsible for assuring best quality patient care. Provision Two states the nurse's primary commitment is to the patient, whether an individual, family, group, or community. Provision Three states the nurse promotes, advocates for and strives to protect the health, safety, and rights of the patient (Fowler, 2008).

Nursing-sensitive indicators identify structures of care and care processes which in turn influence outcomes. Nursing-sensitive indicators are distinct and specific to nursing and differ from medical indicators of quality (Montalvo, 2007). Maas, Johnson, and Moorehead (1996) coined the phrase "nursing-sensitive indicators" to reflect the patient outcomes affected by nursing practice. A comprehensive assessment of outcomes sensitive to the nursing care is important since nurses represent the largest number of the health care workforce and nurses play an important role in detecting and/or mitigating adverse events. Nurses are responsible for ongoing assessment, evaluation and treatment of the patients. Nursing-sensitive indicators, for

the research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, include mortality, central-line associated blood stream infections, ventilator-associated pneumonia, and late or failure to rescue. Because patient surveillance is the responsibility of the nurse, the ED nurse monitors for significant changes in the patient condition and intervenes as appropriate (Koran, 2007).

The safety of each patient and the level of quality of care provided are crucial to patient outcomes. Many organizations have developed criteria to ensure safe, high quality of care. The American Nurses Association (ANA) developed a national data resource for investigating the relationship between nursing and patient outcomes. The National Patient Safety Goals (NPSGs) were developed in recent years to ensure there is a consistent, evidence-based, safe, high end quality provision of care. Transition in care in a timely manner will align with the NPSGs. National Patient Safety Goal three is to improve the safety of using medications. Medication errors, omission of medications while in the emergency department or delays in administering a medication can affect patient outcomes. Another goal is to reduce the risk of health care associated infections. NPSG.07.04.01 states "implement evidence-based practices to prevent central line-associated bloodstream infections" (The Joint Commission, 2011). The research study will attempt to align with the National Patient Safety Goals.

Theoretical Framework

The theoretical framework utilized for the research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, was Duffy's Quality-Caring Model. The model is based on Watson's (2002) Theory of Human Caring and Donabedian's (1988) Structure-Process-Outcome framework.

Providing quality health care is a professional responsibility and a patient expectation. The Quality-Caring Model describes caring relationships as the primary focus of professional nursing and the nurse-patient relationship is at the core of the process. This model incorporates nursing theorist, Jean Watson (2002), who views the establishment of meaningful relationships with patients and families as a nursing function. Watson's essence of caring is complementary to medicine's curing (Duffy & Hoskins, 2003). Duffy also incorporated Donabedian's structure-process-outcomes theoretical framework into the Quality-Caring Model. Donabedian theorizes that the structure of care influences the processes of care and both in turn influences the outcomes of care (Dunton, Gajewski, Klaus, & Pierson, 2007). Donabedian developed the basic framework in which to think about quality-improvement efforts. The health care triad has three components: structure, processes, and outcomes. The structural component focuses on the environment that may influence the outcomes of care. The processes of care are those specific interventions that are provided. Outcomes are the endpoints of the processes of care. The caring processes that are the essence of nursing may be a key independent factor in improving outcomes (Duffy & Hoskins, 2003).

Duffy's theory has blended quality health care and human caring into the Quality-Caring Model. "The model integrates biomedical and psychosocialspiritual factors associated with quality health care" (Duffy & Hoskins, 2003, p. 80). The Quality-Caring Model emphasizes the significance of nursing to quality outcomes and minimizes non-valued-added work (Duffy, Baldwin, & Mastorovich, 2009).

The first component, *structure*, refers to the factors that are present prior to the delivery of health care. These factors include the patient/family, the health care providers, and the health care system. Within each of these participants, there are unique attributes such as demographics,

various psychosocial, spiritual, and physiological properties. The concepts influence the processes of care and may directly or indirectly influence the outcomes (Duffy & Hoskins, 2003). One example of caring practices is the ED nurse interaction with the patient and family. A caring presence generated by the ED nurse will be manifested in such ways as being present and having frequent interactions with the patient and family. The accessibility of the ED nurse is an important element of the structure process. This element also reflects the organizational environment. This component as related to the study assures that the necessary equipment and supplies are available 24/7 to care for the critically ill or injured patient.

The second component, *process*, involves interventions and is the focus of the model. Process refers to what is done to the patient and is composed of technical and interpersonal activities. In the Quality-Caring Model, caring relationships dominate the process. Caring relationships are "human interactions grounded in clinical caring processes. They incorporate physical work (doing), interaction (being with), and relationship (knowing)" (Duffy & Hoskins, 2003, p. 82). In this model, the role of the nurse is to be the link between the patient, the multidisciplinary team, and the outcomes (Duffy & Hoskins, 2003). The patient will encounter the ED nurse who should possess qualities necessary to influence the process of care and may directly or indirectly affect the outcome (Duffy & Hoskins, 2003). A collaborative relationship with the ED physician, the critical care nurse, ancillary staff such as respiratory therapists, and the attending physician is paramount to the care of the critically ill or injured patient. Interventions such as titrating medications and adjusting oxygen therapy represent multidisciplinary healthcare providers working together to affect patient outcomes.

The third component of the Quality-Caring Model is *outcomes* and refers to the end results of health care. There are two forms of outcomes: *intermediate outcomes* and *terminal*

outcomes. *Intermediate outcomes* represent a change in the patient and/or family that could influence the end result. *Terminal outcomes* are those that affect quality of life, costs, disease specific factors, and satisfaction (Duffy & Hoskins, 2003). The *outcomes* as related to the research study are the direct result of a nursing intervention or action.

The model assumes that caring is a part of the nursing process and that caring contributes to the positive patient outcomes. The model has an unlimited number of interrelated factors that contributes to a continuous pursuit of excellence (Duffy & Hoskins, 2003). Structures (having the right things) to processes (doing the right things) to outcomes (having the right things happen) describes the Quality-Caring Model (Korniewicz & Duffy, 2008)

The role of the nurse in the study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, has a strong reliance on the nursing theory of the Quality-Caring Model. The core of nursing work is focused on initiating, cultivating, and sustaining caring relationships with the patients and other health care providers. This patient care delivery model preserves nursing aspects that ultimately affects quality patient care and outcomes (Duffy, Baldwin, & Mastorovich, 2007). Patient outcomes may be the end product of care as the direct result of nursing intervention or action.

Research Question

Outcomes for critically ill or injured patients often depend on time sensitive interventions and the specialized skills of critical care nurses and resources of a critical care unit. Because of the chaotic environment of the emergency department where many patients of varying severities of illness or injury are arriving each hour, ED nurses may not be able to provide the critical care the patient needs.

The researcher proposed to answer the question, "Does the emergency department length of stay affect clinical outcomes for critically ill or injured patients?"

Definitions of Terms

The key terms identified, in relationship to this research study are defined as the following:

APACHE II score.

The Acute Physiology and Chronic Health Evaluation (APACHE II) score uses a points system to provide a general measure of disease severity. The score is based on initial values that include physiologic measurements, age and previous health status (Knaus, Draper, Wagner, & Zimmerman, 1985).

Central-line associated blood stream infection.

Central- line associated blood stream infection (CLABSI) is a hospital acquired infection. It is defined as the recovery of a pathogen from a blood culture in a patient who had a central line at the time of the infection or forty-eight hours before the development of infection (Centers for Disease Control, 2011). CLABSIs increase length of stay, costs and mortality.

Critical care nurse.

A critical care nurse is defined as a licensed registered nurse (RN) working in the critical care unit who meets the requirements and maintains the competencies as outlined in the policies and procedures of the critical care unit. The critical care RN is responsible for ensuring that acutely ill and injured patients receive optimal care (American Association of Critical-Care Nurses, 2011, para 1).

Critical care unit.

The critical care unit is a clinical environment that enables close attention to the critically ill or injured patient. This environment allows prompt recognition of physiologic changes and sudden deterioration in the patient's condition (Chaflin, et al., 2007). Critical care units are also known as intensive care units.

Critically ill/injured patient.

Critically ill/injured patients are defined as those patients who are at high risk for actual or potential life-threatening health problems. The more critically ill the patient is, the more likely he or she is to be highly vulnerable, unstable and complex, thereby requiring intense and vigilant nursing care (American Association of Critical-Care Nurses, 2011, para. 2).

Emergency department.

The emergency department (ED) is a section of the hospital that is equipped to provide episodic care to those persons who present to the ED with various chief complaints. The emergency department is designed to provide emergent, initial stabilization to those persons who are critically ill or injured (Cowan & Trzeciak, 2005).

Emergency department acuity score.

The acuity score is defined as the classification that characterizes the degree to which the patient's condition is life or limb threatening and whether immediate treatment is needed (National Center for Injury Prevention and Control, 1997). The emergency nurse assigns a number from one to five, with one being the highest acuity score and requiring immediate evaluation and treatment by a provider (see Appendix for more detail).

Emergency nurse.

An emergency nurse is defined as a registered nurse (RN) working in the emergency department who meets the requirements and maintains the competencies as outlined in the policies and procedures of the emergency department. The emergency nurse cares for patients of all age groups and all conditions. The emergency nurse works at a pace that varies from slow to fast within minutes (Emergency Nurses Association, 2011, para. 1).

Failure-to-rescue.

Significant change in physiological variables that are not appropriately acted upon by the RN in a timely manner and the patient expires as a result (Koran, 2007).

Injury severity score.

The injury severity score (ISS) is an anatomical scoring system that provides an overall score for those who are injured. The ISS correlates to the morbidity, mortality, and length of stay of critically injured patients. ISS is defined as "the sum of the squares of the highest AIS grade in each of the three most severely injured areas" (Baker, O'Neill, Hadden & Long, 1974, p. 190).

Late-to-rescue.

Significant change in physiological variables that are not appropriately acted upon by the RN in a timely manner and the patient receives delayed care but does not expire from the particular incident (Koran, 2007).

Length of stay.

The amount of time a patient remains in the specified area of the hospital is defined as length of stay. Overall length of stay is the amount of time the patient stays in the hospital as an inpatient. Emergency department length of stay is defined as the time the patient registers in the ED to when the patient physically leaves the ED (Gardner, Sarkar, Maselli & Gonzales, 2006).

Mortality.

Mortality is defined, for the purposes of the study, as a death in the hospital (Clark & Normile, 2007a).

Nursing -sensitive indicators.

Nursing-sensitive indicators, for the purpose of this study, include outcomes that are affected, provided, and/or influenced by nursing personnel (Maas, Johnson & Moorehead, 1996). The nursing-sensitive indicators are nosocomial infections that include ventilator associated pneumonia, central-line associated blood stream infections, and failure-to-rescue.

Patient.

A patient is an individual who requires assistance to achieve health and independence or a peaceful death (Henderson, 1964). The patient, for this particular research study, will be any male or female over the age of 18 years who is being admitted to the critical care unit.

Ventilator associated pneumonia.

Ventilator associated pneumonia (VAP) is a form of nosocomial pneumonia that develops forty-eight hours after endotracheal intubation and initiation of mechanical ventilation.

Ventilator-associated pneumonia is associated with increased morbidity and mortality, hospital length of stay and costs (Augustyn, 2007).

The research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, reviewed the relationship between the emergency department environment and patient outcomes. Overcrowding in the emergency department has been defined as any time there are inadequate resources to meet patient care demands therefore resulting in a reduction in the quality of care (American College of Emergency Physicians, 2002). Emergency health care providers must continue to deliver timely, safe, quality patient care regardless of departmental crowding.

Chapter II

Literature Review

The purpose of the study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, was to correlate the effects of length of stay and clinical outcomes in critically ill or injured patients.

The literature review reflected data and research from the CINAHL, PubMed, and Google Scholar's databases from 2005-2011. The search was limited to full text, peer-reviewed, research, and English language publications of which eight studies were chosen as representative of the data to support the purpose of the study. Two articles consisted of literature reviews by researchers. The research studies that focused on *causes* of ED overcrowding were excluded because those studies did not include clinical outcomes.

A retrospective, cross-sectional analytical study using the IMPACT database was conducted by Chaflin, Trzeciak, Likourezos, Baumann, and Dellinger (2007) to determine the association between Emergency Department boarding and outcomes for critically ill patients. The researchers reviewed the IMPACT database. This database consisted of 50,322 adult patients from 120 hospital intensive care units. The patients included those admitted from the emergency department to the intensive care unit between the years 2000-2003. Delayed transfer was defined as "boarding $\geq$ 6 hours". Main outcomes were intensive care unit and hospital survival and intensive care and hospital length of stay. The researchers concluded that critically ill emergency department patients with a greater than or equal to 6 hour delay in intensive care unit transfer had increased hospital length of stay and higher mortality. Mortality of patients transferred to the intensive care unit greater than six hours was 17.4 percent versus 12.9 percent

for patients transferred in less than six hours ($p < .001$). The median hospital length of stay was 7.0 (delayed) versus 6.0 (non-delayed) days ($p < .01$). The researchers concluded delayed (greater than or equal to six hours) transfers to the intensive care unit resulted in increased length of stay and higher mortality (Chaflin, Trzeciak, Likourzos, Baumann & Dellinger, 2007).

A retrospective, exploratory analysis of secondary data was conducted by Clark and Normile (2007). The study hospital was a large tertiary care, inner city, level 1 trauma center. The researchers reviewed the timeliness of first medication; first radiological examination result; first blood work result; and time from order for an intensive care bed to time leaving the emergency department. These variables were analyzed to identify the impact on length of stay. In this study, 46 percent of the admissions from the ED to the ICU walked into the ED and 53.8 percent arrived by ambulance. Nearly 40 percent of the admission lengths of stay were greater than 298 minutes. Approximately 60 percent ED to ICU length of stay was less than 298 minutes. The researchers determined that the time to medication was significant related to the length of hospital stay ($p=.03$). The longer it took for the first medication suggested longer hospital length of stays. The researchers concluded that those patients admitted on a weekend were 1.23 times more likely to have longer emergency department length of stays ($p=.023$). The researchers did conclude that the patient's length of stay in the hospital was shorter if admitted to the intensive care unit on the weekend ($p=.017$). Mortality was not reported in the linear regression. The researchers concluded that timeliness to first medication and order for intensive care unit bed to leaving the ED influenced both ED and hospital length of stay. Timely interventions affect outcomes, access, and quality of care (Clark & Normile, 2007b).

A retrospective analysis of 3,973 trauma activations between January 2002 and July 2009 at a level 1 trauma center in North Carolina was performed by Mowery et al. (2011). The results

of this study revealed that hospital mortality increased for each additional hour a patient spends in the emergency department (ED). The ED length of stay (LOS) measured in minutes was an independent predictor of mortality. The findings were odds ratio of 1.003, 95% confidence interval, and $p = 0.014$. Linear regression showed that a longer ED LOS was associated with anatomic injury pattern rather than physiologic derangement. The researchers concluded that a longer ED LOS is associated with increased hospital mortality. They recommended rapid movement to the critical care unit for implementation of early goal directed resuscitation (Mowery, Dougherty, Hildreth, et al., 2011).

A two year retrospective case-control study of pneumonia risk among blunt trauma patients that presented to an urban level I trauma center was conducted by Carr, Kaye, Wiebe, Gracias, Schwab and Reilly (2007). The researchers sought to study the association between prolonged ED LOS and the rates of pneumonia. Patients who were intubated prior to arrival or while in the emergency department and developed pneumonia were identified as cases. A group of matched controls with equivalent age, injury severity score (ISS), abbreviated injury score (AIS) chest, and AIS head who did not develop pneumonia were identified. A comparison between the two groups was assessed using conditional logistic regression. Of the 509 emergently intubated blunt trauma patients, 33 developed pneumonia and could be matched with comparable controls. The ED LOS for the cases was significantly longer than the ED LOS for the control group (281.3 minutes versus 214 minutes, $p < 0.05$). The researchers concluded for each hour in the ED the risk of developing pneumonia was increased by approximately 20 percent (Carr et al., 2007).

A retrospective analysis of 13,460 adult visits between April 2006 and March 2007 at a Canadian tertiary care teaching hospital with two ED sites was performed by Huang, Thind,

Dreyer and Zaric (2010). The delayed transfer was defined as greater than 12 hours and the mode of disposition was to ICU, surgery or inpatient units. The results of the study revealed that approximately 11.6 percent of admitted patients experienced delays in admission. Of this 11.6 percent, 14 percent of those patients were admitted to the intensive care unit. For patients admitted to the intensive care unit, the time to decision to admit to the intensive care unit variable was not significant ($p > 0.1$). The multivariate analysis found that the inpatient length of stay was 12.4 percent longer for those patients who experienced a delayed transfer. The researchers estimated the cumulative impact of delay on all delayed patients as an additional 2,183 inpatient days. The researchers concluded that delays from the ED to admission are associated with increased hospital length of stays (Huang, Thind, Dreyer & Zaric, 2010).

A literature review conducted by Johnson and Winkelman (2011) summarized the findings of published studies that reviewed and investigated quality-related outcomes and emergency department crowding. The researchers categorized the studies into three groups: delay in treatment, decreased satisfaction, and increased mortality. The researchers used PubMed for articles that included terms ED or emergency department with crowding. Of the 276 data-based articles, twenty-three reported association with patient outcomes. Several studies were of large populations from multiple hospitals. The researchers concluded that the effect of ED crowding on patient satisfaction, medication administration delays, and mortality is well documented. The researchers recommended emergency nurses and providers examine strategies for optimal outcomes. The researchers further recommended additional investigation related to the effect ED crowding has on the quality of care provided to ED patients by nurses (Johnson & Winkelman, 2011).

A literature review was conducted by the Society for Academic Emergency Medicine Emergency Department (ED) Crowding Task Force (2008). The objective was to review the medical literature that addressed the effects of ED overcrowding on clinically oriented outcomes. The researchers reviewed the literature from 1989-2007. A total of 369 articles were identified and forty-one articles were included in the review. The researchers concluded that ED crowding is associated with increased in-hospital mortality; however, they recommended further research (Bernstein et al., 2009).

Tilluckdharry, Ticko, Amoateng-Adjepong and Manthous (2005) hypothesized those critically ill patients who remained in the emergency department greater than 24 hours experienced worse outcomes and longer length of stays than those who were transferred less than 24 hours. Their study was a retrospective review of 443 medical records in a 325 bed teaching hospital between 2001 and 2002. There were no significant differences in demographic characteristics, APACHE II scores were 18.9 +/-1.0 for a random sample of ED less than 24 hours and 20.5 +/-0.9 for ED greater than 24 ($p= 0.2$). Lengths of hospital stay were 10.9 +/- 0.8 days for less than 24 hours and 9.8 +/- 0.9 for ED greater than 24 hours ($p=0.7$). Mortality rates were 26.8 percent for ED less than 24 hours and 26.9 percent for ED greater than 24 hours ($p=0.5$). The researchers concluded no significant difference in patient outcomes or length of stay for those patients who were transferred to the intensive care unit greater than 24 hours (Tilluckdharry, Ticko, Amoateng-Adjepong & Manthous, 2005).

Yurkova and Wolf (2011) conducted a quantitative descriptive correlational study in a one hundred forty-two (142) bed community hospital in the eastern United States. The purpose of the study was to identify factors that affect transfer times between the emergency department and the intensive care unit. Data was collected from the charts of 75 patients who were

transferred from the emergency department to the intensive care unit. Forty-four of the 75 patients (58.7 percent) spent more than four hours in the emergency department and 19 of 25 patients (76 percent) with an acuity level of 3 were identified as delayed. Delayed status and an acuity level of 3 had an r value of -.339 and p = .004 which showed a significant correlation. Eleven patients with the diagnosis of sepsis were delayed. A total of 70.4 percent of the female patients were delayed as compared to 52.1 percent of male patients. The researchers concluded there were significant delays in transfer to the critical care unit when the patient was under-triaged.

The literature review revealed a gap in patient outcomes as it relates to the emergency department length of stay and nursing care. Some adverse patient outcomes such as ventilator associated pneumonia, failure-to-rescue, and central line associated blood stream infections may be reflective of nursing care. Most of the research studies were retrospective reviews and were unable to determine the critical care occupancy rates, the staffing ratios, and the number of patients in the ED. The studies also had an inconsistent definition of delay in transfer. The time intervals ranged from five hours to greater than 24 hours. The lack of a consistent definition of delay in transfer limits the correlation of the delay in transfer to the critical care unit and the outcomes. With the small amount of research performed to date on the ED length of stay and the effects on clinical outcomes as related to nursing-sensitive indicators, the research study could result in important findings as related to patient outcomes and the ED length of stay.

Chapter III

Methodology

The aim of the research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, was to determine the effects of emergency department length of stay on clinical outcomes for those patients who were critically ill or injured. The literature review revealed a gap in knowledge with the outcomes as related to nursing care. The definition of delay in transfer posed a threat to the study. This chapter will discuss the design, setting, study population, inclusion and exclusion criteria, data collection methods, and statistical analysis.

Study Design

The research study was a quantitative, retrospective, non-experimental analysis of patients admitted through the emergency department to the critical care units. This method was chosen to better understand the relationships among variables after they have occurred. The researcher was searching for commonalities among the ED length of stay and clinical outcomes.

Study Setting

The research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients, was conducted at a 752 bed regional referral center located in Western North Carolina. This facility was selected due to the hospital serving as the referral center for 17 surrounding counties. The hospital is fully accredited by The Joint Commission (TJC). The hospital is also a TJC accredited primary stroke center, designated Level II trauma center and ranked in the top 5 percent of hospitals for cardiac care. The hospital

has two air ambulances, ground critical care transport units and county based Emergency Medical Services (EMS) ambulances.

The emergency department (ED) at this facility has an annual census of 105,000 patient visits with a 24 percent admission rate. Of those admissions, 2.2 percent are admitted to the critical care units. The average length of stay for admitted patients is greater than 6 hours. The overall length of stay for all ED patients is 3.5 hours. The emergency department has five different areas to evaluate and treat patients. The critically ill or injured are treated in the acute pod of the emergency department. Physiological monitoring, which includes central venous pressure monitoring and arterial pressure monitoring, is available in all patient rooms. A nurse is required to complete specialized training for patients from birth to death and includes all ages.

The hospital has five adult critical care units and two pediatric critical care units. The adult critical care units consist of medical-surgical (two units), cardiovascular, cardiac, and neuro-trauma units. Hemodynamic monitoring, intracranial pressure monitoring, intra-aortic balloon pumping and continuous renal replacement therapy are several therapies offered in the critical care units.

Study Population

Inclusion criteria.

The study population consisted of critically ill or injured adult patients (age 18 years and older) who were admitted from the emergency department to one of the adult critical care units. This population was selected due to the existing databases as related to the research study, The Effect of Emergency Department Length of Stay on Clinical Outcomes for Critically Ill or Injured Patients.

Exclusion criteria.

Patients who were transferred to the operating room, the cardiac catheterization laboratory, or the interventional radiology suite were excluded from this research study. Patients who died within 24 hours of admission, patients who were declared brain dead within 24 hours of admission, and patients who were designated in the emergency department as do not resuscitate (DNR) were also excluded.

Data Collection and Analysis

Prior to collecting data, the researcher obtained approval from the organization's Institutional Review Board and the participating university's Institutional Review Board. Patient consent was waived since this was a retrospective study. Subjects were not identified directly or indirectly. There were no research-related or treatment-related procedures.

Data was collected from the emergency department logs, the trauma registry, and APACHE II registry during a one year period from January 2010 to December 2010. The initial sample was abstracted from the data set based on the inclusion/exclusion criteria. Data was extracted from electronic programs using an Excel spreadsheet. The data was then entered into the statistical program Minitab version16. Extracted data has been secured and kept in a locked drawer in the researcher's private office.

The methodology chosen for the study was a retrospective chart review. This epidemiological study was chosen since the group of subjects identified had already experienced an emergency department visit and admission to a critical care unit (Burns & Grove, 2009). The cause and effect have already occurred. Previous research studies related to the effect of

emergency department length of stay on clinical outcomes used similar methods of data collection.

Chapter IV

Results

From January 1, 2010 to December 31, 2010, 1681 patients were entered into the APACHE II database. These critically ill patients were admitted from the emergency department (ED) to one of the five adult intensive care units. Critically injured patients were also included in the APACHE II database. Of the 1681 patients, 152 patients were excluded from the analysis. Of the excluded patients, 86 patients died within 24 hours of admission, 32 patients were directly admitted to the intensive care unit (ICU) therefore bypassing the emergency department (ED), 16 patients were discharged within 24 hours of arrival, nine patients were do-not-resuscitate (DNR), and seven patients were less than 18 years of age. Two additional patients were also excluded. One patient was transferred to the operating room and the other was transferred to a non-ICU unit before being transferred later to the intensive care unit.

Between January 1, 2010 and December 31, 2010, 802 males (53%) and 718 females (47%) were transferred from the ED to the ICU. The overall emergency department length of stay using descriptive statistics demonstrated a mean of 6.1645 hours (SD 2.8649) with a median time of 5.87 hours. Selected patient characteristics are shown in Table 1. Male study patients had a mean ED length of stay of 5.831 hours (SD 2.854) with a median time of 5.510 hours. Female study patients had a mean ED length of stay of 6.537 hours (SD 2.833) with a median time of 6.340 hours. As shown in Table 2, there was statistically significant relationship between ED acuity and ED length of stay ($p < 0.001$). Patients with a Canadian triage and acuity scale 1 (CTAS-1) had a shorter length of ED stay (n = 147, mean 4.213 hours, SD 2.477).

Table 1- Patient Characteristics

Gender	Age-yrs (average)	ED LOS (Mean)	ICU LOS (Mean)	Hospital LOS (Mean)	Total (n= xxx)
Males	58.5 years	5.831 hours	3.432 days	8.808 days	802 pts
Females	63.7 years	6.537 hours	3.111 days	7.905 days	718 pts

Table 2- ED Length of Stay versus ED Acuity Scale

Acuity Scale	Number of Patients	Mean Length of Stay (hrs)	Standard Deviation
CTAS-1	147	4.213 hrs	2.477
CTAS-2	741	5.877 hrs	2.676
CTAS-3	557	7.211 hrs	2.754
CTAS-4	23	7.582 hrs	2.715
CTAS-5	3	6.660 hrs	3.007

$p < 0.001$

Of the 1520 patients admitted to a critical care unit, there was no significant relationship between the ED length of stay and the overall hospital length of stay ($r = -0.047$, $p = 0.066$). There was a significant but extremely weak negative relationship between the ED length of stay and the ICU length of stay ($r = - 0.096$, $p < 0.001$). The ICU length of stay and the hospital length of stay had a strong statistically significant positive relationship between the two ($r = 0.710$, $p < 0.001$). The mean ED length of stay for the study patients was 6.16 hours with SD 2.86. The mean ICU length of stay was 3.28 days with SD 3.96. The mean hospital length of stay was 8.38 days with SD 7.43.

Of the 157 deaths in this sample, 84 patients died in the ICU. Of the 84 deaths, 43 (51%) were males and 41 (49%) were females. There was no significant relationship between males and females ($p = 0.753$). As shown in Table 3, patients whose ED length of stay was 3-6 hours had a statistically significant higher death rate than other ED length of stay ranges ($p = 0.033$). As shown in Table 4, there was not a statistically significant difference for patients who died in non-ICU units and the ED length of stay ($p = 0.206$). Seventy-three patients died after transferring from an intensive care unit. There was not a statistically significant difference whether the patient died in an ICU or a non-ICU unit ($p = 0.367$).

Table 3- Died in the Intensive Care Unit

ED Length of Stay Category	Number of Deaths	Total # of Patients in Sample	Percentage of Patients
0-3 hours	8	175	4.5%
3-6 hours	46	607	7.5%
6-9 hours	19	517	3.6%
>9 hours	11	221	4.9%

One-Way ANOVA: $p = 0.033$

Table 4- Died in Non-ICU Hospital Unit

ED Length of Stay Category	Number of Deaths	Total Number of Patients in Sample	Percentage of Patients
0-3 hours	8	175	4.5%
3-6 hours	27	607	4.4%
6-9 hours	30	517	5.8%
>9 hours	8	221	3.6%

One-Way ANOVA: $p = 0.206$

The patients with higher injury severity scores (ISS) had a longer hospital length of stay ($r = 0.398$, $p < 0.001$) and longer ICU length of stay ($r = 0.374$, $p < 0.001$). There was a weak relationship between the higher ISS and shorter ED length of stay ($r = -0.195$, $p = 0.007$). The patients with a higher APACHE II score had a longer ICU length of stay ($r = 0.306$, $p < 0.001$). There was no significant relationship between the APACHE II score and the ED length of stay ($r = 0.013$, $p = 0.620$).

For the reporting period of January 1, 2010 to December 31, 2010, there were 12,156 central line days with a total of three central line associated blood stream infections (CLABSIs). None of the CLABSIs were associated with patients who were admitted from the emergency department. For the same time period, there were 7693 ventilator days with 14 patients who acquired ventilator associated pneumonias (VAPs). Five of the 14 patients were treated in the emergency department and transferred to the intensive care unit. Four of the five patients with VAPs were transferred to the critical care unit in 4.75 hours or less. One patient's ED length of stay was 10.2 hours. There was a statistically significant relationship between the emergency department and VAP rates ($p = 0.042$, 95% CI: 0.000418399, 0.0226908).

After completion of acute hospital treatment, 69.34% of the patients were discharged home, 5.2% were transferred to a rehabilitation hospital, 1.32% were transferred to a long term acute care hospital (LTACH), 8.29% were transferred to a skilled nursing facility, 2.04% were transferred to a psychiatric facility, 0.79% were transferred to a hospital closer to the patient's home, 0.59% were transferred to a hospice facility, 0.13% were transferred to assisted living, 1.97% were designated as other, and 10.33% died in the hospital.

Chapter V

Discussion

Interpretation of Findings

Previous studies have associated negative clinical outcomes when there is a delay in patient transfer from the emergency department to the critical care unit. The purpose of the retrospective review was aimed at analyzing the effects of the emergency department (ED) length of stay on clinical outcomes.

In this retrospective review, the average time for the patient to be admitted to the intensive care unit was 6.16 hours. The average time included triage, assessment by the nurse, evaluation by the emergency medicine physician, diagnostic work-up and evaluation by the admitting physician. The findings suggest that the patients with a higher ED acuity score (CTAS-1 or CTAS-2) had a shorter ED length of stay than those patients with a lower acuity score (CTAS-3 to CTAS-5). The sickest (CTAS-1) patients were transferred to the intensive care unit in the shortest amount of time. As expected, the sickest patients had the longest ICU and hospital length of stay.

At this facility, a two tiered trauma activation system is used and triggered by pre-determined physiologic and mechanical criteria. The highest trauma level requires the attending trauma surgeon to respond to the emergency department within 20 minutes of the patient's arrival. The patients with the higher injury severity scores (ISS) were also categorized as CTAS 1 or CTAS 2 and had the shortest ED length of stay. The shorter length of stay for critically injured patients may be related to the attending trauma surgeon's early involvement in the care of the injured patient.

There was no difference in the APACHE II score and the ED length of stay. Critically ill patients may not be perceived as requiring time-sensitive treatment within the "golden hour" (Chaflin et al., 2007). A critical care physician does not respond to the emergency department in a specified timeframe. This may suggest the delay in transferring critically ill patients to the critical care unit. If the ED length of stay is greater than three hours but less than six hours, those patients are statistically more likely to die in the critical care unit. Critically ill patients may be under-triaged and/or under-resuscitated resulting in increased mortality.

Female patients had a longer ED length of stay but a shorter ICU and hospital length of stay. Research has demonstrated that triage nurses make triage decisions based on gender bias, sociodemographic characteristics, and beliefs that female patients do not present their symptoms objectively (Lopez, Wilper, Cervantes, Betancourt, & Green, 2010).

No central line associated blood stream infections were associated with the ED length of stay. Five patients developed ventilator associated pneumonia (VAP). Increasing the head of bed at least 30 degrees and initiating early oral care are preventive strategies that are not routinely implemented in the emergency department (Institute for Health Improvement, 2011). The average length of stay for patients who acquired a ventilator associated pneumonia was 4.09 hours. These findings may suggest the emergency nurse did not implement the preventive strategies while the patient was in the emergency department (ED).

Components of Duffy's Quality-Caring Model are structure-process-outcomes. The research findings suggested that factors related to structure were present prior to the delivery of healthcare. Within each participant, whether patient or nurse, are unique attributes such as demographics, psychological, and physiologic properties. Patients in this research study arrived

with pre-existing gender, co-morbidities and severity of illness or injury. The process component includes interventions that the emergency nurse offers. Findings suggested the interventions to prevent central line associated blood stream infections (CLABSIs) were implemented in the ED; however, findings suggested a statistically significant relationship between the ED and ventilator associated pneumonia (VAP) rates. The third component of Duffy's Quality-Caring Model is outcomes which include those that affect quality of life. Findings suggested a statistically significant relationship between the ED length of stay of 3-6 hours and increased mortality in the intensive care unit (ICU).

The researcher proposed to answer the question, Does the emergency department length of stay affect clinical outcomes for critically ill or injured patients?

Implications for Nursing

This research study was to examine the effects of ED length of stay on clinical outcomes, specifically those outcomes that are nursing-sensitive. Triage assessments influence the timeliness of interventions and the flow of patients through the emergency department. As Duffy's Quality-Caring Model suggests, the core of nursing work is focused on initiating, cultivating, and sustaining caring relationships with the patients and other health care providers. The emergency nurse must be the link between the patient, the caregivers, and the outcomes. Using this model as the foundation for nursing practice supports the value of caring relationships in optimizing patient outcomes (Duffy, 2005).

Instituting best practices such as the ventilator bundle has a significant impact on patient outcomes. Pneumonia accounts for nearly 20% of all nosocomial infections in hospitalized patients. The most significant risk factor for developing VAP is tracheal intubation.

Implementing the ventilator care bundle in the emergency department (raising the head of bed and oral care) could have an impact on patient outcomes (Institute for Health Improvement, 2011). Nurses should advocate for rapid transfer to the critical care unit but if that cannot occur in a timely fashion, the critical care nursing care delivery model should be implemented.

Limitations

The study was conducted in one community hospital and the findings may be limited to this one hospital. The retrospective study concentrated on patients who were admitted from the emergency department (ED) to the intensive care unit (ICU). With the retrospective study, it was impossible to fully determine the conditions in the ED for the 2010 time period. Variables such as high hospital occupancy rates, high ED census, nurse staffing patterns, and lack of available resources were not considered.

Late or failure to rescue rates were difficult to determine from the databases reviewed for this study. It is the nurse's responsibility to monitor the patient for changes in the condition and intervene with nursing interventions and/or notify the physician. Since patients who died within 24 hours were excluded from this study, late or failure to rescue rates could not be determined. Emergency department staff competencies also were not considered in this study.

Implications for Further Research

Since this was a retrospective study that concentrated only on those patients admitted from the emergency department (ED) to the intensive care unit (ICU), it is suggested that further analysis be performed to look at a subgroup of patients who were admitted to the non-ICU unit and transferred to the ICU within 12 hours of admission. This study could determine if the ED acuity score aligned with the assignment of the appropriate level of nursing care.

Future research could include monitoring performances and examining trends in patient safety as related to staffing patterns and their alignment with the volume and acuity. Staff education and competencies could be explored as related to clinical outcomes. More research is needed regarding nursing-sensitive indicators.

Critically ill or injured patients with a delay in ICU transfer of 3-6 hours had an increased mortality rate. Further research is needed to identify the factors associated with the increased mortality rate for this population. The results of this study suggest that patients could benefit from the implementation of the ventilator care bundle. As emergency departments continue to function at or over capacity, further work is needed to identify the specific factors that affect patient outcomes. The findings suggest that the emergency department length of stay in the 3-6 hour range has an effect on patient outcomes.

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Appendix

Canadian Triage & Acuity Scale – CTAS Reference

Triage Level 1 – Resuscitation

Definition: Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions.
Summary: Abnormal vital signs with signs of hypoperfusion (VSA, major trauma, severe respiratory distress, unconscious, seizures, third trimester vaginal bleeding)

Triage Level 2 – Emergent

Definition: Conditions that are a potential threat to life, limb or function, requiring rapid medical intervention or delegated acts.
Summary: Abnormal vital signs without hypoperfusion (altered mental state GCS ≤13), severe trauma, ischemic chest pain, head injury with LOC >5 minutes or amnesia >15 minutes, dyspnea (not severe), anaphylaxis, severe eye pain, overdose (conscious), severe abdominal pain, GI bleed, CVA with major deficit, Diabetes with hypo/hyperglycemia, labor pains q 2 minutes, fever in less than 3 months, acute psychosis/extreme agitation, signs of abuse/neglect, neonate ≤7 days old

Triage Level 3 – Urgent

Definition: Conditions that could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living.
Summary: Potential to deteriorate, severe extremity pain, head injury, alert but with high-risk mechanism of injury, moderate trauma, chronic mild SOB, atypical chest pain, GI bleed not actively bleeding, moderate abdominal pain, severe extremity or chronic pain

Triage Level 4 – Less Urgent

Definition: Conditions that related to patient age, distress, or potential for deterioration or complications would benefit from intervention or reassurance within 1-2 hours.
Summary: Needs attention but can wait 1-2 hours (minor head injury, moderate chronic abdominal pain, moderate ear ache, corneal foreign body, URI symptoms, vomiting and diarrhea >2 years old, moderate muscle-skeletal pain, laceration requiring sutures)

Triage Level 5 – Non Urgent

Definition: Conditions that may be acute but non-urgent as well as conditions which may be part of a chronic problem with or without evidence of deterioration.

Summary: Minor pain, can wait several hours (minor trauma not requiring closure, minor URI symptoms, vomiting alone, diarrhea alone without signs of dehydration and greater than 2 years old)

Adapted from the Canadian Triage and Acuity Scale (CTAS) Participant Package Summer 2001, MOHLTC-EHSB Implementation Guidelines for the Canadian ED Triage & Acuity Scale