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The purpose of this study was to explore and describe (1) to what extent emergency departments (EDs) in the United States (U.S.) are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the Emergency Severity Index Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. The study was guided by Donabedian's Structure, Process, Outcome model that allows for the assessment of operations in EDs that organize and influence the quality of triage decision accuracy.

The sample of 152 ED nurses with an average of 18 years of emergency nursing experience completed the online survey. The participants represented all four geographic regions of the United States, multiple levels of trauma center designation, annual patient visits from less than 25,000 to greater than 100,000, and 3, 4, and 5-level triage acuity systems. The majority of EDs (94%) used the Emergency Severity Index triage system. In 43% of EDs, nurses with less than one year of nursing experience met the qualification to triage.

Triage nurse experience, triage education and quality monitoring of triage accuracy in EDs in the U.S. are not consistent with the recommendations outlined in the Emergency Severity Index guidelines. Procedures (processes) for triage education and quality monitoring were reported more often than having a policy (structure) to guide either of the processes. Significant positive relationships were found between EDs with a

policy for triage education and those that required triage system training and between EDs with a policy for quality monitoring and those that monitored the accuracy of triage decisions. The findings add to the body of knowledge that relationships exist between structure (triage policies) and process (triage procedures) in the ED. The relationship needed to be established before quality assessment of emergency department triage can begin. This study is a foundation for examining triage accuracy and improvements in meeting the Emergency Severity Index recommendations.

STRUCTURE, PROCESS, AND RECOMMENDATIONS OF EMERGENCY DEPARTMENT TRIAGE IN THE U.S.

by

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CHAPTER I

INTRODUCTION

Emergency departments (EDs) have become the major diagnostic and resuscitation sites of hospitals (Schriver, et al., 2003), an important element in the access to and quality healthcare in the United States (U.S.; Schuur, Hsia, Burstin, Schull, & Pines, 2013). Laws and health policies reflect access to emergency care as a right of all persons in the U.S. and high-quality care is an expectation. In 2013, there were a total of 5,025 EDs in the U.S. that managed over 139 million patient visits (Emergency Medicine Network, 2013). The most common diagnosis category for all ED patients in 2011 was injury and poisoning; this included patients that were diagnosed with fractures, sprains, head injuries, wounds, and trauma (Centers for Disease Control and Prevention [CDC], 2014). The most common complaint category for the adult population age 15 to 64 was stomach and abdominal pain, followed by chest pain. These complaint categories can result in benign diagnoses, such as gastric reflux, to life threatening conditions, such as a dissecting abdominal aortic aneurysm or acute myocardial infarction.

A phenomenon inherent to EDs is the volume of patients seeking care at a given time. In the U.S., less than 16 percent of patients arrive at EDs via ambulance (CDC, 2014); the majority of patients arrive by personal vehicle, known as "walk-in" visits. Crowding in EDs is a growing national problem (Wiler, et al., 2010) where the number of people seeking care is greater than the available resources in the ED (Emergency Nurse

Association [ENA], 2014). It is paramount in these situations that the limited number of resources (e.g. ED nurses, ED providers [physicians, nurse practitioners and physician's assistants], beds in the treatment area, and available diagnostic services) are optimally used for the patients in need of urgent treatment and intervention. Triage is a key process in ED operations, particularly in crowded EDs, to assure patient safety (McHugh, Tanabe, McClelland, & Khare, 2012) and has led to the development and evaluation of reliable triage systems for EDs throughout the world over the past two decades (Gerdtz, et al., 2009; Gilboy, Tanabe, Travers, & Rosenau, 2011).

Triage in the ED has been defined as a decision-making process whereby triage staff members (triage nurses and/or providers in triage) prioritize care for patients based on their immediate need for medical care (Emergency Nurses Association [ENA], 2017; Gerdtz & Bucknall, 2001; Gilboy, Travers, & Wuerz, 1999; Noon, 2014). Triage is a brief, initial focused assessment that is completed upon patient arrival to the ED and occurs within the confines of limited information from the patient, time constraints and an ever-changing environment of available resources for patient care (Gilboy et al., 2011). Triage decisions are reflected in the assignment of a triage category indicating which patients should be seen first (Atzema et al., 2010; Edwards & Sines, 2007; Kuhn, Page, Rolley, & Worall-Carter, 2014; Kuhn, Worall-Carter, Ward, & Page, 2013). Triage acuity decisions are used to describe the case mix, or patient population in EDs (McHugh et al., 2012). Initially, three-level triage systems (e.g. emergent, urgent, and non-urgent) were the most frequently used systems in EDs. However, 3-level triage systems were found to have low reliability, the degree to which clinicians agreed on the allocation of

the triage levels (Christ et al., 2010; Travers, 2002). Five-level triage systems were first introduced in the late 1990s and are now the gold standard, with well-documented reliability and validity (Christ et al., 2010; Fernandes et al., 2005).

Multiple five-level triage systems are used throughout the world. The most widely used triage systems are the Manchester Triage System (MTS) in the United Kingdom and internationally, the Australian Triage Score (ATS), the Canadian Triage and Acuity Scale (CTAS) available in English and French versions, and the Emergency Severity Index (ESI) in the U.S. with translated versions used internationally. Each system has been developed through collaborative efforts of ED physicians and registered nurses and are supported through respective national organizations (Gerdtz et al., 2009; Gilboy et al., 2011).

The overarching goals of all triage systems are to quickly assess patients arriving at the ED, to identify patients in need of immediate care, and to sort patients based on clinical urgency or how long a patient can safely wait for treatment (Gerdtz, et al., 2009). The MTS was based on the patient's complaint, rather than suspected diagnosis. The triage staff member follows presentation charts in a reductive manner, assuming the patient is dying until proven otherwise, by ruling out high priority discriminators (Ganley & Gloster, 2011). The CTAS and ATS are patient complaint driven. The CTAS uses a complaint list and complaint specific physiological modifiers are considered to sort patients into triage levels (Bullard et al., 2014) based on an ideal maximum amount of time within which a patient should see a physician (Funderburke, 2008). The ATS begins with eliciting the chief complaint followed by a primary assessment approach (airway,

breathing, circulation, disability, environment, limited history and co-morbidities) to render a triage decision of acuity level based on the maximum time limit in which a patient should be seen by an ED provider (Gerdtz et al., 2009). The ESI (Gilboy et al., 2011) determines acuity based on the stability of vital functions (is this patient dying?) or is there a potential threat to life, limb or organ (is this a patient who should not wait?). Patients who are not prioritized into an ESI high acuity level are sorted by the number of resources needed to determine disposition from the ED. This is based on the triage staff member's experience of patients presenting with similar injuries or complaints.

The function of triage systems to achieve the intended goals was based on the assumption that triage decisions are consistent over time and among clinicians using the scale (Gerdtz et al., 2009). The MTS, ATS, CTAS and ESI triage systems have published guidelines for consistent education, implementation, and audits to promote triage accuracy. In the United Kingdom, an accreditation standard of hospitals using the MTS includes commitment to training and implementation of MTS updates, as well as audits of at least two percent of clinician triage records. The ATS utilizes macro audits where "like" EDs are compared by triage levels to identify patterns of inconsistent triage decisions (Gerdtz et al., 2009). In Canada, there is mandatory reporting of CTAS triage levels to a national database and quality monitoring audits are recommended.

In the U.S., the American College of Emergency Physicians (ACEP) and Emergency Nurses Association (ENA) have endorsed the use of a 5-level triage system as the standardized triage scale and acuity categorization process for EDs (Fernandes et al., 2005). The first ESI Implementation Handbook was published 15 years ago and the

latest revision was published in 2012, the ESI Handbook Version 4 (hereafter referred to as ESI Handbook; Gilboy et al., 2011). The ESI Handbook is a resource guide for ED leaders to use in adopting and monitoring the ESI as the triage system in individual EDs. The ESI Handbook (Gilboy et al., 2011) includes recommendations for ED nursing experience, development of an educational program for triage staff members, implementation of the ESI algorithm used in determining the triage level assignment and designing an ongoing quality improvement program. Gilboy et al. (2011) developed the ESI Handbook with the belief that consistent use of the triage system is crucial in preserving its reliability and validity.

There are several research studies in the literature focused on the accuracy of triage decision using ESI (Arslanian-Engoren, 2009; Arslanian-Engoren & Engoren, 2007; Garbez, Carrieri-Kohlman, Stotts, Chan, & Neighbor, 2011; Madsen, Choo, Seigel, Palms, & Silver, 2015; Martin, et al., 2014; Sanders & Minick, 2014; Wolf, 2010; Zook et al., 2016). Accuracy rates for triage have been reported as low as 48 percent (Wolf, 2010) and as high as 80 percent in a study limited to a population of acute stroke patients arriving to the ED within six hours of symptom onset (Madsen, et al., 2015). However, little is known about the ESI recommended triage structure and process among EDs, especially related to the consistency with the gold standard ESI.

In 2008, Singer et al. (2012) surveyed individuals that had requested ESI education material through the Agency of Healthcare and Quality Research (AHRQ) regarding the use of and satisfaction with ESI. Sixty-four percent of the respondents had used ESI less than two years and only five percent had used the ESI triage system for

more than five years, indicating the majority of the respondents had recently adopted the use of the ESI triage system. Surprisingly, only 25 percent of the respondents indicated that accuracy of triage was monitored in the ED; thus, further investigation is needed to better understand the current structure and process of ED triage systems that promote accuracy of triage decisions.

Purpose of the Study

The purpose of this study was to explore and describe (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. Donabedian (1988) explained that relationships between structure and process, as well as process and outcomes should be established before quality assessment can take place. Patient safety for individuals arriving to an ED is realized through sorting patients based on the priority in which they need treatment, and is dependent on triage nurses assigning accurate triage ratings. Further, the findings were compared for consistency with the ESI recommendations as documented in the most recent ESI Handbook, Version 4 (Gilboy et al., 2011). The consistent use of the recommended guidelines promotes accurate triage acuity decisions and quality of triage.

Background and Significance

EDs have an enhanced capability to manage a wide range of simple to complex and time-sensitive medical conditions (Morganti, et al., 2013). The care provided in EDs has advanced over the past several decades, as has the use of and dependence on

emergency care. This was reflected in a recent report that approximately 1 of 5 U.S. adults sought care in an ED (Gindi, Black, & Cohen, 2016). Although there was a decrease in the number of actual EDs in the U.S. between 1993 and 2013, the number of patient visits increased by 51 percent (The New England Healthcare Institute, 2010). The declining number of EDs and increase in use has resulted in ED crowding, a growing national problem (Wiler et al., 2010). ED crowding was deemed by the Institute of Medicine (IOM, 2007) as a national crisis after ninety-one percent of EDs reported crowding in the ED.

Crowding has been defined by the ACEP and the ENA as "a situation in which the identified need for emergency services outstrips available resources in the emergency department, hospital, or both" (ENA, 2014; ACEP, n.d.). Crowding in the ED has negative consequences of delayed patient care, safety concerns, patient dissatisfaction with the care or lack of care, and patients leaving before being seen by an ED provider or before their treatment is complete (French et al., 2014; Han et al., 2010; Nestler et al., 2010). It is well recognized that not all ED visits require emergency care (ACEP, n.d.), but all patients presenting to an ED must be provided a timely medical screening exam and stabilizing treatment (Emergency Medical Treatment and Labor Act (EMTALA), 2011).

Triage is an integral part of the flow process and safety of patients in the ED. It is a dynamic process that requires accurate decision making in prioritizing the care of patients that present to the ED for evaluation and treatment. The goals of triage include determining who needs to be seen next and to accurately assign patients into the correct

triage level to best utilize scarce resources for patient safety. The triage decision of acuity level assignment determines the patient trajectory or patient flow through the ED visit. Improving patient flow has been effective in reducing ED crowding, a situation that studies have shown contributes to poor quality care (McHugh, Van Dyke, McClelland, & Moss, 2011). The Joint Commission (TJC, 2012), an accreditation organization in the U.S. that evaluates hospitals for safe and high-quality care, recognized the importance of patient flow issues and made revisions of hospital standards. Effective January 2013, hospitals were required to measure and set goals for patient flow standards, review measurements to determine if goals were met, and to take action to improve patient flow when goals were not met. Innovative solutions to improve patient flow in the ED have been studied, tested, revamped and instituted prior to implementation of the TJC mandate (McHugh et al., 2011; Schuur et al., 2013; Wiler et al., 2010). Consequences related to crowding have led interdisciplinary teams to study and seek improvement to the triage process for decades, to include the development of the ESI in the U.S. (Gilboy et al., 2011).

Based on the ESI 5-level triage system, a patient who needs immediate life-saving interventions is considered an ESI level-1 (Gilboy et al., 2011). Likewise, patients that present with a chief complaint, signs and symptoms, or a history of a problem or conditions that could deteriorate rapidly if not treated promptly are considered "high-risk" and triaged as ESI level-2 (Gilboy et al., 2011). An ESI level of 3, 4, and 5, indicate that the patient does not have a high-risk situation and levels are assigned based on the number of resources the patient will need (i.e. injections, intravenous hydration,

radiology studies, or laboratory studies) to determine disposition from the ED (Gilboy et al., 2011).

The ESI Handbook provides an algorithm and procedure to prioritize incoming patients based on how long an individual can safely wait to be seen by a provider (Gilboy, et al., 2011). Upon patient arrival to the ED, traditionally a triage nurse, but may be an ED provider, completes a focused patient assessment by soliciting subjective and objective data from the patient (or patient representative), and then a triage decision is rendered through a triage level assignment (Atzema, Austin, Tu, & Schull, 2010; Edwards & Sines, 2007; Kuhn et al., 2013; Kuhn et al., 2014). The ESI algorithm is a tool used by triage personnel for determining the treatment priority based on a patient's presenting symptoms (Christ et al., 2010*).*

An example of triage level assignment with ESI is used with the diagnosis of acute coronary syndrome (ACS). Patients with suspected ACS are considered high-risk for cardiac ischemia and timeliness in diagnosis and treatment impacts patient outcomes (Amsterdam et al., 2014). Thus, the triage staff member's decision to assign a patient with suspected ACS to a high-risk level 2 triage category is a critical step in the process as only 18% of patients presenting to the ED are seen by an ED provider within 15 minutes (Gilboy et al., 2011). Thus, assigning a patient with suspected ACS to an ESI level-1 (who is conscious and has vital signs) would be considered an over-utilization of scarce resources, such as ED nurses, ED providers, diagnostic services, and resuscitation beds in the treatment area. This is often referred to as "overtriaging". Likewise, assignment of a patient with suspected ACS to an ESI level-3, 4, or 5 is considered

under-utilization of resources (i.e. “undertriaging”) because the high-risk situation is not accurately identified potentially resulting in a delay of patient treatment.

The ESI Handbook, as well as the other evidence-based 5-level triage systems, recommended consistent triage policies and procedures in EDs to promote accurate triage decisions (Bullard et al., 2017; Gerdtz et al., 2009; Gilboy et al., 2011). When more patients arrive at an ED than there are resources available, patients are prioritized through a triage process to sort patients based on the need for medical treatment. The safety of ED patients and the reliability of triage systems are dependent on accurate triage decisions. There is limited research if the recommended policies and procedures are used in EDs in the U.S.

Donabedian’s Structure, Process, Outcome Model

The theoretical framework selected for this study was Donabedian’s *Structure, Process, Outcome* model. Donabedian first introduced the triad structure in 1966 as a way to approach the assessment of quality health care. The model encompasses studying quality from the viewpoint of the care that patients receive as opposed to the performance of practitioners (Donabedian, 1988). He believed that neutrality is important in studies of quality and one should ask “what is going on here?” rather than “what is wrong; and how can I make it better?” (Donabedian, 1966). Research questions that are derived with respect to institutions are focused on the mechanisms that organize, influence and direct human effort in general, not on individuals. The research questions in this study focused on EDs and the policies (structure) and procedures (process) in place that influence and guide triage decision accuracy.

Donabedian emphasized that the following fundamental questions need to be answered before quality assessment can begin: "(1) Who is being assessed? (2) What are the activities being assessed? (3) How are these activities supposed to be conducted? (4) What are they meant to accomplish?" (Donabedian, 1988, p. 1745). EDs that experience crowding, where the numbers of patients arriving for treatment outweigh the resources immediately available, utilize triage systems to prioritize incoming patients. Registered nurses have been historically responsible for the initial assessment or triage of patients arriving at an ED, although ED providers may also participate in triage (Barbee, Berry-Caban, Daymude, Oliver, & Gay, 2010; Holroyd et al., 2007; Love et al., 2012; Rogg, White, Biddinger, Chang, & Brown, 2013; Traub et al., 2015). Recognized as the gold standard, reliable and valid five-level triage systems have published guidelines that recommend the training of personnel and the use of algorithms or decision-support tools for the specific triage system. Accuracy of triage decision is regarded as a critical indicator that should be routinely monitored (Bullard et al., 2014; Gerdtz et al., 2009; Gilboy et al., 2011) to maintain consistency among those using the triage system at individual EDs (Gilboy et al., 2011). Triage is a process aimed to provide safe and effective care by quickly identify patients arriving at an ED in need of immediate care and to sort patients based on how long one can safely wait for initiation of care by an ED provider. Donabedian contended that once these questions were answered and a relationship between structure and process and process and quality were established, quality assessment of triage could begin (Donabedian, 1988).

Structure refers to the attributes of the setting in which care takes place and may include material resources, human resources and organization structure (Donabedian, 1988). Structure includes policies that direct the provision of care and was based on the assumption that given the proper instrument, good healthcare will follow (Donabedian, 1966). Written policies and procedures that define the triage system used to sort patients on arrival to the ED, the role of triage, the qualifications of triage nurses, training for triage staff members, and quality monitoring of triage decisions are examples of structural characteristics related to the triage.

Process encompasses what is actually done in the exchange of care or seeks to answer if "good" medical care has been applied (Donabedian, 1966). With the selection of relevant dimensions, values, and standards to measure, one can answer the important questions as to whether health care is being properly provided, that is, is the process being followed as designed. The measurement of triage process is related to the structural characteristics of the individual ED. Are the policies and procedures of triage being consistently implemented in the ED? For example, do triage staff members receive triage training? Do triage staff members use the triage system as designed? Is an algorithm or decision support tool available during triage? Do triage nurses meet the qualifications set forth in policy? Is the defined quality monitoring procedure of triage decisions consistently implemented?

Outcome refers to the effectiveness of care. While outcomes do not give insight as to where deficiencies or strengths might be attributed (Donabedian, 1966), measuring outcomes allows one to further investigate factors that may impact quality care.

Outcomes should be appropriate and measurable. The aim of triage is to sort patients into triage levels based on priority need of medical care, therefore accuracy of triage decision is representative of effective triage. Further, monitoring accurate triage decisions ensures that the reliability of the triage system is maintained in individual EDs (Gilboy, et al., 2011).

Donabedian (1966) described structure, process and outcome as an unbroken chain of antecedent means followed by intermediate ends and recommended that each aspect should be considered in quality assessment. Safe and effective triage in EDs begins with the structure of comprehensive policies and procedures that guide the process of triage. Donabedian's process refers to if the policies and procedures are being followed. Outcomes are focused on the effectiveness or quality of triage. If the quality of triage decisions is not deemed satisfactory, one should consider the structure as well as the processes of triage. Before this quality assessment can begin, Donabedian (1988) explained that a relationship between structure and process and process and outcome should be established. The structure and processes of triage in EDs the U.S. is unknown, therefore establishing if a relationship exists precedes quality assessment of the effectiveness of triage.

Research Questions

This study sought to explore and describe (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if

relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions.

1. What structure aspects (triage policy for years of nurse experience, policy for triage training, policy for triage quality monitoring) are associated with the type of triage-level system used and trauma center designation?
2. What process aspects (actual triage system training, general triage training,) are associated with the type of triage-level system and trauma center designation?
3. What process aspects (monitoring of triage decision accuracy, feedback of triage decision accuracy) are associated with the structure of a quality monitoring policy?
4. What quality monitoring aspects (monitoring of triage decision accuracy, frequency of monitoring) are associated with the type of triage-level system and trauma center designation?
5. What is the consistency of current triage structure and process with the gold standard ESI recommendations?

Chapter Summary

The number of patients seeking care in an ED is unpredictable. EDs are often crowded where the number of patients seeking treatment is greater than the resources available to initiate treatment upon arrival. Triage is a patient safety practice where patients are assessed and sorted into categories indicating who needs to be seen first based on the urgency of the clinical presentation. The accuracy of triage acuity decisions is crucial in the prevention of patient harm and in providing quality care. The gold

standard of ED triage is the implementation of a five-level triage system and the recommendations for initial training, ongoing training and quality monitoring of the triage decisions. However, there is minimal evidence about the actual use of the recommendations by EDs in the U.S.

Donabedian (1988) developed the Structure, Process, Outcome model to assess quality healthcare. The model contends that attributes of the setting (structure), what is actually done (process) and the effectiveness of care (outcomes) are interconnected links that influence each other. The ESI Handbook provides a standardized approach for the adoption, implementation and ongoing use of the ESI valid and reliable triage system. Recommendations for policies to guide the triage process (structure), for monitoring procedures to be followed for the triage process to be effective (process), and data points to be collected that indicate the effectiveness of care (outcomes) are provided in the ESI Handbook (Gilboy et al., 2011). This study sought to explore and describe (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions.

CHAPTER II

LITERATURE REVIEW

Triage in the ED serves as a patient safety process to quickly identify and sort patients upon arrival based on how long an individual can wait for a medical screening examination and intervention (Gilboy et al., 2011). Historically, registered nurses have been solely responsible for ED triage. Although ED providers may be a part of the triage team, registered nurses (RNs) remain the foundation of the triage staff members. To meet the goals of triage, accurate triage decisions in determining the acuity of the patient is essential. Evidence-based triage systems recommend nurse experience, triage education and quality monitoring to promote accuracy of triage decisions. The consistent practice of triage among triage staff members promotes reliability of the triage system and is crucial in providing safe and effective patient care. The purpose of this study was to explore and describe (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. This review of the literature includes a discussion of previous research investigating the accuracy of triage decision, nurse experience and expertise in triage, and the reliability of the ESI triage system.

Accuracy of Triage Acuity Decisions

The accuracy of triage decisions in the literature reflected the performance of the triage nurse. Accuracy is often reported in the literature as a percentage of correct triage decisions or acuity level assignment to prioritize care for patients based on their immediate need for medical care (Emergency Nurses Association (ENA), 2017; Gerdtz & Bucknall, 2001; Gilboy, Travers, & Wuerz, 1999; Noon, 2014). The accuracy of triage decisions has been studied with multiple methods to include written patient scenarios/simulation, retrospective studies extracting data from patient medical records, secondary analyses, prospective studies, and education intervention studies.

Patient Scenarios

Standardized patient scenarios have been used to assess nurses' accuracy of triage decisions. This format allowed for a prospective collection of data in a simulated environment. Allen et al. (2015) used nine pediatric scenarios used previously in triage training that were designated as acuity level 3, 4, or 5 according to the ATS. A total of 167 nurses assigned triage levels for each of the written scenarios, with most completing assigning all nine acuity levels in less than ten minutes. Comparing three general hospitals and one pediatric specialty hospital, the best overall nurse accuracy rate (66%) was at the pediatric specialty hospital. A wide variation of accuracy was noted between hospitals on particular scenarios. For instance, with Scenario 2: a 4-month-old with a two-day history of breathing difficulty, moist sounding cough and expiratory wheeze, low oral intake, and tachypnea, the accuracy rate was as low as 15% at one hospital and a high of 88% at another.

The interrater reliability between the nurses at each hospital was low, ranging from a weighted kappa = 0.26 to weighted kappa = 0.42. Cohen's kappa represents the extent that raters agree that a triage decision is a particular triage level (Huck, 2012). Weighted kappa allows for the measurement of agreement based on the amount of disagreement (level 2 versus level 4), not just how consistently the two raters agreed or disagreed (Cohen, 1968). This study took place after the Department of Health and Ageing published the Emergency Triage Education Kit (ETEK) designed to provide consistent education and use of the ATS by clinicians. In fact, the nine scenarios used in the study came from the ETEK. However, it is not known if the participants in the study had used the ETEK previously.

Goransson et al. (2005) recruited 423 ED nurses in Sweden to assign acuity levels to forty patient scenarios using the CTAS triage guidelines. Only the eighteen scenarios that had an interrater agreement of 80% or greater between the participants and developers of the scenarios were used in the data analysis. An overall accuracy rate of 57.7% was calculated for the 7550 acuity ratings with weighted kappa = 0.71. The accuracy for level 2 triage (conditions such as cerebral vascular accident, myocardial infarction, severe trauma, altered mental status) was accurately triaged 39.5% of the time, with a 36.8% occurrence of under-triage. A major limitation of the study was the CTAS was not familiar to most of the nurses who participated in the study and nurses received no education on how to use the tool prior to the study.

Wolf (2010) initiated a triage reeducation program for forty nurses in an ED as the result of negative patient outcomes. Knowledge or accuracy of triage decision was

first assessed via two live simulation scenarios where an actor playing the patient was able to answer questions posed by the nurse participants. Next, triage decision accuracy was assessed with a written test that included patient scenarios for which the nurse assigned acuity levels using the ESI triage system. The accuracy of triage decisions ranged from 48% to 100%. Only one nurse correctly answered all test questions and passed the simulation scenarios. The majority of the nurses (80%) had an accuracy rate of 48% to 69%.

Studies that used written patient scenarios acknowledged there are limitations. One limitation was the nurse rendered a triage acuity decision based on the limited information presented in the scenario. This measures only how the nurse responds to information presented, not the information the nurse may have elicited from the patient or family. Other limitations noted using written patient scenarios included the absence of non-verbal communication and visual assessment, as well as the impact of decision-making outside of the natural environment. However, the use of patient scenarios allows for the recognition of cognitive gaps (Wolf, 2010) and the nurses' compliance in following the triage algorithm as designed.

Retrospective Studies

Triage accuracy has been evaluated globally using retrospective data from large databases and from hospital medical records. Each of the studies included in this review focused on accurate triage decision for a specific patient population. Three of the studies were focused on the accuracy of triage of patients diagnosed with an acute myocardial infarction (AMI) (Atzema et al., 2010; Kuhn et al., 2014; Ryan et al., 2016), one on acute

stroke (Madsen et al., 2015) and one on patients over 65 years old (Grossman et al., 2012).

Atzema et al. (2010) used the Enhanced Feedback for Effective Cardiac Treatment (EFFECT) database that included 3,088 AMI patients discharged from Ontario hospitals from April 1999 to March 2001. Overall, 50.3% of AMI patients were under-triaged. The study examined patient related variables of age, sex, number of risk factors, arrival mode and socioeconomic status and hospital variables of time of day, day of week, ED AMI volumes, hospital type and if electrocardiograms (ECGs) were performed in triage. The result of a logistic regression analysis revealed 4 independent predictors of accurate triage: presenting to a high AMI volume ED, arriving via ambulance, male gender, and a higher number of cardiac risk factors. The odds of being under-triaged were 56% lower for patients who presented to an ED with a very high volume of AMIs, defined as more than 300 AMI cases annually. The conclusion was that nurses at high volume centers have more exposure and experience to patients presenting with an AMI.

Kuhn et al. (2014) utilized the Victorian Emergency Minimum Dataset (VEMD) that holds data for all ED patient presentations in Victoria, Australia to study the effect of patient gender on triage accuracy of patients with AMIs. A total of 21,080 patients presented to Victorian EDs from 2005-2010 who were ultimately diagnosed with an AMI. Triage accuracy was higher for men (61%) than for women (51.4%). Women were found to be undertriaged significantly more often than men. Triage nurse demographics were not provided.

Grossmann et al. (2012) completed a secondary data analysis from a study originally designed to test the reliability of the ESI in a hospital in Switzerland. Inaccurate triage decisions occurred in 132 (25%) of the 519 triage interactions reviewed by two triage experts (a physician and advanced practice registered nurse). Undertriage occurred in 117 (89%) of the inaccurate triage cases and over-triage occurred in 15 cases (11%). The experts identified the most common reasons for undertriage as: neglect of high-risk situations (29 cases), number of resources (25 cases), inappropriate interpretation of vital signs (20 cases) and severe pain (17 cases). The fifteen nurses included in this study were formally trained with a 3-hour ESI class, had used the ESI for more than one year, and attended monthly education sessions with discussions of case scenarios. The authors noted that all of the nurses were either certified in emergency nursing or considered to have expert knowledge based on having five or more years of emergency nursing practice. The accuracy rate of 75% in this study was one of the highest reported rates in the studies included in this literature review.

Madsen et al. (2015) extracted data from 537 patient medical records and reported one of the highest triage accuracy rates in the literature where 79.2% of women and 80.2% of men were triaged into an ESI level 1 or level 2 category. The study focused on gender disparities for patients who presented to a facility within six hours of symptom onset and were diagnosed with a hemorrhagic or ischemic stroke. The rate of undertriage, or inaccurate triage in this population was fourteen percent. No gender disparities were found in the accuracy of triage. When comparing symptom presentation, patients with atypical symptoms had higher odds of being undertriaged as ESI level 3 versus ESI level

1 or 2, OR 3.04, 95% CI (1.36-6.82). It is important to note that the facility cared for a high volume of stroke patients. Also, 90% of the patients arrived via ambulance where prehospital identification of stroke symptoms could have been a confounding variable in the study.

Ryan et al. (2016) found an undertriage rate of 20% in a cohort of 153 AMI patients included in a study that took place at a large teaching hospital in Australia. The accuracy findings were higher than expected. The investigators explained that the findings might have been partially explained by the required initial training, ongoing training and a standardized protocol for assigning triage score. Another consideration is nearly 75% of the patients arrived by ambulance. Of the patients that were undertriaged, 93% presented with atypical symptoms of AMI and were mostly older women. Another unexpected finding was 33% of the under-triaged patients presented with a chief complaint of fall, denied chest pain, and were elderly.

Recent studies using retrospective data to measure triage decisions that occurred in the natural setting reveal a wide range of accuracy. The results of the studies are limited to the accuracy of the information entered into and extracted from the medical record or database. The majority of the studies focused on AMI, a high-risk situation that is time sensitive. The timely initiation of treatment and increased use of evidence-based therapies and interventions, particularly in the STEMI (ST segment elevation myocardial infarction) population, is matched by significantly decreased rates of death (Jneid et al., 2017).

Quasi-Experimental Study

An Aid to Cardiac Triage (ACT) intervention was designed to improve nurses' knowledge and recognition of symptoms of ACS in women presenting to the ED (Arslanian-Engoren, Hargerty, & Eagle, 2010). Triage acuity decisions using ESI were collected but not reported in the study. Although accuracy of assigning an ESI level 1 or level 2 was not the focus of the study, obtaining a physician-read ECG within 10 minutes of arrival was indicative of accurately recognizing a high-risk situation. Chart reviews were completed to assess the percentage of ECGs read within ten minutes before the 1-hour education intervention and three months' post intervention. The rate of physician read ECGs within 10 minutes increased from 5% pre-intervention to 14% post-intervention. Impact of the intervention past the 3-month time frame is unknown and a limitation of an intervention study without long-term follow-up.

In the studies included in the review, overall triage accuracy rates were reported from 48 percent to 90 percent. Only two of the nine studies addressed initial triage education and ongoing education for triage personnel as a standard of practice at the facilities. One of the studies took place in Switzerland (Grossmann et al., 2012) and another in Australia (Ryan et al., 2016). Wolf (2010) and Arslanian-Engoren et al. (2010) implemented additional education for triage nurses seeking to improve triage decision-making. Both of these studies took place in the U.S. but did not provide information as to the initial education, ongoing education or quality monitoring practices at the facilities. None of the studies addressed if ongoing quality monitoring of triage decisions (process) was practiced at the study sites.

Experience and Expertise

The term "experience" is used judiciously to categorize nurses, usually represented by a passage of time or years of nursing practice, however the term is ill defined in the nursing literature (Considine, Botti, &Thomas, 2007). In nursing, expertise is often associated with years of experience and determined through a social context or peer nomination as opposed to other domains that use measures of reproducible superior performance (Ericsson, Whyte, & Ward, 2007). Considine's et al (2007) systematic review of publications in MEDLINE from 1966 to 2005 and CINAHL from 1982 to 2005 found that the literature does not support the belief that more experienced nurses make better triage nurse decisions. More recent quantitative studies have reported a lack of correlation in years of experience and accuracy of triage decision (Goransson et al., 2006; Martin et al., 2014; Sanders & Devon, 2016). However qualitative studies indicate that according to nurses' perspectives, nursing experience and triage expertise are directly related to triage accuracy (Andersson, Omberg, & Svedlund, 2006; Arslanian-Engoren, 2009; Patel et al., 2008; Sanders & Minick, 2014).

An aim of Goransson's et al. (2006) study included identifying if a relationship existed between nurse experience and accuracy of triage decisions for 423 RNs working in Swedish hospitals. The authors selected the CTAS triage system for use in this study as it was an internationally accepted triage scale. At the time, there was not a national triage scale in use in Sweden. There was a slight correlation (r =.131) between ED experience and triage accuracy when experience was dichotomized into < 5 years and > 5 years of triage experience. However, it was not felt that this was likely to explain the distribution

of accurate triage decisions. The authors did not offer an explanation as to why five years was the cut point to determine a more experienced RN versus a less experienced RN. A limitation of the study was the CTAS was a new triage scale for the RNs and may have affected the results.

Martin et al. (2014) compared nurse years of experience to the accuracy of assigning triage levels using the ESI. The sixty-four nurse participants had completed a critical care course and an ESI course within two months of the study. ED experience ranged from three months to thirty-five years. Years of triage experience were used to define experience. Eighty percent of the participants self-identified their triage ability as intermediate or advanced on a novice to expert scale. Although twenty percent of the participants had more than fifteen years of triage experience, only five percent of the participants considered themselves to have expert triage ability.

The accuracy of triage decision for all participants in Martin et al. (2014) compared to the ESI experts was an overall weighted kappa = 0.65 (95% CI, 0.63to 0.68). Nurse experience was categorized into < 1 years, 1.00 to 1.99 years, 2 to 4.99 years, 5 to 9.99 years, 10 to 14.99 years and > 15 years of triage experience. The categories were not evenly distributed and an explanation for how the categories were determined was not provided. The highest interrater agreement between triage nurse and expert nurses was in the 1.00 – 1.99 years of experience with a weighted kappa of 0.63 (95% CI, 0.60 to 0.66) and 5 – 9.99 years of triage experience with a weighted kappa of 0.63 (95% CI, 0.61 to 0.66). The lowest interrater agreement was between the > 15 years of triage experience and triage experts with a weighted kappa of 0.51 (95% CI, 0.39 to 0.63). This study

supports the previous literature suggesting that years of experience were not a significant indicator of triage accuracy.

Sanders and Devon (2016) used a retrospective study design to explore the relationship of accuracy of triage for patients with symptoms suggestive of a MI and nurse experience. Accuracy of triage decisions were determined by symptoms presented at triage as opposed to the final discharge diagnosis. The forty RNs who participated in the study had a 54% accuracy rate of assigning the 286 triage encounters to an ESI level 2. The nurses' average years of ED experience was 10.98 (SD 8.51) years with a range of 3 to 35 years of experience. Experience did not predict accuracy of triage.

While quantitative studies have not shown a relationship between years of nursing experience and expertise in triage decisions, the qualitative literature indicates that nurses believe there is a direct relationship. In Andersson et al., (2006) and Arslanian-Engoren (2009) nurses identified their knowledge and experience as important factors in triage decisions. Nurses described the need to rely on "the look of the patient" (Arslanian-Engoren, 2009; Patel et al., 2008) or a sixth sense (Andersson et al., 2006) when rendering decisions, a quality believed to be acquired through experience. The terms experienced and inexperienced were used throughout the studies, but were not clearly defined. The experience of nurses reported in the qualitative studies was described as years of nursing experience.

Perceptions from experienced nurses in the Sanders and Minick (2014) study included the conviction that experienced nurses are better able to connect with patients and correctly interpret the patient presentation. Less experienced nurses were described

as unable to read between the lines and decipher the patient information, therefore impacting the quality of triage decisions. The terms "experienced" and "less experienced" were not defined in the study. The seven nurses included in the study had a range of nursing experience from two to fifteen years, with an average of 9 years.

In each of the studies included in this review, a passage of time was used exclusively when referring to experience, although the number of years to delineate "experienced" was not reported. Benner (1982), using the Dreyfus Model of Skill Acquisition from novice to expert, defined experience as not just passage of time, but as "the refinement of preconceived notions and theory by encountering many actual practical situations that add nuances or shades of differences to theory" (p. 407). McHugh and Lake (2010) further explain refinement as complex reflective thinking, an important component to clinical nursing expertise. Engaging in reflective practice includes an active approach to learning from one's nursing experiences that leads to developing and maintaining competence in practice (Mann, Gordon, & MacLeod, 2009).

The ESI Handbook referred to "experienced triage nurses" throughout the document. However, there was no definition of "experienced". Previously, the ENA position statement included a qualification that triage nurses have a minimum of six months ED experience prior to performing triage (Funderburke, 2008). An update to the "Triage Qualifications" position statement in 2011 did not address a minimum experience qualification (ENA, 2011). However, it was recommended that triage nurses have "experience", additional and ongoing education, and monitoring through peer review to enhance accuracy and competence (ENA, 2011). In 2017, the ENA position statement

"Triage Qualifications and Competency" was updated and recommends triage be performed by a registered nurse or nurse practitioner with a minimum of one-year of emergency nursing experience (ENA, 2017). The ESI Handbook (Gilboy et al., 2011) referred to the qualifications of nurses participating in the ESI educational program as "expected to be experienced triage nurses and/or to have a separate, comprehensive triage educational program" (p. vi).

Reliability Studies of the Emergency Severity Index (ESI)

Five-level triage systems around the world, including CTAS, ATS, MTS and ESI have been recognized as highly reliable and recommended for use in EDs to sort patients seeking care. McHugh et al. (2012) reported that the ESI was the most commonly used five-level triage system in the United States. Therefore, the review of the literature for this study is focused on reliability studies of the ESI triage system.

The ESI was originally implemented in 1999 with several modifications and improvements made based on scientific evidence and feedback from physicians and nurses. The most current ESI Version 4 has been available since June 2005. Reliability studies have been conducted with each version and have consistently shown high interrater agreement as measured by weighted kappa (see Table 1). The ESI triage system uses a ranked triage scale and weighted kappa allows for adjustment for degrees of discordance in an ordinal scale (Cohen, 1968; Wuerz et al., 2000).

Wuerz et al. (2000) measured reliability of the original ESI tool in two phases for patients fourteen years and older. This was a unique study that was conducted in an ED that used a 3-level triage system. Nurse participants were research investigators. After

nurse researchers completed an education session on ESI, they assigned an ESI triage level to written patient scenarios with excellent weighted kappa ranging from 0.80 to 0.96. In the second phase, research nurses observed live triages and recorded an ESI 5-level score for each patient. The triage data were then reviewed by a physician investigator who assigned an ESI triage level. The nurse investigator and physician investigator agreement had an overall weighted kappa 0.80 (95% CI = 0.76 to 0.84).

The next reliability study (Wuerz et al., 2001) was conducted in two EDs that were adopting the ESI triage system. The processes of required ESI training and quality monitoring of triage decisions had been established in both EDs. After initial ESI training, triage nurses completed a twenty-scenario posttest with an overall weighted kappa 0.80 (95% CI = 0.78 to 0.82), demonstrating robust use of and reliability of the ESI. The next reliability assessment was measured by comparing 219 paired blinded triage nurse ESI scores to a researcher score that was determined through retrospective chart review of the triage documentation. The overall weighted kappa was 0.73 (95% CI = 0.66 to 0.80). This study was limited to patients fourteen years and older, as the ESI was initially designed to focus on triage of adult patients.

The positive findings of reliability of the ESI triage system as well as feedback from physicians and nurses led to the ESI Version 2 with the addition of pediatric vital signs, changes in the parameters of oxygen saturation level and heart rate when determining level 2 triage criteria. Eitel et al. (2003) studied the reliability of ESI Version 2 using the same research plan as Wuerz et al. (2001) and expanded to ESI implementation in seven EDs. Weighted kappa ranged from 0.70 to 0.80 with an overall

weighted kappa 0.76 for 3,289 written scenarios. The interrater reliability of 386 actual triages between triage nurse and expert nurse ranged from 0.69 to 0.87 with a combined weighted 0.78 kappa.

Tanabe et al. (2004) conducted a reliability study of ESI Version 3 that allowed for triage nurses to consider patient vital signs when determining triage acuity decisions. The prior versions guided the triage nurse to automatically assign a level 2 triage when vital signs were outside the listed normal parameters. The study took place in one hospital. In addition to triage nurses completing an ESI education class, the nurses received a minimum of 8-hours of mentored training in triage. All nurses were monitored until competency was established through ongoing monitoring of triage decisions. Overall, the weighted kappa was 0.89 for the 359 pair blinded actual triages conducted by triage nurses and the retrospective chart review by nurse experts.

Baumann and Strout (2005), a physician and nurse respectively, led an investigation of the reliability of ESI Version 3 in the pediatric population. The ED was using the ESI triage system and all triage nurses were required to attend a 2-hour ESI education class. As in previous studies, standardized written scenarios were assessed first with weighted kappa scores ranging from 0.84 to 1.00. Triage nurses and a nurse investigator simultaneously triaged twenty cases with an overall weighted kappa 0.82 (95%CI = 0.66 to 0.98). An additional 272 triages were assessed through retrospective chart reviews with a triage nurse and nurse investigator weighted kappa of 0.59 (95% CI = 0.55 to 0.63). The triage nurse and physician weighted kappa of 0.42 (95% CI = 0.38 to

0.46) was not as strong. However, concordance between the nurse investigator and physician investigator was strong with a weighted kappa of 0.84 (95% CI = 0.80 to 0.88).

Given the differences in weighted kappa scores in Baumann and Strout (2005), the investigators discussed triage decisions with the triage nurses who retrospectively reported conscious decisions to deviate from the algorithm based on environmental influences of "departmental issues" within the ED and for patient comfort. The weighted kappas were strong with the written scenarios and nurse investigator/physician investigator, indicating that when the ESI algorithm was used in an objective manner, it was highly reliable. This report did not indicate if ongoing quality monitoring of triage decision was practiced in this ED.

Travers et al. (2009) conducted a reliability study focused on the pediatric population that included five EDs, three of which were dedicated pediatric EDs, using ESI Version 4 that was designed to triage patients of any age. Each site had been using the ESI Version 3 for at least two years and all triage nurses completed a mandatory education session about the changes included in Version 4. Interrater reliability was first assessed with 40 pediatric written scenarios completed by 155 triage nurses with an overall weighted kappa of 0.77 (95% CI = 0.76 to 0.78). A total of 498 actual patient triages conducted simultaneously by a triage nurse and an expert nurse had an overall weighted kappa of 0.57 (95% CI = 0.52 to 0.62). The narrow confidence intervals indicated consistency in triage by participating nurses. Travers et al. (2009) concluded that although the nurses were educated on ESI Version 4, they might not have followed the revised criteria. The report did not indicate if triage nurses had received ongoing

triage education while using ESI in the previous years or if the EDs had ongoing quality monitoring of accuracy of triage decisions.

Platt-Mills et al. (2010) and Grossman et al. (2012) both focused on the reliability of ESI Version 4 in the greater than 65 years old population. Platt-Mills et al. (2010) used a weighted sample of 50 cases, as the study focus was the accuracy of level 1 triage for patients who received an immediate intervention in the ED. During the study enrollment, 782 patients over 65 years old presented to the ED and 26 of the patients received an immediate intervention. Immediate intervention was defined as a receiving a life-saving intervention within the first hour of arrival to the ED. Eighteen patients were randomly selected from the immediate intervention group and 32 patients were randomly selected from the remaining 732 triage cases. Of the 50 randomly selected triage cases, interrater agreement between triage nurse and expert triage nurse was an overall weighted kappa 0.61, the CIs were not reported. The ESI had been in use in this ED since 1999, and triage nurses received ESI training and had at least one-year ED experience prior to performing triage. The study did not indicate if ongoing education or quality monitoring was practiced at the facility.

Grossman's et al. (2012) study was conducted at a hospital in Switzerland that used the ESI triage system. The triage nurses included in the study had received ESI training, conducted triage using the ESI triage system for more than one year, and received ongoing monthly one-hour training and case review sessions. Interrater reliability was calculated by an independent retrospective chart analysis by two triage experts (a physician and an advanced practice nurse). The triage experts were blinded to

triage nurses' assigned triage levels and patient outcomes. The interrater agreement between triage nurses and the two triage experts was a moderate weighted kappa 0.759 (95% CI = 0.714 to 0.807) and high between the two triage experts with a weighted kappa of 0.934 (95% CI = 0.913 to 0.954).

Martin et al. (2014), reported reliability of the ESI in a study focused on ESI accuracy and triage nurse attitudes and experience. In the first phase, leadership in a health system with three EDs identified six nurses to serve as triage expert nurses in the study. After the triage experts completed a refresher ESI training class, each nurse assigned ESI triage levels to 20 written scenarios. Interrater reliability was determined using Fleiss-Kappa statistic and achieved 0.80. Interrater reliability of triage nurse acuity decisions compared to a triage expert was a weighted kappa of 0.68 (95% CI 0.63 to 0.68). The practice of continuous ESI training and quality monitoring of triage decisions was not reported for three EDs in the study.

Table 1

ESI Interrater Reliability Studies and Recommended Education and Quality Monitoring

Authors	Year	Data Collection	Weighted Kappa	95% CI	ESI Training	Ongoing ESI Training	QI
Wuerz et al.	2000	Scenarios	0.83 to 0.96	NR			
		Research Nurse/ Research physician	0.80	(0.76 to 0.84)	Yes	N/A	N/A
Wuerz et al.	2001	Scenarios	0.80	(0.78 to 0.82)			
		Triage Nurse/ Research Nurse	0.73	(0.66 to 0.80)	Yes	N/A	Yes
Eitel et al.	2003	Scenarios	0.76	NR			
		Triage nurse/ research nurse	0.78	NR	Yes	N/A	NR
Tanabe et al.	2004	Triage Nurse/ Expert Nurse	0.89	NR	Yes	Yes	Yes
Baumann & Strout	2005	Scenarios	0.82	(0.66 to 0.98)			
		Triage Nurse/ Research nurse	0.59	(0.55 to 0.63)			
		Triage nurse/ Research physician	0.42	(0.38 to 0.46)	Yes	NR	NR
		Research nurse/ research physician	0.84	(0.80 to 0.88)			

Table 1. (cont.)

Authors	Year	Data Collection	Weighted Kappa	95% CI	ESI Training	Ongoing ESI Training	QI
Platts-Mills et al.	2010	Triage nurse/ nurse expert	0.61	NR	Yes	NR	NR
Grossman et al.	2012	Triage nurse/ nurse expert	0.759	(0.71 to 0.80)	Yes	Yes	Yes
		Nurse expert/ physician expert	0.934	(0.91 to 0.95)			
Martin et al.	2014	Scenarios (expert nurses)	0.80[a]		Yes	NR	NR
		Triage nurse/ expert nurse	0.68	(0.63 to 0.68)			

N/A= Not applicable. NR= Not reported. QI = Quality Improvement. [a]Fleiss Kappa Statistic

The ESI reliability studies indicated that initial training for the triage system was required for triage personnel. The highest weighted kappas of 0.759 (Grossman et al., 2012) and 0.89 (Tanabe et al., 2004) measured between triage nurse and expert nurse were at sites that reported initial ESI training, ongoing ESI training and ongoing quality monitoring of triage decisions. It was unknown if ongoing ESI training and quality monitoring occurred in the EDs of the four studies that did not report this information (Baumann & Strout, 2005; Travers et al., 2009; Platt-Mills et al., 2010; & Martin et al., 2014). These studies reported the lowest weighted kappas between triage nurse and expert nurse.

Chapter Summary

This literature review reflects considerable variation in the accuracy of triage decisions in EDs, although the 5-level triage systems used in the studies have been found to be highly reliable. Five-level triage systems, recognized as the gold standard for use in ED triage, have developed guidelines to promote consistency of triage decisions. The most widely used triage systems (ATS, CTAS, ESI, and MTS) have a common structure that recommends the use of experienced triage nurses, initial training for the triage system, ongoing triage training and quality monitoring or audits of triage accuracy.

Several gaps in the literature are noted. The literature reports are inconsistent as to whether triage training and quality monitoring are implemented in EDs. The term experienced triage nurse was not consistently defined or used to evaluate triage nurse qualifications. Past research has been conducted with both simulated patient scenarios and simultaneous patient triages by a triage nurse and triage expert in the ED, with mixed accuracy results across both types of evaluation. Lastly, there has been a mixture of different triage systems and evaluation methods in different countries over the past two decades. Further research was warranted to ascertain who is conducting triage and if triage nurse qualifications, triage training and quality monitoring recommendations are part of the structure and processes of ED triage in the U.S. According to Donabedian's Structure, Process, Outcome model, the structure and process of ED triage are interconnected with the outcomes of accurate triage acuity decisions. To adequately assess the quality of triage acuity decisions, it is important to ascertain if the antecedents of structure and process are in place and if there are relationships between them.

The majority of EDs in the U.S. have reported using the ESI triage system (McHugh et al., 2012). The ESI recommendations are consistent with the ATS, CTAS, and MTS evidence-based triage systems. The recommendations in the ESI Handbook are representative of the recommendations of five-level triage systems and therefore can be used as the reference of the structure and processes that should be practiced in EDs to meet the evidence-based guidelines and recommendations for ED triage.

CHAPTER III

METHODOLOGY

Design

This study used a descriptive correlational design. This design is appropriate to use when exploring relationships of attribute independent variables (Gliner, Morgan, Leech, 2009). The purpose of this study was to explore and describe (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. Donabedian's (1966) Structure, Process, and Outcome model emphasized that the antecedents of structure and process impact quality outcomes. There is an absence in the literature describing the use of formal structure and process variables to guide qualifications of triage nurses, triage training and quality monitoring in EDs. This design allowed for the collection of data and assessment of the distribution and relationships among ED demographic, structure, and process variables. The design supported the identification of relationships of structure and processes in practice in EDs that promote accuracy of triage decisions.

Setting, Sample and Recruitment

This was a field study where research participants completed the questionnaire from a personal computer. The target population was licensed RNs in EDs who were

familiar with the structure (policies) and processes (the actual procedures) of triage nurse qualifications, triage education and quality monitoring of triage decision accuracy in their respective EDs. Criteria for inclusion included: licensed registered nurse, currently working in an ED, access to a computer and the Internet, and able to read and write English. Exclusion criteria were a self-report that the participant was not knowledgeable about the structure or policies and processes or procedures of triage in the ED.

A purposive sample of registered nurses from the Emergency Nurses Association (ENA)'s Emergency Department Managers list was used as the primary sampling plan. The study was approved by the ENA's Institute for Emergency Nursing Research (IENR) to purchase the member list. However, the ENA did not endorse or sponsor the study. On date of purchase, there were 1,456 members on the list. The list was purchased through InFocus® Marketing, the agency that exclusively manages the ENA member mailing lists. The ED Manager list was received as a packet of preprinted labels via the United States Postal Service. Each label included a member's name and a physical mailing address.

Labels were used to mail a letter that invited each person on the ED Managers list to participate in the study. The letters were printed on the university official stationary and signed individually by the principal investigator. The letter introduced the study, provided a web address and a QR code scan link to complete the survey, and the deadline date of August 10, 2017 for participation. A small monetary incentive of a one-dollar bill was included with the letter and mailed in an official university return address envelope.

During the study, three emails were received by the primary investigator from nurses who received the letter but were not eligible for the study due to no longer working in an ED. Twelve letters were returned to the University of North Carolina at Greensboro (UNCG) School of Nursing. The returned letters were either due to a non-deliverable mailing address (seven) or mailed by the recipients returning the one-dollar bill and a note explaining why they were not eligible for the study (five). The maximum estimated eligible sample was 1,441 nurses. The survey was accessed by 152 participants who consented to participate in the study, with an overall response rate of 10.5%. Four participants did not answer any survey questions after providing consent, therefore the analyses are derived from the 148 participants who provided survey responses.

The estimated number of participants needed was based on a priori power analysis of the most complex research question using G*POWER 3.1.9.2. For research question #4 (What quality monitoring aspects [monitoring of triage decision accuracy, frequency of monitoring] are associated with the type of triage system and trauma center designation?) using a chi square test of independence with an effect size of 0.3, alpha of .05, a sample of 122 ED nurses was expected to be needed to achieve statistical power of .80.

Measurement

Data were self-reported and collected using the online Qualtrics® survey software. The ED TRiAGE Structure and Process Survey was developed by the investigator using the ESI Handbook, previous research literature, The Joint Commission guidelines, and ED experts. The reliability and validity of the ESI triage system in EDs to

safely sort patients based on urgency and to optimize quality patient care and flow has been well established (Eitel et al., 2003; Tanabe et al., 2004; Travers et al., 2009; Grossman et al., 2012).

Participants were asked to answer questions related to participant's demographic characteristics, ED characteristics, and structure and processes of triage in the ED. The participant characteristic questions included their current position in the ED, number of years as a registered nurse, number of years as ED nurse and level of education. The demographic questions for participants and EDs were designed to gather data similar to other health services research surveys and questionnaires.

The ED characteristic questions were used to gather descriptive information about the ED, including, geographical location, trauma center designation, triage system used, annual number of patient visits, and estimated hours per day of ED crowding. In the U.S. there is not a mandated triage system that must be used by EDs. Individual EDs may opt to adopt any triage system or develop a triage system specific to that ED. Therefore, participants were asked to identify the triage system used in the ED. EDs may opt to be a designated trauma center by meeting the criteria developed by local or state authorities. Level 1 trauma centers are typically larger EDs with the most resources, including education and research, and are held to the highest standards (American College of Surgeons [ACS], 2014). ED engagement in performance improvement and patient safety activities is one of the criteria for designated trauma centers. In the situation of crowding, triage is key to ED operations to assure patient safety and a valid and reliable tool should

be used (Emergency Nurses Association, 2011; Gerdtz & Bucknall, 2001; Gilboy et al., 1999; McHugh et al., 2012; Noon, 2014).

The participants were asked to provide information pertaining to triage in the ED in which they were employed. The survey had three categories: a) items addressing common institutional structural characteristics of triage, b) items addressing current processes for triage, and c) participant perspectives on triage with open ended questions for brief discussions. There were 17 questions regarding structure and processes for ED triage. The questions contained fixed alternative responses and when appropriate allowed the participant to free text "other" or "please describe" responses not included in the given alternatives.

The final eight questions in the survey elicited participants' perspectives about triage. Three questions asked participants to estimate the percentage of accurate triage decisions for pediatric, adult and older adult patients in the ED. Two questions focused on barriers to quality monitoring and to providing performance feedback to triage nurses. Three questions were open-ended and allowed participants to share thoughts related to challenges for triage nurses to render accurate triage decisions, how to improve triage decision accuracy, and additional thoughts the participant would like to share about triage decisions.

The face and content validity of the instrument was estimated using two experts in ED triage. The triage experts reviewed the instrument for clarity and content and found the items were representative of recommendations in the ESI Handbook (Gliner et al.,

2009). Further, the survey was pilot tested with two ED leaders for readability, clarity and time required to complete the survey.

Data Collection

A web-based survey was used for data collection. This data collection method allowed participants to respond at their leisure (Keough & Tanabe, 2011), and had a potential to decrease data entry error. A challenge with this method was the reliance on the motivation of the subjects to connect to the website to complete the survey. Of the 152 responses, 142 participants accessed the survey by typing in the web address provided in the written letter. The other 10 participants used the QR scan code printed on the letter.

The questionnaire was administered and data collected via the Internet using Qualtrics® Survey Software (Qualtrics, Provo, UT). When the participant accessed the survey link, a cover letter explaining the study purpose, participant eligibility, and study information appeared first. This allowed the participants to have an overview of the study and a choice to agree to participate in this study. It was estimated that the survey would take ten minutes to complete. The average time to complete the survey was twelve minutes. The survey was open for three weeks after the letters were mailed.

The data collected within the survey were stored in an electronic password and firewall secured personal computer. Data were backed up using Box @ UNCG for online file storage, on the university server, and on the principal investigator's password protected personal laptop. Data collected in the survey were electronically transferred from the Qualtrics® Survey Software to IBM® SPSS® Statistics Version 24 (SPSS,

Chicago, IL) for analysis. Each survey received was coded with a unique ID number (example: 1001, 1002, 1003,) for the purpose of identifying the individual survey responses. Items that allowed participants to select more than one response were divided into separate variables and coded as a yes (item checked) and no (item not checked). Data entered into free text fields of "other" and "please describe" were grouped by the responses provided. Text boxes were used for the three open-ended questions and responses were divided into categorical groups.

Data Analysis

This study explored and described (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and (2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. Descriptive statistics were used to describe and summarize the sample participants and ED characteristics. Proportions and frequencies were used to calculate the participants' position in the ED, the region in the U.S. that the ED was located, trauma center designation, type of triage system used, and who completed triage in the ED. The following data analyses were performed for each study research question.

1. What structure aspects (triage policy for years of nurse experience, policy for triage training, policy for triage quality monitoring) are associated with the type of triage system used and trauma center designation?

   H_0: Triage system used and triage policy -years of experience are independent.

H_0: Triage system used and triage policy -triage training are independent.

H_0: Triage system used and triage policy- quality monitoring are independent.

H_0: Trauma center designation and triage policies -years of experience are independent.

H_0: Trauma center designation and triage policy -triage training are independent.

H_0: Trauma center designation and triage policy- quality monitoring are independent.

Univariate descriptive statistics using frequency distributions and percentages were calculated to describe the categorical variables that represented structural processes of triage in the sample. Tables were used to present multiple data points simultaneously. Chi-square tests of independence (Pearson's chi square) or Fisher's exact tests were used to describe if there was a relationship of established policies (structure) for triage by the trauma level designation or type of triage system used.

2. What process aspects (triage system training, general triage training,) are associated with the type of triage system and trauma center designation?

H_0: Triage system used and triage training for the triage system are independent.

H_0: Triage system used and general triage training are independent.

H_0: Trauma center designation and triage training for the triage system are independent.

H_0: Trauma center designation and general triage training are independent.

Univariate descriptive statistics using frequency distributions and percentages were calculated to describe the categorical variables that represented processes of triage education in the sample. Tables were used to present multiple data points simultaneously. Chi-square tests of independence (Pearson's chi square) or Fisher's exact tests were used to describe if there was a relationship of triage training with the trauma center designation or type of triage system used.

3. What process aspects (monitoring of triage decision accuracy, feedback of triage decision accuracy) are associated with the structure of a quality monitoring policy?

H_0: Monitoring of triage decision accuracy and a quality monitoring policy are independent.

H_0: Feedback of triage decision accuracy and a quality monitoring policy are independent.

Univariate descriptive statistics using frequency distributions and percentages were calculated to describe the categorical variables that represented processes of quality monitoring in the sample. Chi-square tests of independence (Pearson's chi square) were used to describe if there was a relationship of monitoring accuracy of triage decisions or the frequency of monitoring of triage

decision accuracy with the structure of a quality monitoring policy. Odds ratios were used to describe the strength of the association.

4. What quality monitoring aspects (monitoring of triage decision accuracy, frequency of monitoring) are associated with the type of triage system and trauma center designation?

H_0: Triage system and monitoring of triage decision accuracy used are independent.

H_0: Triage system and frequency of monitoring of triage decision accuracy used are independent.

H_0: Trauma center designation and monitoring of triage decision accuracy are independent.

H_0: Trauma center designation and frequency of monitoring of triage decision accuracy are independent.

Univariate descriptive statistics using frequency distributions and percentages were calculated to describe the variables that represented processes of triage quality monitoring by triage system and trauma center designation in the sample. Tables were used to present multiple data points simultaneously. Chi-square tests of independence (Pearson's chi square) were used to describe if there was a relationship of quality monitoring or frequency of monitoring of triage decision accuracy with the trauma level designation or the type of triage system used.

5. What is the consistency of current triage structure and process with the gold standard ESI recommendations?

Univariate descriptive statistics using frequency distributions and percentages were calculated to describe the number of EDs utilizing triage structure and processes recommended by ESI. Tables were used to present multiple data points simultaneously. Chi-square tests of independence (Pearson's chi square) were used to describe if there was a relationship between ESI recommended structure and process pairs. Summed scores of ESI recommended structure and process were calculated. Kendall's tau was used to describe if there was a correlation of summed structure and summed process scores.

For each question in the survey with an "Other" or "Please describe" field, where the participant could free-text responses, content analysis was performed. Through content analysis, the responses were subjectively interpreted and grouped into identified categories (Hsieh & Shannon, 2005) and analyzed numerically for frequency of groups (Braun & Clarke, 2013).

Data Management

Data were coded numerically for each variable. A codebook was created identifying the variable name for each question in the questionnaire and the values assigned for each possible response. For questions where more than one response could be selected, each possible response was divided into a separate variable and coded as 1 (yes, item checked) and 0 (no, item not checked). The minimum and maximum scores in the data were compared to the appropriate lowest and highest scores in the codebook.

Missing data were examined seeking patterns. Frequency distributions were calculated for each variable and the rate the missingness was reported in the analyses. Of the 152 participants who consented to participate in the study, four participants did not answer any survey questions after providing consent. These four cases were deleted; therefore, the analyses were derived from the 148 participants who provided survey responses. The survey was designed to minimize missing data by providing a response choice of "unsure" when a question was intentionally not answered. However, the participant was not forced to answer questions to proceed through the survey.

Human Subjects Protection

This research proposal was approved by the UNCG IRB prior to conducting the study and received exempt status. The survey was confidential; no identifying information such as name, address or place of employment was collected in the survey or retained from the mailing labels. The collection of IP addresses was disabled in the Qualtrics® Survey Software. However, participants were informed that absolute confidentiality of data collected through the Internet could not be guaranteed. An online cover letter that appeared at the beginning of the survey provided an overview of information about the study, the principal investigators contact information for questions, and the choice to participate in the study.

Chapter Summary

This descriptive, correlational study explored and described (1) to what extent EDs in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the ESI Handbook and

(2) if relationships existed between triage structure and processes in EDs that promoted accuracy of triage decisions. A purposive sample of registered nurses who worked in an ED setting was the target population to complete the online survey. Donabedian's Structure, Process, Outcome model was used to guide the study. The survey was developed from the ESI recommendations, previous research literature, TJC guidelines and ED experts.

Data analyses included descriptive statistics, chi-square tests of independence, and Fisher's exact tests to examine relationships between EDs, triage structure and triage processes. Kendall's tau was used to describe correlations of summed structure scores and summed process scores. Odds ratios were used to describe the strength of associations. Open ended responses were grouped into categories identified through basic content analysis and analyzed numerically for frequency of categorical groups.

CHAPTER IV

RESULTS

Data were obtained from the ED TRiAGE Structure and Process Survey. The investigator for the study developed the survey. The survey gathered information about the study participants and ESI recommended structure and processes of ED triage. A description of the participants and EDs represented are presented followed by analyses for each research question.

Sample

Nurse Demographics

Study participants included RNs in various ED positions. The majority of the participants were nurse managers/directors, followed by trauma program managers, staff nurses, clinical educators, and nurse practitioners. The eight positions provided in the "other "category included a care manager, clinical case manager, clinical nurse specialist, patient safety consultant, research program manager, manager hospital staffing, risk manager, and stroke program manager (see Table 2). Most nurses held a Bachelor of Science or Master's degree while the remainder had an Associate Degree, diploma or doctorate.

Table 2

Registered Nurse Demographics

Variable	Frequency	Percentage
Position in ED		
Nurse Manager/Director	113	76.4
Trauma Program Manager	10	6.8
Staff Nurse	9	6.1
Clinical Educator	6	4.1
Nurse Practitioner	2	1.4
Other[a]	8	5.4
Education		
Diploma	3	2.0
Associate Degree (ADN)	15	10.1
Bachelor of Science (BSN)	68	45.9
Master's Degree	60	40.5
Doctorate Degree	2	1.4

[a]Other included care manager, clinical case manager, clinical nurse specialist, patient safety consultant, research program manager, manager hospital staffing, risk manager, and stroke program manager

Years of nursing experience (n=147) ranged from 4.5 to 48 years (M= 22.24; SD±10.91). The range of years of ED experience (n=146) was 0 to 48 years (M= 17.83, SD±9.62). Histograms for both the years of nursing experience and years of ED experience were approximately normal in shape with a very modest positive skewness index of .290 and .639, respectively. The years of nurse experience were used for descriptive purposes only in this study.

Emergency Department Demographics

Characteristics of EDs represented are displayed in Table 3. More than half of the EDs were trauma centers and included level 1, level 2, and level 3 designations. A higher

number of participants reported the ED had less than 50,000 annual patient visits (52%) compared to more than 50,000 annual visits (46.6%). Two participants indicated they were unsure of the number of ED annual patient visits (1.4%).

The region of the ED location most often represented was the Midwest, followed by the south, northeast, and the west. The majority of participants reported the use of the ESI 5-level triage system in the ED (n = 139, 93.9%). The one participant in the "other" category described the triage system as a "modified ESI" triage system, defined later in the survey as ESI triage level 3 modified into ESI 3 vertical and ESI 3 horizontal (reflecting whether the patient needs a stretcher or can be safely processed in a lounger). The 5-level Canadian Triage and Acuity System was used by two of the respondents. A total of seven participants indicated they did not use a 5-level triage system in the ED.

Participants were asked to estimate the average number of hours of crowding per day in the ED. Crowding was defined by the investigator as: at least one patient in urgent need of placement in the treatment area who has to wait in a waiting area 30 minutes or more. The mean number of estimated crowding hours per day, by number of annual ED visits, trauma center designation and ED region are displayed in Table 4. The responses covered the entire range of 0 to 24 hours (M = 6.14, SD± 5.56). Of the 132 participants who responded to the estimated number of hours of crowding per day, 88% reported at least one hour of crowding per day. The distribution of crowding hours was asymmetrical with a positively skewed distribution (skewness = .990). The highest average number of crowding hours by annual patient visits was in the 75,000 to 99,999 annual visits category (M = 9.0, SD±4.90). For trauma center designation, level 1 trauma centers (M =

9.26, SD±6.21) had the highest average number of crowding hours per day. By region, participants reported the northeast (*M* = 7.08, SD±7.44) had the highest average number of crowding hours per day.

Table 3

Emergency Department Demographics

Variable	Frequency	Percentage
Trauma Center Designation		
Not Designated	72	48.6
Level 1	31	20.9
Level 2	24	16.2
Level 3	20	13.5
Missing	1	0.7
Number of Annual Patient Visits		
<25,000	41	27.7
25,000 to 49,999	36	24.3
50,000 to 74,999	37	25.0
75,000 to 99,999	21	14.2
>100,000	11	7.4
Unsure	2	1.4
ED Location by Region		
Midwest	48	32.4
South	42	28.4
Northeast	29	19.6
West	28	18.9
Missing	1	0.7
Triage Acuity System		
3-Level Triage	4	2.7
4-Level Triage	2	1.4
5-Level CTAS[a]	2	1.4
5-Level ESI[b]	139	93.9
Other (Modified ESI)	1	0.7

[a]CTAS = Canadian Triage and Acuity System ; [b]ESI = Emergency Severity Index

Table 4

Estimated Number of Crowding Hours Per Day

Variable	*N*	M (±SD)
Overall	132	6.14(5.56)
Number of Annual Patient Visits	132	6.06(5.56)
<25,000	35	2.46(2.73)
25,000 to 49,999	34	4.97(4.87)
50,000 to 74,999	32	8.63(6.20)
75,000 to 99,999	20	9.00(4.90)
>100,000	9	8.56(6.84)
Unsure	2	11.50(2.12)
Trauma Center Designation	132	6.14(5.56)
Not Designated	66	5.39(5.67)
Level 1	27	9.26(6.21)
Level 2	23	5.91(4.47)
Level 3	16	4.31(3.34
ED Location by Region	131	6.16(5.58)
Midwest	39	5.46(4.96)
South	39	6.38(5.06)
West	27	5.96(5.22)
Northeast	26	7.08(7.44)

Analysis

Research Question #1

Question #1: What structure aspects (triage policy for years of nurse experience, policy for triage training, policy for triage quality monitoring) are associated with the type of triage system used and trauma center designation?

The majority of participants reported the ED had a policy or guideline that defines the qualifications of nurses who perform triage, while nearly one-third of EDs did not have a policy (see Table 5). When participants were asked if the ED had a policy or guideline for a triage training program, more than half of the participants reported they

had a policy. Concerning a triage quality monitoring policy, less than one-third of participants reported having a policy or guideline.

Table 5

Triage Structure

Policy/Guideline	Frequency	Percentage
Qualifications of Triage Nurses (*n* = 147)		
Yes	100	68.0
No	42	28.6
Unsure	5	3.4
Triage Training Program (*n* = 145)		
Yes	79	54.5
No	62	42.8
Unsure	4	2.8
Quality Monitoring of Triage Decisions (*n* = 145)	46	31.7
Yes	91	62.8
No	8	5.5
Unsure		

Nearly 95% of participants reported the 5-level ESI triage system was used in the ED (see Table 3). The assumptions of a chi-square test of independence were not satisfied in analyses for triage system due to the expected count of less than 5 in some of the cells. The low expected counts are likely due to the small sample *(n*=9) of participants who reported the use of triage system other than ESI (see Table 6). Fisher's exact test is recommended when assumptions of an expected cell count of 5 or more is violated and

does not assume that the study populations are divided evenly, when cases fall into one of two dichotomous categories (Huck, 2012). For Fisher's exact tests, all cases of unsure were recoded as missing data, and the dichotomous categories of yes and no were used in the analyses. Triage systems were dichotomized into ESI 5-level triage and non-ESI triage.

Table 6

Triage Structure Among ESI and Non-ESI Users

Policy/Guideline	ESI *n* (%)	Non-ESI *n* (%)
Qualifications of Triage Nurses (*n* = 147)		
Yes	96 (69.6)	4 (44.4)
No	37 (26.8)	5 (55.6)
Unsure	5 (3.6)	
Triage Training Program (*n* = 145)		
Yes	73 (53.7)	6 (66.7)
No	59 (43.4)	3 (33.3)
Unsure	4 (2.9)	
Quality Monitoring of Triage Decisions (*n* = 145)		
Yes	44 (32.4)	7 (77.8)
No	84 (60.4)	2 (22.2)
Unsure	8 (5.8)	

H0: Triage system used and triage policy – triage nurse qualifications are independent.

The association of triage system used and having a policy for triage nurse qualifications was analyzed using Fisher's exact test. There was not a significant relationship in the ESI group indicating they had a policy for qualifications of triage

nurses compared to the participants of EDs not using ESI (96 of 133 EDs versus 4 of 9, $p = .125$).

H0: Triage system used and triage policy -triage training are independent.

Fisher's exact test was used to test the association of triage system used and having a policy for triage training. There was not a significant association of having a policy for triage training in EDs using the ESI triage system compared non-ESI EDs (73 of 132 EDs versus 6 of 9, $p = .731$).

H0: Triage system used and triage policy- quality monitoring are independent.

Fisher's exact tests were used in this analysis. There was not a significant relationship in the number of EDs using the ESI triage system that had a quality monitoring policy compared to EDs not using ESI (44 of 128 EDs versus 2 of 9, $p = .718$).

The distribution of trauma center designations and structure aspects of triage are displayed in Table 7. The assumptions of the chi-square test of independence were met to test the null hypotheses of relationships between trauma center designations and structure aspects of triage. All variables were measured on a nominal scale and observations were randomly and independently sampled. The expected frequency of each cell in the contingency table was at least five (Polit, 2010). For all chi-square tests of independence, cases of unsure were recoded as missing data, and the dichotomous categories of yes and no were used in the analyses.

Table 7

Triage Structure Among Trauma Center Designations

		Trauma Center Designation			
Policy/Guideline	*n*	Non-Designated *n* (%)	Level 1 *n* (%)	Level 2 *n* (%)	Level 3 *n* (%)
Qualifications of Triage Nurses	146				
Yes		47 (66.2)	25 (80.6)	14 (58.3)	13 (65)
No		21 (29.6)	6 (19.4)	10 (41.7)	5 (25)
Unsure		3 (4.2)			2 (10)
Triage Training Program	144				
Yes		36 (50.7)	18 (62.1)	12 (50)	12 (60)
No		34 (47.9)	10 (34.5)	11 (45.8)	7 (35)
Unsure		1 (1.4)	1 (3.4)	1 (4.2)	1 (5)
Quality Monitoring of Triage Decisions	146				
Yes		21 (29.6)	10 (33.3)	7 (29.2)	7 (36.8)
No		48 (67.6)	17 (56.7)	15 (62.5)	11 (57.9)
Unsure		2 (2.8)	3 (10)	2 (8.3)	1 (5.3)

H0: Trauma center designation and triage policy – triage nurse qualifications are independent.

A chi-square test of independence was used to test the relationship between trauma center designation and having a policy for triage nurse qualifications for triage. The 4 (trauma center designation) x 2 (triage system) cross-tabulation analysis did not show a significant association, χ^2 (3, N=141) = 3.30, p = .347, among the trauma center designations and having a policy for triage nurse qualifications for triage.

H0: Trauma center designation and triage policy -triage training are independent.

A chi-square test of independence was used to test the relationship between trauma center designation and having a triage training policy. The analysis did not show a significant association, χ^2 (3, N=140) = 1.898, p = .594, among the trauma center designations and having a triage training policy.

H0: Trauma center designation and triage policy- quality monitoring are independent.

A chi-square test of independence was used to test the relationship between trauma center designation and having a quality monitoring policy. The analysis did not show a significant association, χ^2 (3, N=136) = 0.699, p = .873, among the trauma center designations and having a quality monitoring policy.

Research Question # 2

Question #2: What process aspects (triage system training, general triage training,) are associated with the type of triage system and trauma center designation?

The majority of participants reported specific triage system education is required for triage nurses prior to providing triage in the ED (see Table 8). Less than half of the participants reported that general triage education is required, either for all triage nurses (38.1%) or on an individual basis (10.9%) prior to working in triage.

For the participants indicating general triage training is determined on an individual basis, 14 of the 16 respondents provided details. The majority of the detailed responses (n = 9) indicated that the determination for general triage education is based on the nurse's work or ED experience. Other detailed responses included the type of training provided (i.e. online computer-based training), working in triage is voluntary, and

difficulty finding an instructor to teach the class. One participant explained that while general triage education is mandatory for "new to the ED nurses", these nurses are assigned to work in triage prior to completing the course.

Table 8

Triage Processes: Triage Education

Required Education	Frequency	Percentage
Triage System Specific Education		
Yes	112	76.2
No	35	23.8
General Triage Education		
Yes	56	38.1
No	75	51.0
Determined on an Individual Basis	16	10.9

H0: Triage system used and required training for the triage system are independent.

Fisher's exact test was used due to the expected cell count of less than 5 in some of the cells. Triage systems were dichotomized into ESI 5-level triage and non-ESI triage (see Table 9). There was not a significant association in the number of EDs using the ESI triage system that required triage system education prior to working in triage compared to EDs not using ESI (106 of 138 EDs versus 6 of 9, $p = .445$).

Table 9

Triage Processes: Triage Education Among ESI and Non-ESI Users

Required Education	ESI *n* (%)	Non-ESI *n* (%)
Triage System Specific Education		
Yes	106 (76.8)	6 (66.7)
No	32 (23.2)	3 (33.3)
General Triage Education		
Yes	53 (38.4)	3 (33.3)
No	71 (51.4)	4 (44.4)
Determined on an Individual Basis	14 (10.1)	2 (22.2)

H0: Triage system used and general triage education are independent.

Fisher's exact test was used for this analysis. Triage systems were dichotomized into ESI 5-level triage and non-ESI triage. For general triage education, the participant's responses of "determined on an individual" basis were collapsed into the "yes" category. This dichotomized; required general triage education, into yes, meets the recommendation versus no, does not meet the recommendation. This re-categorization was based on the ESI's statement in the handbook that the use of the ESI algorithm requires an experienced ED nurse and/or to have attended a separate general triage education program (Gilboy et al., 2011). There was not a significant association in having a required general triage educational program and EDs that used the ESI triage system triage compared to non-ESI EDs (67 of 138 EDs versus 5 of 9. $p = .742$).

H0: Trauma center designation and required training for the triage system are independent.

A chi-square test of independence was used to test the relationship between trauma center designations dichotomized into "designated a trauma center" and "not designated trauma center" and required triage system training prior to working as a triage nurse (see Table 10). The analysis did not show a significant association, χ^2 (1, N=146) = 3.378, p = .066, among designated trauma centers and non-designated trauma center EDs and required triage system training.

Table 10

Triage Processes: Triage Education Among Trauma Center Designations

		Trauma Center Designation			
Policy/Guideline	*N*	Not Designated *n* (%)	Level 1 *n* (%)	Level 2 *n* (%)	Level 3 *n* (%)
Triage System Specific Education	147				
Yes		50 (69.4)	27 (90)	22 (91.7)	12 (60)
No		22 (30.6)	3 (10)	2 (8.3)	8 (40)
General Triage Education	147				
Yes		23 (31.9)	14 (46.7)	10 (41.7)	8 (40)
No		44 (61.1)	10 (33.3)	12 (50)	9 (45)
Individual Basis		5 (6.9)	6 (20)	2 (8.3)	3 (15)

H0: Trauma center designation and general triage training are independent.

A chi-square test of independence was used to test the relationship between trauma center designation and required general triage training prior to working in triage. The participants' responses of yes and determined on an individual basis were collapsed into one category. The analysis did not show a significant association, χ^2 (3, N=146) = 6.985, p = .072, among the trauma center designations and required general triage training.

Research Question #3

Question #3: What process aspects (monitoring of triage decision accuracy, feedback of triage decision accuracy) are associated with the structure of a quality monitoring policy?

More than half of the participants indicated accuracy of triage decisions were monitored in the ED. More than half of triage accuracy monitoring was reported to occur on an "as needed" basis while others reported planned monitoring on a monthly, quarterly and annual basis (see Table 11).

Skip logic was coded in the electronic survey to only ask respondents who indicated accuracy of triage acuity decisions were monitored (n = 90), if feedback on the accuracy of triage decisions was provided to triage nurses. For the two participants that did not answer the frequency of monitoring question, the skip logic was not employed; therefore, the accuracy of feedback question was presented to both of these participants. One of the participants who did not answer the frequency of monitoring question provided responses for questions related to accuracy of feedback to triage nurses, increasing the responses to n = 91.

Table 11

Triage Processes: Quality Monitoring of Triage Acuity Accuracy and Providing Accuracy Feedback to Nurses

Triage Process	Frequency	Percentage
Monitoring of Accuracy (*n* = 146)		
Monitored	90	61.6
Not Monitored	56	38.4
Frequency of Monitoring (*n* = 90)		
As needed	46	51.1
Monthly	29	32.2
Quarterly	12	13.3
Annually	3	3.3
Accuracy Feedback Provided to Nurses (n = 91)[a]		
Yes	76	83.5
No	15	16.5

[a]One participant did not answer frequency of monitoring question but provided a response for accuracy feedback provided to nurses.

A total of 145 participants provided responses to the question that inquired if the ED had a policy or guideline that outlines quality monitoring of triage acuity rating accuracy. Eight participants indicated they were unsure if a quality monitoring policy existed in the ED. For the Chi square and Fisher's exact test analyses, all cases of unsure were recoded as missing.

Table 12

Triage Structure: Policy for Quality Monitoring and Triage Processes: Monitoring of Triage Acuity Accuracy and Feedback to Triage Nurses

	Quality Monitoring Policy		
Triage Process	Yes n (%)	No n (%)	Unsure n (%)
Monitoring of Accuracy (*n* = 145)			
Monitored	43 (93.5)	40 (44)	
Not Monitored	3 (6.5)	51 (56)	
Unsure			8 (100)
Frequency of Monitoring (*n* = 88)			
As needed	14 (32.6)	29 (72.5)	2 (40)
Monthly	21 (48.8)	6 (15)	1 (20)
Quarterly	7 (16.3)	3 (7.5)	2 (40)
Annually	1 (2.3)	2 (5)	
Accuracy Feedback Provided to Nurses (n = 89)			
Yes	37 (86)	33 (82.5)	5 (62.5)
No	6 (14)	7 (17.5)	1 (12.5)

Of the EDs who monitored accuracy, but did not have a quality monitoring policy, the majority indicated triage acuity level accuracy was monitored on an as needed basis. Conversely, EDs that monitored accuracy and had a quality monitoring policy, the majority monitored accuracy on a scheduled basis of monthly, quarterly or annually. EDs with a quality monitoring policy had more than 5 times the odds of monitoring accuracy on a regular (monthly, quarterly, or annual) basis relative to EDs in the study without a quality monitoring policy (OR 5.45, 95% CI: 2.13, 14.02).

H0: Monitoring of triage decision accuracy and a quality monitoring policy are independent.

A chi-square test of independence was used to test the relationship between having a policy for quality monitoring of triage acuity rating accuracy and the actual monitoring of triage acuity decision accuracy (see Table 12). EDs that had a quality monitoring policy were significantly more likely to monitor the accuracy of triage decisions than those without a policy for quality monitoring (χ^2 (1, N=137) = 31.38, p < .001). The estimated odds of monitoring accuracy of triage decisions was 18 times higher among EDs with a policy for quality monitoring than among EDs without a quality monitoring policy in this sample (OR 18.28, 95% CI: 5.28, 63.24).

H0: Feedback of triage decision accuracy and a quality monitoring policy are independent.

The relationship of EDs with a quality monitoring policy and EDs that provide feedback of triage decision accuracy to triage nurses was explored using a chi-square test of independence. The analysis showed that there was not a significant relationship, χ^2 (1, N=83) = 0.197, p = .657. The sample of n = 83 was limited to the 90 participants who responded that triage decisions were monitored in the ED, plus the one participant who did not did not answer the frequency of monitoring question but provided a response for accuracy of feedback to triage nurses.

Research Question #4

Question #4: What quality monitoring aspects (monitoring of triage decision accuracy, frequency of monitoring) are associated with the type of triage system and trauma center designation?

Participants were asked how often the ED monitored (or audited) the accuracy of triage decisions. Response options included: as needed, monthly, quarterly, annually, or not monitored. The majority of EDs reported triage decision accuracy was monitored in the ED (see Table 13). More than half of the participants who used the ESI triage system reported monitoring of accuracy of triage decisions was completed on a scheduled (monthly, quarterly, or annual) basis. The majority of participants in the non-ESI group reported accuracy of triage decisions was completed on an as needed basis.

Table 13

Triage Processes: Quality Monitoring of Triage Acuity Accuracy and Frequency of Monitoring Among ESI and Non-ESI Users

Quality Monitoring Processes	ESI *n* (%)	Non-ESI *n* (%)
Monitoring of Accuracy (*n* = 146)		
Monitored	83 (60.6)	7 (77.8)
Not Monitored	54 (39.4)	2 (22.2)
Frequency of Monitoring (*n* = 90)		
As needed	40 (48.2)	6 (85.7)
Monthly	29 (34.9)	
Quarterly	11 (13.3)	1 (14.3)
Annually	3 (3.6)	
Frequency of Monitoring (Dichotomized)		
As Needed	40 (48.2)	6 (85.7)
Scheduled Monitoring	43 (51.8)	1 (14.3)

H0: Triage system used and monitoring of triage decision accuracy are independent.

To test this hypothesis, Fisher's exact test was used due to the expected cell count of less than 5 in one of the cells. Triage systems were dichotomized into ESI 5-level triage and non-ESI users. There was not a significant association between EDs that used the ESI triage system that monitored triage decision accuracy compared to non-ESI EDs that monitored triage decision accuracy (83 of 137 EDs versus 7 of 9, $p = .483$).

H0: Triage system and frequency of monitoring of triage decision accuracy used are independent.

The small sample size of non-ESI triage system users precluded statistical analysis of a relationship between the triage system used and each category of the frequency of monitoring for triage decision accuracy. The frequency category was dichotomized into "as needed" and "scheduled monitoring" (monthly, quarterly, and annually) and input into a 2 x 2 contingency table. Fisher's exact test was used for the analysis. There was not a significant relationship between EDs that used the ESI triage system that performed scheduled quality monitoring of triage decisions compared to non-ESI EDs (43 of 83 EDs versus 1 of 7, $p = .111$).

The majority of all trauma centers monitored accuracy of triage decisions, with the highest rate of monitoring reported in Level 1 trauma centers (see Table 14). Scheduled monitoring of triage accuracy was reported more often in designated trauma centers compared to EDs that were non-designated trauma centers. Monitoring of triage acuity decisions was done on an "as needed" basis more frequently in non-designated trauma center EDs.

Table 14

Triage Processes: Quality Monitoring of Triage Acuity Accuracy and Frequency of Monitoring Among Trauma Center Designations

		Trauma Center Designation			
Policy/Guideline	*N*	Not Designated *n* (%)	Level 1 *n* (%)	Level 2 *n* (%)	Level 3 *n* (%)
Monitoring of Accuracy	**145**				
Monitored		41 (56.9)	21 (72.4)	14 (58.3)	13 (66)
Not Monitored		31 (43.1)	8 (27.6)	10 (41.7)	7 (35)
Frequency of Monitoring	**89**				
As needed		24 (58.5)	10 (47.6)	6 (42.9)	6 (46.2)
Monthly		12 (29.3)	7 (33.3)	4 (28.6)	5 (38.5)
Quarterly		3 (7.3)	4 (19	4 (28.6)	1 (7.7)
Annually		2 (4.9)			1 (7.7)
Frequency of Monitoring (Dichotomized)	**89**				
As Needed		24 (58.5)	10 (47.6)	6 (42.9)	6 (46.2)
Scheduled Monitoring		17 (41.5)	11 (52.4)	8 (57.1)	7 (53.8)

H0: Trauma center designation and monitoring of triage decision accuracy are independent.

A chi-square test of independence was used to test the relationship between trauma center designation and monitoring of accuracy of triage decisions. The analysis did not show a significant association, χ^2 (3, N=145) = 2.291, p = .514, among the trauma center designations and monitoring of triage decision accuracy.

H0: Trauma center designation and frequency of monitoring of triage decision accuracy are independent.

To test the relationship of trauma center designations and frequency of monitoring, the frequency category was dichotomized into "as needed" and "scheduled monitoring" (monthly, quarterly, and annually) thus creating a 4 x 2 contingency table. The chi-square test of independence did not show a significant association, χ^2 (3, N=89) = 1.506, p = .681, among the trauma center designations and frequency of triage decision accuracy monitoring.

Research Question #5

Question #5: What is the consistency of current triage structure and process with the gold standard ESI recommendations?

The ESI Handbook provides a comprehensive outline of recommendations and guidelines that support the consistent use of the ESI 5-level triage system. The guidelines promote maintaining the reliability and validity of the ESI system. Within the guidelines (Gilboy et al., 2011), there are four processes that are stated in absolute language for ESI users: (1) "nurses who participate in an ESI educational program are expected to be experienced triage nurses and/or to have attended a separate, comprehensive triage educational program" (p. vi); (2) "triage nursing staff will need a full orientation to the ESI" (p. 55); (3) "every patient (should) be assigned a triage score on arrival" p. 64); and (4) "at a minimum (for evaluation and quality improvement), always monitor accuracy of the triage level" (p. 64). Table 15 presents the consistency of these recommendations as reported by the participants in this study.

Table 15

Prevalence of ESI Recommendations Implemented in EDs

Process Recommendation & Survey Questions	*n*	%
Experienced nurses for ESI training and/or complete a separate, comprehensive triage program		
"In your ED, are nurses required to attend a general triage educational program (not specific to the triage acuity system) prior to working as a triage nurse?"		
Yes, all nurses must attend	56	38.1
Determined on an Individual Basis	16	10.9
No	75	51.0
Triage nurses need a full orientation to the triage system		
"In your ED, are nurses required to complete an educational program specific to your triage acuity system prior to working as a triage nurse?"		
Yes	112	76.2
No	35	23.8
Every patient should be assigned a triage score on arrival		
"In your ED, is a triage acuity rating (level) assigned for every ED patient (ambulatory and non-ambulatory arrivals)?"		
Yes	147	100
No		
At a minimum, always measure the accuracy of the triage level		
"How often does your ED monitor (audit) the accuracy of triage acuity decisions?"		
Monitored	90	61.6
Not Monitored	56	38.4

The lowest consistency with ESI guidelines was the requirement for a general triage educational program and less than half of the participants reported it was required for either all nurses to attend or based on an individual basis. The majority of participants

reported that education is required, specific to the triage system used in the ED. The recommendation of assigning a triage acuity level for every ED patient appeared to be a well-known and accepted practice as 100% of participants reported this guideline was followed in the ED. The majority of participants reported monitoring the accuracy of triage acuity decisions either on an "as needed" basis or on a "scheduled monitoring" time line of monthly, quarterly, or annually.

Each of the policy (structure) and procedure (process) pairs were analyzed to determine if a significant relationship existed using chi square tests of independence. For the process of general triage education, the participant's responses of "determined on an individual basis" were collapsed into the "yes" category. This dichotomized required general triage education into yes meets the recommendation and no does not meet the recommendations. There was not a significant relationship between having a policy that defined a triage training program for nurses and nurses being required to attend a general triage educational program prior to working as a triage nurse (χ^2 [1, N=141] = 0.885, p = .347). EDs with a triage system training policy were significantly more likely to than those without a policy to require nurses to complete a triage specific education program prior to working as a triage nurse (χ^2 [1, N=141] = 22.84, p = < .001). As previously discussed, EDs that had a quality monitoring policy were significantly more likely to monitor the accuracy of triage decisions than those without a policy for quality monitoring (χ^2 [1, N=137] = 31.38, p < .001).

A summed structure score was calculated by adding the number of recommended policies (structure) that existed in an ED. Possible summed structure scores ranged from

0 to 3. A summed process score was calculated by adding the number of recommended procedures (process) that existed in an ED. Possible summed process scores ranged from 0 to 4. An overall summed score of the number of recommended policies (structure) and procedures (process) for each ED was obtained by adding structure and process scores (see Table 16). Possible scores ranged from 0 to 7.

Table 16

Summed Scores of Recommended Structure and Processes in EDs

Number of Recommendations Followed	**Number of EDs**	**Percentage**
Structure		
0	32	24.6
1	29	22.3
2	31	23.8
3	38	29.2
Process		
1	11	8.5
2	31	23.8
3	53	40.8
4	35	26.9
Structure/Process		
1	9	6.9
2	13	10.0
3	20	15.4
4	20	15.4
5	27	20.8
6	20	15.4
7	21	16.2

Maximum scores: Structure = 3; Process = 4; Structure/Process = 7

Nearly one quarter of the EDs did not have a policy for triage nurse qualifications, triage system training or quality monitoring of triage decisions. Less than one third of the participants reported that all three policies (structure) existed in the ED. All EDs indicated that a triage acuity level was assigned for every ED patient; therefore, the minimum score found for the four process recommendations was one. Nearly three-fourths of the EDs did not have the all of the procedures (process) recommended in the ESI handbook (Gilboy et al., 2011). Overall, only 16.2% of the participants reported that all of the structure and processes were in place to drive the ESI recommendations. A significant positive correlation was found using Kendall's tau between the summed score of the structure and the summed score of processes in EDs ($\tau = .452$, $p < .001$).

Perceptions of Participants

Accuracy of Triage Decisions in EDs

Nurses were asked to estimate how accurate triage acuity decisions were for pediatric, adult and older adult patients in the ED where they were employed. Participants were able to slide a horizontal bar within the electronic survey from 0 to 100 percent. The data are presented in Table 17.

The participants estimated the adult population age 18 to 65 years old had the highest overall accuracy of triage acuity ratings followed by adults older than 65 years old. The pediatric population had the lowest overall average of accurate triage acuity ratings. Overall, participants who worked in EDs that completed some form of triage accuracy monitoring estimated higher accuracy of triage acuity ratings than participants from EDs that did not monitor accuracy.

Table 17

Estimated Accuracy of Triage Acuity Decisions by EDs that Monitor Triage Acuity Accuracy

Patient Category	*N*	Range (%)	Median	Mean ± SD
Adults 18 to 65 years old	**141**	**47 – 100**	**81**	**80.9 ± 11.8**
Monitored	87	47 – 100	85	83.4 ± 10.2
Not Monitored	53	50 - 98	80	77.2 ± 13
Adults > 65 years old	**140**	**30 – 100**	**80**	**78 ± 13.9**
Monitored	86	30 – 100	83	81.2 ± 12.2
Not Monitored	53	40 - 98	75	73.2 ± 14.9
Pediatrics	**142**	**0 – 100**	**76**	**73.4 ± 18.4**
Monitored	87	0 – 98	80	76.6 ± 16.2
Not Monitored	54	4 - 100	71.5	68.1± 20.4

Challenges of Accurate Triage Acuity Decisions

Participants were asked an open-ended question "What is the biggest challenge to rendering an accurate triage acuity decision in your ED?" The answers were rich in content and at times contained more than one challenge. A total of 125 participants responded to this question and individual answers were analyzed using content analysis. Nine categorical groups were identified: Education, Experience, ESI Resources, Not Following Guidelines, Environmental Influences, Patient Influences, Triage Staffing, Accuracy Monitoring, and Other. Supporting exemplars for each categorical group of challenges to accurate triage acuity decisions are presented in Table 18.

Table 18

Participants' Perceptions: Challenges of Accurate Triage Acuity Decisions in the ED

Categories and Exemplars	*n*
Environmental Influences	**42**
Patient Volume in ED	15
"Stress of volume surges"	
"Overcrowding and overwhelmed triage staff"	
Patient Flow/Limited Time	14
"Rush to bed patients due to door to doctor times"	
"Speed at which triage needs to occur"	
Physician/Provider	11
"Many RNs will place a triage acuity score …based on what providers are working in the back."	
"Sometimes (it is) hard for nurses to take the provider out of the acuity (decision)."	
Peers	2
"Peer pressure, colleagues questioning the reason for a triage acuity decision."	
"Staff question their initial thoughts/decisions on acuity rating"	
Education	**30**
Lack of Education	16
"No formal training program"	
"We struggle with pediatric ESI and attempt to educate staff"	
Inconsistent Education	14
"Ensuring all RN's receive the same education"	
"Lack of ongoing education"	

Table 18 (cont.)

Categories and Exemplars	*n*
Experience	**27**
Years of Experience	16
"Experience level of the nurse"	
"We have a lot of new to the ED nurses and some new nurses in the ED"	
Competence	11
"Experience in judging presenting complaints"	
"Not seeing the big picture"	
ESI Resources	**12**
"The nurse doesn't always have adequate information to determine how many resources will be needed"	
"Difficult for triage staff to understand the determination of resources as a guide to rate patients"	
Not Following ESI Algorithm	**10**
"Breaking down preconceived ideas of nurses"	
"Everyone has a different way of making that triage acuity decision"	
Triage Staffing	**9**
"Keeping long term experienced nurses"	
"Lack of personnel"	
Patient Influences	**8**
"One patient said she ate bad Mexican food…She was discovered to be a STEMI"	
"Patients sometimes only tell the nurse part of their complaints"	
Monitoring Accuracy	**7**
"We have no one auditing the triage level and we have no audit tool"	
"Lack of structured feedback plan"	

Table 18 (cont.)

Categories and Exemplars	*n*
Other	**6**
Electronic Medical Record	3
"Drop down choices have negated much of the written subjective and objective information… a lot of details seem to be left out"	
"The computer system does not [have] an easy way to monitor or change triage acuity"	
[*Pivot Nurse/Greeter/Patient Flow Nurse] Assigns Acuity*	3
"No designated triage area…information from the patient in our lobby area…first look nurse would assign the triage level"	
"In our process the triage acuity is assigned with very little information and no vital signs. It is difficult to be accurate"	

Perceptions on How to Improve Triage Acuity Accuracy

One hundred and eighteen participants responded to the open-ended question "What are your thoughts on how to improve the accuracy of triage acuity decisions?" and provided 188 suggestions. Categorical groups were identified through content analysis and the most frequent six categories were: Education, Feedback, Auditing, Experienced/Consistent Triage Nurses, Physician Involvement, and Triage Policies. The use of case studies or case reviews was suggested by sixteen of the participants and was included within the education category. Supporting exemplars for each categorical group on how to improve triage acuity accuracy are in Table 19.

Table 19

Participants' Perceptions: How to Improve the Accuracy of Triage Acuity Decisions

Categorical Groups and Exemplars	*n*
Education	62
"Provide formal education"	
"A refresher for nurses annually might be helpful"	
"Doing case reviews often"	
"Having mock drills of triage scenarios that all participate in"	
Feedback	28
"Regular performance feedback"	
"Immediate feedback"	
"Scenarios that came up during the week that were questionable should be discussed in huddle to elicit discussion"	
Audits/Audit Tool	32
"Formal, ongoing review/auditing of triage accuracy"	
"Annual review of triage assessments"	
"Continuous audits"	
Experienced/Consistent Triage Nurses	12
"Use a core group of competency tested nurses"	
"Not placing new grads (or even nurses with 12 months experience in triage)- make it 18 months"	
Physician Involvement	9
"Physician training as many do not understand our ESI system with the resource component"	
"Stop being provider driven and instead patient specific"	
"Including providers in the triage process"	
Triage Policies	6
"Clear definitions, procedures, and protocols"	
"Making a policy or guideline to go to"	

Additional Thoughts Related to Triage Acuity Rating Decisions

Finally, participants were asked the open-ended question "Are there any other thoughts you would like to share related to triage acuity rating decisions in your ED?"

Thirty-nine participants shared additional thoughts specific to triage. Additional topics that have not been previously covered included regulatory influences on triage, triage and the electronic medical record (EMR), and ED acuity. Regulatory influences included the response "the triage process has become very cumbersome based on regulatory questions that must be answered. This shifts the focus on the real, immediate need of the patient". Another participant shared how the EMR can be an asset to triage "We are transitioning to a new EMR – there is a Triage 1 (just the basics) and Triage 2 (with all the screenings) – our goal is to direct bed. Triage is a process not a place!" ED acuity comments included distinguishing between the initial triage level assigned for the purpose of sorting patients versus an acuity level snapshot of the department: "I would like to change some patients' acuity later in their visit" and "I believe that an additional acuity system needs to be implemented once the patient is in a treatment room".

Chapter Summary

Data about the structure and processes of triage in EDs across the United States were collected online from 148 RNs using the ED TRiAGE Structure and Process Survey. The RNs worked in a variety of EDs from less than 25,000 to greater than 100,000 annual patient visits, Level 1, 2, and 3 trauma centers non- designated trauma centers. The majority of participants used the ESI 5-level triage system but the 3-level, 4-level, and CTAS systems were represented in the study. Chi square tests of independence and Fisher's exact tests were used to measure if trauma center designation or triage system used was associated with ED triage policies (structure) and ED triage procedures (process). There were no significant relationships between trauma center designation or

triage acuity system used and any of the triage policies (structure) or procedures (process) of triage education or monitoring of triage decision accuracy.

Chi square tests of independence and Fisher's exact test were used to determine if policies (structure) were associated with the ED procedures (process) recommended in the ESI guidelines. There was not a significant relationship between EDs that had a policy that defined a triage training program for nurses and nurses being required to attend a general triage educational program. The number of EDs that required nurses to complete a triage specific education program prior to working as a triage nurse was significantly higher in EDs with a triage system policy than in those without a policy. Also, monitoring of triage acuity accuracy was significantly higher in EDs with a quality monitoring policy compared to EDs without a policy.

Less than one-fifth of EDs had all of the triage structure and processes recommended by ESI. The least frequent policy in EDs was a quality monitoring policy and the least common process reported was required general triage education for all nurses or based on an individual nurse basis. While the consistency of ESI recommendations in EDs was low, a statistically significant positive correlation of summed structure scores and summed process scores was found.

Participants shared their thoughts on the estimated accuracy of triage acuity decisions in the ED, challenges of rendering accurate triage acuity decisions, how to improve triage accuracy, and additional thoughts about triage in the ED. The participants' who worked in ED's with quality monitoring rated the percentage of triage accuracy higher in pediatrics, adult and older adults compared to participants from EDs who did

not monitor accuracy. Thoughts on challenges to triage accuracy were sorted into categorical groups and the top eight were: *Education, Experience, ESI Resources, Not Following Guidelines, Environmental Influences, Patient Influences, Triage Staffing, and Accuracy Monitoring*. Thoughts of how to improve accuracy were sorted into categorical groups and the top six were: *Education, Feedback, Auditing, Experienced/Consistent Triage Nurses, Physician Involvement, and Triage Policies*. Additional thoughts about triage included regulatory influences on triage, the EMR as a tool, and ED acuity.

CHAPTER V

DISCUSSION

The purpose of this study was to explore and describe (1) to what extent emergency departments in the U.S. are assuring the quality and reliability of triage acuity decisions and triage systems implementation according to recommendations in the Emergency Severity Index Handbook and (2) if relationships existed between triage structure and processes in emergency departments that promoted accuracy of triage decisions. This chapter includes a discussion of the findings and conclusions of the study. Strengths and limitations of the study are considered and implications for triage in EDs and recommendations for future research are explored.

Discussion of Findings

The majority of participants' in this study were nurse managers or directors of an ED who were recruited by postal mail from the Emergency Nurses Association (ENA) ED Managers' list. There was a wide range of nursing experience in the sample (4.5- 48 years) with most having an education level of Bachelor's degree or higher. These findings were expected based on the population sampled.

The sample of EDs in this study included all size of departments treating less than 25,000 to more than 100,000 patient visits per year. Designated and non-designated trauma centers were represented as well as all types of triage acuity systems. There was no significant difference in the regional geographic distribution of EDs in this study

compared to the distribution of EDs in the most recent Medicare Hospital Compare data (Centers for Medicare & Medicaid Services [CMS], n.d.). The nurses in this study estimated similar crowding to the IOM report (2007) that reported 91% of EDs in the U.S experience overcrowding.

A surprising finding was nearly half of the EDs in this study reported nurses with less than one-year of ED experience were qualified to work in the triage nurse role. In a free text response, a nurse in the study explained that due to current staffing patterns, ED nurses were triaging "sooner rather than later". The reported minimum number of years of experience required for triage in this study was lower than previous reports in the literature. For example, in Martin et al. (2014), less than ten percent of triage nurses sampled from a single ED in the U.S. reported having less than one year of ED experience. In Sanders and Devon's (2016) study, the least experienced nurse had three years of experience in a sample of triage nurses from two EDs.

Trauma Center Designation and Triage Systems

Trauma center designation and triage system used were attribute independent variables in this study. The majority of participants reported the ESI 5-level triage system was used in the ED. This finding was higher than previous reports in the literature of ESI use. This may be explained by the fact that nearly a decade has passed since a national assessment of the use of the ESI triage system has been reported.

Dependent variables of structure in this study were a policy for the qualifications of triage nurses, a policy for a triage training program, and a policy for quality monitoring of triage decisions. Dependent variables of process were required triage

system training, required general triage training, quality monitoring of triage decision accuracy and feedback on the accuracy of triage decisions to nurses. Statistical analyses were conducted to determine if significant relationships existed for trauma center designation or triage system used and the structure or process variables.

Statistical tests failed to find any relationship between the triage system used and any of the structure or process variables. This finding might be because only nine participants reported they were non-ESI triage system users. The risk of a Type II error is high with small samples and should be considered.

This study failed to find any relationships between trauma center designation and any of the structure or process variables. Although Level 1 trauma centers are typically EDs with the most education and research resources, it is plausible that resources and education may be matched with other priorities in the organization. For instance, trauma triage is focused on accurate activation of the triage team and resources based on trauma specific algorithms or guidelines (ACS, 2014).

Structure, Process, Outcome Model

The Structure, Process, Outcome model is based on a three-part approach where good structure increases the likelihood of good processes, and good processes increase the likelihood of good outcomes (Donabedian, 1998). Of the triage structure explored in this study, the structure most often reported in the EDs was for a policy that defined the qualifications of nurses who perform triage. This study did not explore defining characteristics of a qualified triage nurse, only that the structure existed.

More than half of EDs had a policy to guide a triage training program and three fourths of participants indicated the ED required triage system specific education. This study found a significant relationship between EDs that had a policy for a triage training program and required triage system training. These findings support Donabedian's (1998) model that structure is an antecedent to process. These factors indicate that the structure of a specific policy was related to the increased likelihood that the process existed in the ED. This study failed to find any relationship between a policy for a triage training program and a required general triage educational program. This finding may be due to the lack of asking if a specific policy or guideline (structure) for a general triage education program existed and warrants further investigation.

A higher number of EDs had a process of quality monitoring of triage decisions compared to the number of EDs that had structure (policies) to guide quality monitoring of triage decisions. Of the almost two thirds of EDs that monitored accuracy of triage decisions, more than half of those EDs reported that monitoring was done on an "as needed" basis, rather than a regularly scheduled basis. The Structure, Process, Outcome model is in part supported by the findings in that structure increased the likelihood of processes. In fact, EDs in this study with a quality monitoring policy had more than 5 times the likelihood of monitoring accuracy on a scheduled (monthly, quarterly, or annual) basis relative to EDs in the study without a quality monitoring policy.

Participant Perspectives of Triage

Most of the participants shared thoughts on the accuracy of triage decisions in the ED. The participants in this study estimated triage acuity rating accuracy was higher than

the reported accuracy percentages in previous studies that measured accuracy directly (Allen et al., 2015; Atzema et al., 2010; Goransson et al., 2005; Grossman, et al., 2012; Kuhn et al., 2014; Wolf, 2010). This was an interesting finding considering less than one-third of EDs in this study had a process for monitoring the accuracy of triage decisions on a scheduled basis. Participants were not asked to describe how they estimated the accuracy of triage decisions nor were they asked if a triage accuracy goal was identified in the ED. Gilboy et al. (2011) recommended EDs set realistic quality indicators for accuracy of triage decisions and offered as an example that a frequently selected goal was to have accurate triage decisions 90 percent of the time.

The participants expressed frequently that the experience level of triage nurses was a challenge for accurate triage decisions. This is consistent with previous qualitative studies where nurses expressed a belief that nursing experience and expertise were directly related to triage accuracy (Andersson, Omberg, & Svedlund, 2006; Patel, et al., 2008; Arslanian-Engoren, 2009; Sanders & Minick, 2014). Quantitative studies in the literature do not support a correlation of increased years of nurse experience and better accuracy of triage decisions (Considine et al, 2007; Goransson et al., 2006; Martin et al., 2014; Sanders & Devon, 2016). However, these studies frequently group nurse experience into categories of less than and greater than two, three, and five years of experience (Considine et al., 2007; Goransson et al., 2006. Sanders & Devon, 2016) without a clear explanation of how the years of experience were determined.

Environmental influence was another group of challenges for accuracy of triage decisions reported by participants. The environmental influences of crowding or large

volume of patients, which physicians (or other providers) were working, and receiving pressure from peers were consistent with previous studies (Arslanian-Engoren, 2009; Sanders & Minick, 2014; Reay, Rankin, & Then, 2016).

Other reported challenges of triage included an emphasis on patient flow and triage nurses feeling rushed to meet patient time metrics. Further investigation is warranted to better understand how these challenges influence the accuracy of triage decisions. The terminology used by the participants was consistent with newer CMS standards. In 2013, EDs began reporting ED crowding measures to CMS (McHugh et al., 2011). The CMS ED crowding measures of timely ED care include several patient flow metrics that are measured by the median time it takes a patient to complete steps in the process to reach discharge from the ED (CMS, n.d.).

The majority of participants shared thoughts on how to improve accuracy of triage decisions. The majority of the responses were consistent with recommendations in the ESI handbook and included the need for more education, auditing of triage decisions, feedback on decision accuracy and triage policies. The thoughts on how to improve triage accuracy support the Structure, Process, Outcome model (Donabedian, 1988) and recommendations of evidence-based 5-level triage systems (Gerdtz et al., 2009; Gilboy et al., 2011).

Another perspective of how to improve accuracy of triage decisions included more provider involvement in the triage process. For example, a participant recommended including providers in the triage process and another participant recommended triage system training for providers for them to better understand the

resource component of the ESI. Many research studies of triage systems and accuracy have been multidisciplinary study teams that included nurses and physicians (Baumann & Strout, 2005; Eitel et al., 2003; Grossman et al., 2012; Platts-Mills et al., 2010; Tanabe et al., 2004; Travers et al., 2009; Wuerz et al., 2000; Wuerz et al., 2001). This is a practice that could be extended into the clinical setting. Han et al. (2010) found that physician triage significantly decreased the proportion of patients who left without being seen and decreased ambulance diversion time. Multidisciplinary teams have been strongly recommended and beneficial in successful quality improvement initiatives (McHugh et al., 2011).

Conclusion

This study was designed from the well-established Donabedian Structure, Process, Outcome model (Donabedian, 1966). The information reported from this study reflected input from ED leaders and data from EDs across the nation. This was the first study to report the status of structure and processes of triage in EDs throughout the U.S. Results indicate that the structure to guide triage processes were lacking in EDs and processes in the ED were not guided by policies. Further, there were positive relationships between structure (an ED having a policy) and process (having required procedures), a preliminary step that is necessary before assessing quality. EDs have adopted evidence-based 5-level triage systems but are not following the minimum structure and processes to assure the quality and reliability of triage acuity decisions.

Limitations

Several limitations for this study must be addressed. The participants were recruited from a convenience sample of nurses from the ENA's ED Managers list, which may limit generalizability of the study. Emails and letters were received from nurses on ED Managers list who were not clinically based in an emergency department and did not meet the inclusion criteria of the study. For example, the nurses described themselves as retired, support services to trauma programs, or an instructor of specialized education for ED staff. There was a possibility more than one nurse from the same ED received the invitation letter. However, the EDs represented in the study were checked for independence and no two EDs had the same characteristics.

Recruitment relied on participants to open the letter received in the mail and to access the internet and survey website. The response rate was 10.5% and may lack a full representation of EDs. Lower response rates, the cost of mailing and undeliverable mail were anticipated challenges of using the survey research method (Keough & Tanabe, 2011). Several factors known to increase response rates were used and included a token financial incentive, interesting topic, use of the university letterhead and envelope, a handwritten name included on the return address, personal correspondence by thanking the participant and signing each letter, confidentiality, and first-class mailing. Participants were contacted by mail one time in this study. In future studies, additional contacts by mail are suggested. Dillman's (2007) tailored design method recommended four contacts by first class mail to increase response rates.

The *ED TRiAGE Structure and Process Survey* was developed for this study, limiting the comparison of results to previous studies. Less than half of the EDs provided feedback to nurses concerning the accuracy of triage decisions. Nearly one-third of the feedback was given on an as needed basis. Participants' recommended providing feedback on the accuracy of triage decisions to triage nurses as a method to improve accuracy of triage acuity decisions. The survey only explored the structure of a quality monitoring policy and did not explore if structure of a policy to guide the process of providing feedback to nurses existed in EDs. The use of one standard quality monitoring policy question to assess structure may not have been sufficient.

Implications

Triage is a key process in ED operations (McHugh et al., 2012) that prioritizes care for patients arriving at the ED based on the need for medical care (Gilboy et al., 1999; Gerdtz & Bucknall, 2001; Gilboy et al., 2011; Noon, 2014; ENA, 2017). Based on Donabedian's (1988) three-part approach to quality, good structure increases the likelihood of good processes and good processes increase the likelihood of good outcomes. Strategies must be implemented that will improve the structure and processes of triage in EDs to support maintaining the reliability of the systems.

To maintain the reliability and validity of a triage system, consistent education and monitoring of the system is crucial, and is recommended for ATS, CTAS, ESI, and MTS evidence-based triage systems (Gerdtz, 2009; Gilboy, et al., 2011, Bullard et al., 2014). Review of the data in this study revealed that structure and processes for triage nurse years of experience, triage education and quality monitoring of triage decisions did

not reflect that the ESI guidelines (Gilboy et al., 2011) are consistently used in practice. In fact, less than one-fifth of EDs had all of the minimum structure and processes recommended in the ESI handbook.

While it appeared that some EDs recognized the need for processes, irrespective of a policy in place to guide the activity, 'consistency' is a key concept in maintaining the reliability of the triage system. Using the Structure, Process, Outcome model, policies provide the structure that guide consistent processes that in turn can drive the ultimate goal of positive outcomes (Donabedian, 1988). The Structure, Process, Outcome model has been used as the framework in numerous studies for healthcare quality and specifically for ED triage quality (Gilboy et al., 2011; Sanders & Devon, 2014). This study established that there are positive relationships between an ED having structure (policies) and having processes (procedures), a preliminary step that was necessary before assessing quality (Donabedian, 1988).

Participants reported multiple challenges and thoughts on improving triage acuity ratings that included triage education, audit tools, training for auditing, case study reviews, and feedback on the accuracy of triage decisions to triage nurses. An appropriate starting point is for ED leaders to prioritize a review of the structure (policies) in EDs that support triage accuracy and the reliability of the triage system used. In EDs where policies for triage nurse qualifications, education and quality monitoring exist, the policies should be reviewed for currency with evidence-based guidelines (Gilboy et al., 2011) and recommendations by nursing organizations (ENA, 2017). Assessment of processes (what is actually done) for congruency with structure (policies) should be

undertaken. Triage nurses should be consulted for input and included in prioritizing the development and implementation of structure and process to improve triage practice.

In EDs that do not have structure to support accuracy of triage acuity decisions, development of policies should involve interdisciplinary collaboration. Policies should be written based on the individual ED and what can be realistically achieved based on resources. While initial structure (policies) may be very basic, they should be embraced as a starting point to begin driving consistent processes. Written policies set a standard in the department and not adhering to the policy can become a departmental liability (Gilboy et al., 2011).

The ESI guidelines (Gilboy et al., 2011) are available electronically to all EDs through the AHRQ website. However, the current title of the ESI guidelines includes "Implementation Handbook". The phrase "implementation" could be misinterpreted by readers and ED leaders to mean the information within the handbook is specific to EDs that are in an adoption phase the ESI system. Nearly two decades have passed since the ESI triage system was first introduced. Results from this study indicate that the ESI triage system was the most widely used triage system across the nation. Participants in the study expressed the need for improvements of triage accuracy through education and quality monitoring, but lacked the tools to implement these processes. An updated version of the ESI handbook that reflects use as a resource guide for maintaining the reliability of the triage system is recommended.

Crowding, as noted by this and other studies, impacts triage processes and outcomes. Crowding in the ED has negative consequences of delayed patient care, patient

safety concerns, patient dissatisfaction with the care or lack of care, and patients' leaving before being seen by a provider or treatment is complete (French et al., 2014; Han et al., 2010; Nestler et al., 2010). It has been reported that ambulance diversion due to ED crowding can cost over $1,000 an hour in foregone hospital revenues (McHugh et al., 2011). Because the volume of patients seeking care in an ED cannot be predicted, triage systems afford a patient safety mechanism in prioritizing the sickest patients to be seen first (Christ et al., 2010). Over-triage of patients (assigning a higher level of care than the patient really needs) may consume scarce resources and delay the care of patients that have a more immediate need. Under-triage (assigning a lower level of care than the patient really needs) may put patients at risk for a delay in treatment. It is imperative that EDs set realistic triage goals of accurately assigning patients into the correct triage level to provide quality care, best utilize resources for patient safety, and decrease medicolegal risks related to inaccurate triage.

Accuracy of triage acuity decisions not only impacts the individual patient, but the decisions impact the daily operations of the ED and departmental plans for staffing and financial resources. Further, performance improvement planning in EDs, such as patient flow strategies that are based on a case mix determined by inaccurate triage acuities can lead to wasted resources and failed improvement plans (McHugh et al., 2012). A participant articulated this phenomenon "When I first came to this ED …, they were using the … triage system. The only patients classified as a [triage Level] 1 were full-arrests. Our acuity levels looked like we were an urgent care. We changed to …, did some education, and now we look more like an ED, with acutely ill patients." The

management of patient flow in the ED is a TJC hospital accreditation standard and one of the elements of performance is "the hospital has processes that support the flow of patients throughout the hospital" (TJC, 2012). Assigning accurate triage acuity ratings to patients in the ED improves ED flow processes. EDs should implement, at minimum, the ESI recommended processes that support accurate triage decisions.

Future Research

Future studies prospectively investigating the years of ED nursing experience and accuracy of triage decisions are warranted. The ENA's (2017) position statement for triage qualifications include at least one year of ED nursing experience. Participants explained that due to nurse turnover, shortages, and staffing mix, inexperienced nurses and nurses with less than one year of ED experience are working in the triage role. Based on current projections, the shortage of ED nurses will continue to be a challenge. In 2015, ED nurses had a turnover rate of 21.1% in EDs and it took an average of 95 days to find a nurse to fill vacant positions (NSI Nursing Solutions, Inc., 2016). A review of the literature on ED nurse experience and accuracy of triage decisions identified only one recent study that reported the accuracy of triage acuity decisions of nurses with less than one year of ED experience This group represented less than 10% of the sample (Martin et al., 2014). Therefore, further studies are needed to investigate the safe practice of nurses with less than one year of ED experience performing triage.

Environmental influences of the volume of patients and patient flow or limited time were identified as challenges of accurate triage. Stokols (1972) explained crowding is not just a spatial constraint, it also includes one's perception of the limitations.

Individuals who perceive crowding may have behavioral, social, and cognitive responses in an attempt to cope with the perceived restrictions of crowding. Future studies are needed to explore triage nurses' perceptions of crowding and the influence of behavioral, social, and/or cognitive responses on the accuracy of triage decisions.

The ED characteristics of triage system used and trauma center designation were explored as two potential confounding variables that may influence the relationship of structure and processes in EDs in this study. Another ED characteristic that could be considered in future studies on triage decision accuracy is the number of annual patient visits. The volume of ED visits, when reported in the literature, have been grouped in different size categories. For example, in a data brief by Hing and Bhuiya (2012), EDs were grouped into three volume categories with the largest ED volume group representing greater than 50,000 annual visits. Pines, Decker, and Hu (2012) grouped EDs into four volume categories with the largest volume group representing greater than 60,000 annual visits. In a Handel, Sun, Augustine, Shufflebarger, & Fu (2015), EDs were divided into five volume categories with the largest ED volume group representing greater than 80,000 annual visits. The annual ED census or volume has been identified as an ED operating characteristic that affects ED performance (Wiler, et al., 2015), however annual patient volume categories have not been consistently reported.

The addition of two questions to the TRiAGE Structure and Process Survey is recommended for use of the survey in future studies. First, the addition of a question to explore if EDs have a policy to guide providing feedback to triage nurses on the accuracy of triage decisions is recommended. The second recommendation is to add a survey

question to explore if structure of a policy to guide the process for general triage education program exists in EDs. decisions are warranted. Findings from quality assessment studies will lead to intervention studies aimed at improving outcomes of triage acuity decisions.

In future studies seeking ED nurse manager participants, the CMS hospital database should be considered for the sampling plan. The database contains the name and address for over 4,000 Medicare-certified hospitals including over 130 Veterans Administration medical centers. The list is available to the public and can be accessed and downloaded from the CMS website (CMS, n.d.). This sampling plan will allow access to a larger number of nurse managers and delivery of a single recruitment letter for each ED.

This study addressed structure and process that promote accuracy of triage decisions and maintaining the reliability of evidence-based triage acuity systems. Using the Structure, Process, Outcome model, the next step is to study if relationships exist between triage processes and outcomes. Once it is determined that relationships exist, quality assessment studies of the structure, process and outcomes of triage acuity.

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