Southern California CSU DNP Consortium

California State University, Fullerton
California State University, Long Beach
California State University, Los Angeles

REDUCING INITIAL TRIAGE ASSESSMENT WAIT TIME OF EMERGENCY DEPARTMENT PATIENTS ON AMBULANCE OFFLOAD DELAY

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

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Doctoral Project Committee Approval:

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ABSTRACT

Patients accessing the 9-1-1 system for emergency medical care and requiring ambulance transport expect the prompt transfer to and treatment at an emergency department (ED). Ineffective system input, throughput, and output flow processes contribute to ED overcrowding. Often this leads to ambulance offload delay (AOD), which is defined as a wait time of greater than 25 minutes. Patients on AOD do not receive an immediate triage nurse assessment, are often left untreated by ED personnel, and experience limited treatment options and oversight. To address this problem, a protocol was implemented to reduce time of emergency medical services (EMS) arrival time to initial triage assessment for patients transported by ambulance when AOD was anticipated to be greater than 25 minutes. To assess the effectiveness of the protocol in reducing time to triage assessment for AOD patients, data from patient records of 121 pre- and 132 post-protocol patients who were on AOD times for greater than 25 minutes were collected. A *t*-test and Mann-Whitney U test found no significance regarding EMS arrival to triage time between protocol groups. To avoid a Type I error, a chi-square test of independence was conducted to analyze protocol effectiveness when implemented correctly. One protocol compliant charge nurse and one non-compliant protocol charge nurse were compared. Results showed statistical significance for reducing the time of arrival to initial assessment when the protocol was correctly implemented ($\chi2(1) = 4.71$, $p = .030$). The findings support the correct implementation of this protocol will reduce

the time of EMS arrival to triage time in patients arriving by ambulance when AOD times were greater than 25 minutes. Ongoing evaluation of the protocol is in progress. Reducing time of arrival to time of triage will ultimately result in improved patient safety and outcomes.

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ACKNOWLEDGMENTS

Socrates stated, “Wi*SD*om begins with wonder.” My DNP journey started as an “I wonder” that was encouraged and supported by my husband, Tom, and my children, Stormy, Austin, Ryan, and Eric. To my husband Tom, words cannot express how much I love you and appreciate the many sacrifices you made and your unwavering support throughout this program. Because of you, I was able to pursue my doctoral degree. You are the love of my life. I am grateful to be your wife. For my children, who chose to use humor as a support strategy, it worked. A special thank you to my mom, Evelyn; my mother-in-law, Irene; my Father-in-law, Enrique; and my sister, Jill for checking in on me frequently to make sure I was surviving. To my friend and cohort member Bernadette Roberson, you were the first person I met at orientation, and we have endured and grown together ever since. You were with me through the rocky and occasional humorous times, late night support calls, group projects, and life coaching talks. You have been a rock for me and a gift I will always cherish. A special thanks to Dr. Sotelo, my project chair who has shown great patience, wi*SD*om, guidance, and respect throughout this journey. I will always be grateful. To Dr. Brady, I cannot say thank you enough for your guidance with statistics, problem-solving, and encouragement. I would be remiss if I did not say thank you to Dr. Armendariz, for her patience and guidance in all of my writing projects. You are amazing and know that you will forever be in my head as “what would Dr. Armendariz say?” For all my family and friends, thank you for believing in me and your persistent positive support and reassurance. Your love and support helped guide me in making the dream of a DNP degree come to fruition. I love you all so much and appreciated the support and humor along the way

BACKGROUND

In 2016, the National 911 Progress Report findings showed that the 9-1-1 system was activated 181,720,179 times for emergency medical care (National Highway Traffic Safety Administration & National 911 Program, 2016). Data were requested from all 50 States, the District of Columbia, and six territories, which included American Samoa, Guam, Minor Outlying Islands, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. Eleven states did not report data and two states provided incomplete data; therefore, actual numbers are likely higher. For patients accessing the 9-1-1 system for emergency medical care, prompt transfer and treatment of these patients arriving by ambulance are crucial. With increasing numbers of ambulance transports to emergency departments (EDs), emergency medical service (EMS) personnel experience an increase of delays in offloading patients.

Ambulance offload is the term used to describe the time of ambulance arrival at the ED, to the time the patient is moved off the stretcher, and transfer of care (TOC) to the ED staff occurs (Cooney, Wojcik, Seth, Vasisko, & Stimson, 2013). Patients arriving by ambulance with life-threatening conditions are immediately placed in an ED bed. Patients determined to be non-urgent are taken directly to the triage area for TOC. The term ambulance offload delay (AOD) emerged as the time frame of patients remaining on the EMS stretcher extended. The time patients remain on the EMS stretcher range from minutes to hours when there is no bed or nurse available. Patients presenting with non-life-threatening conditions but who are unable to be placed in the ED lobby for triage remain on the EMS stretcher. All patients arriving at the ED receive a triage assessment by a registered nurse (RN). The triage assessment includes the use of a 5-level

Emergency Severity Index (ESI) algorithm that is used to determine patient care priority, which is based on objective and subjective findings (see Figure 1). Following the triage assessment, the patient receives a medical screening exam by the medical provider and treatment begins (Agency for Healthcare Research and Quality [AHRQ], 2012).

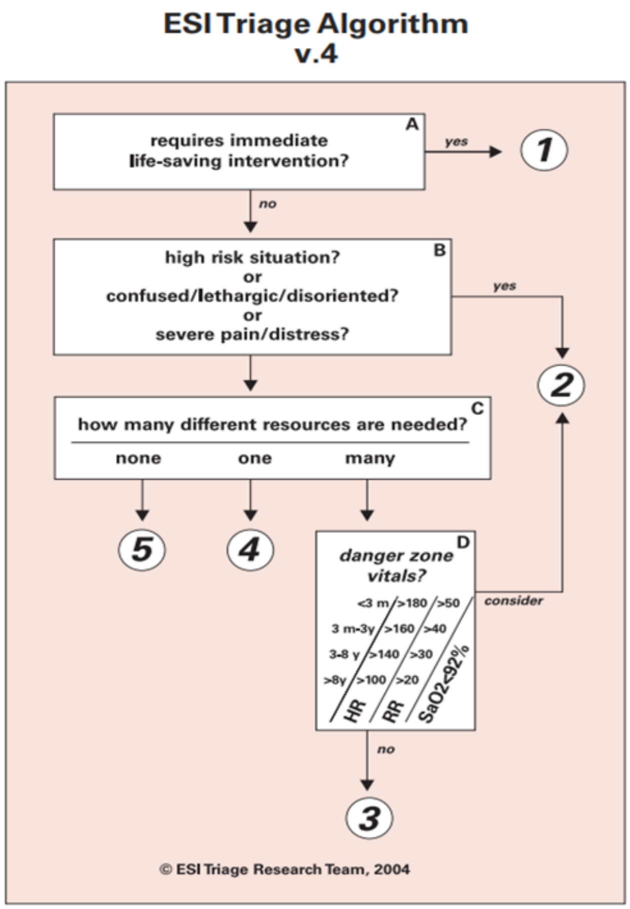

Figure 1. Emergency severity index algorithm. Reprinted from "Emergency Severity Index (ESI): A Triage Tool for Emergency," by the Agency for Healthcare Research and Quality, 2012. Retrieved from https://www.ahrq.gov/professionals/systems/hospital/esi/index.html

Canada was the first country to conduct a study on AOD. The study defined the measurement of AOD as greater than 30 minutes (Crilly et al., 2015). Studies conducted in Canada, Australia, and the United States found the highest number of AOD patients were identified as Level 3 or less acute patients based on the ESI prioritization algorithm system. Patients older than 65 years of age had the highest percentage of experiencing AOD (Cone, Middleton, & Marashi-Pour, 2012; Crilly et al., 2015; Hitchcock et al., 2009).

Background to the Problem

According to the California Hospital Association (CHA, 2014), AOD is a result of ED overcrowding. Emergency department overcrowding is attributed to increases in healthcare needs and limited resources to meet the demands. The delay in TOC from EMS personnel to ED staff results in a delay in triage assessment and care for these patients. Patients arriving by ambulance do not receive a triage assessment until an ED bed becomes available. This is in contrast to patients presenting by a private vehicle who receive an immediate assessment by an RN and are assigned an ESI triage level.

Patients on AOD do not receive an immediate triage assessment and are often left untreated, have limited treatment options, and limited oversight. Studies conducted in the U.S. and France found similar results for patients receiving little to no care during AOD (Cone et al., 2012; Crilly et al., 2015; Hitchcock et al., 2009). The care provided for patients during AOD has not been well studied. All patients arriving at the hospital, regardless of arrival mode, should receive equivalent care. Developing and implementing a protocol change would ensure consistent care for all patients and result in improved outcomes.

Local Context

Patients experiencing AOD are vulnerable to poor health outcomes when a change in condition is not identified early or delay in treatment occurs (Crilly et al., 2014). The CHA (2014) data showed that, in Los Angeles, patients meeting the definition of AOD of greater than 30 minutes were 8.4%. The AOD experienced by patients was greater than 1 hour, with 6.75 hours being the longest delay. Urban areas in California found 2 to 4 hour AOD times (CHA, 2014).

In 2016, 145,437 patients were transported via 9-1-1 ambulance in San Bernardino County (Inland Counties Emergency Medical Agency [ICEMA], 2016b). The ICEMA, San Bernardino County's local EMS regulating authority, defines AOD as occurring after the first 25 minutes of arrival to the ED (ICEMA, 2016a). Of the 145,437 transports in San Bernardino County, 42.7% met criteria to be identified as an AOD. The median time for TOC at the project hospital was 40 minutes (ICEMA, 2016b).

The project hospital is located in San Bernardino County and is a 9-1-1 receiving hospital. In 2016, the hospital had an AOD rate of 34.2% for patients arriving in the ED, reflecting an increase of 6.6% from 2014 (ICEMA, 2016b). Based upon current policies, patients arriving by ambulance do not receive equivalent care as those arriving by private vehicle because they are not immediately triaged by an RN at the same rate as those arriving by private vehicle. Patients experiencing AOD are susceptible to safety risks due to the delay in assessment and care. The problem has been identified as a lack of a standardized protocol for evaluation, reassessment, and communication during AOD and needed follow-up thereafter.

Purpose of the Project

The purpose of this DNP project is to reduce the time of patients' arrival to the ED by ambulance to initial triage nurse assessment. A standardized protocol will be developed and implemented for all patients who arrive by ambulance when an anticipated AOD time is greater than 25 minutes. A standardized protocol will ensure that all patients arriving in the ED will receive the same level of care regardless of their method of arrival. The ED environment is in constant flux, and monitoring changes in patients' conditions is vital to ensure patient safety and improve outcomes.

Supporting Framework

According to Polit and Beck (2017), frameworks provide the foundation to identify concepts and variables along with explaining their relationships. The application of a framework establishes a structure for a process change and provides the lens in which the project will be explained, examined, and explored. A model is a descriptive tool that necessitates identification of variables and how they are interrelated. Once the variables are identified, the model is used to test the variables. This DNP project will be using the Donabedian quality (DQ) framework to evaluate a process change in the assessment of patients arriving by ambulance to the ED for emergency care. The plan-do-study-act (PDSA) model will be used to provide a logical method for evaluating the quality improvement protocol.

The DQ framework was initially published in 1966 and was based on a three-concept approach to evaluating the quality of healthcare and analysis of the management of healthcare resources (Ayanian & Markel, 2016). The DQ framework has been used in previous research to evaluate changes in healthcare processes (Ayanian & Markel, 2016; Gardner, Gardner, & O'Connell, 2013; Sardasht, Shourab, Jafarnejad, & Esmaily, 2012). There are three concepts, which are Structure, Process, and Outcome. The "Structure" defines the setting, providers, and systems in which care is provided. The "Process" includes the elements of care delivery, and the "Outcome" is the end product after the implementation of a process change. An adaptation of the DQ framework will be used in this DNP project to evaluate the process change for patients arriving at the ED by ambulance (see Figure 2). The Structure includes analysis of the stakeholders involved in the care of patients during AOD. Evaluation of the Process will assist in guiding the ED process change through the development of a protocol, and the Outcomes will include the evaluation for a reduction in delays of assessment following protocol implementation.

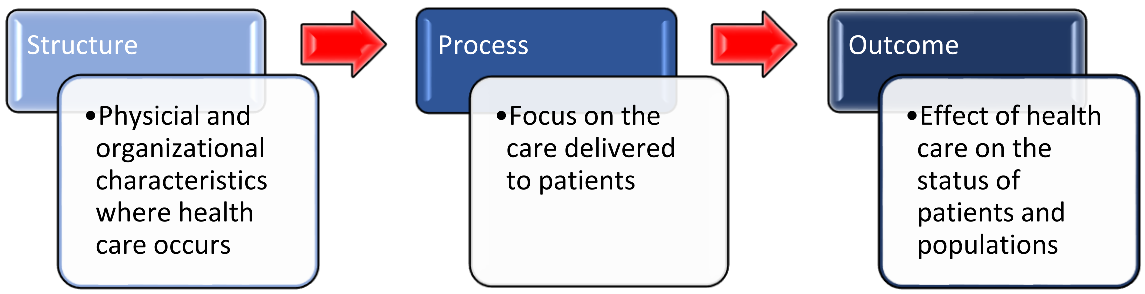

Figure 2. Donabedian quality framework. This figure illustrates an adaptation of the Donabedian quality framework.

The PDSA model was initially developed by W. Shewhart in 1939 (Shewhart cycle), and it was modified in 1950 by W. Edwards Deming, who renamed it the Deming cycle (Taylor et al., 2014). The PDSA model is a descriptive quality control tool used to test a product or process. The model is a 4-step approach using a circular design (see Figure 2). The circular format creates a template that allows for a continuous process of design, development, implementation, and testing. The 4-step process continues until the desired outcome is achieved. Current institutions that use the PDSA model for their quality improvement programs include the AHRQ (2013), Duke University School of Medicine (2016), and the Health Resources and Services Administration (2016).

The PDSA model will be used in this study to develop a protocol “Plan,” implementation of the protocol “Do,” conduct analysis of data “Study,” and create revisions based on data results and staff feedback "Act" (Taylor et al., 2014). The PDSA model provides a practical approach to testing interventions for outcomes that are predictable and sustainable (Taylor et al., 2014).

The integration of the PDSA model begins with the Plan, which includes data collection to show a problem exists, review of the literature, and the development of the protocol. The Do portion includes the implementation of the protocol, documenting observations, and gathering staff feedback. The Study includes collecting post-protocol data, conducting an analysis of the pre- and post-data and summarizing the findings. The Act evaluates the data results, making revisions for improvement and dissemination of the findings (see Figure 3).

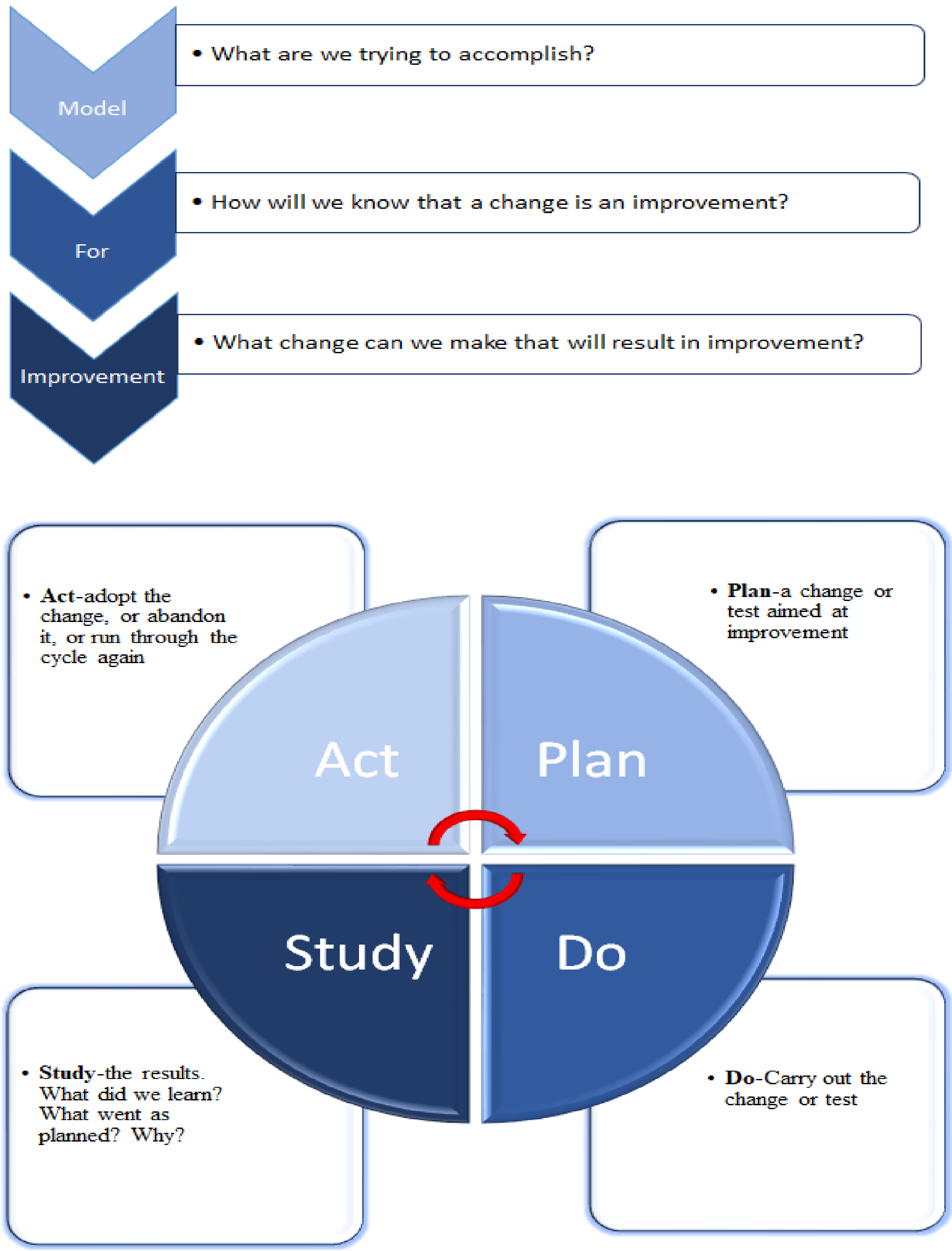

Figure 3. The Plan-Do-Study-Act model (Deming cycle). This figure illustrates how the PDSA model will be used to develop and protocol to reduce the delay of care for patients arriving by ambulance, experiencing ambulance offload delay. Adapted from "Systematic Review of the Application of the Plan-Do-Study-Act Method to Improve Quality of Healthcare," by Taylor et al., 2014.

REVIEW OF LITERATURE

The literature review for this project used the following databases: PubMed, CINAHL, ProQuest, Google Scholar, and Cochrane databases. The topics for the literature search included: ED overcrowding, ambulance offload delay, delay transfer of care, pre-hospital handover to ED, delay of care during ambulance offload delay, ambulance patient outcomes, ambulance patient safety in ED, and patient experiences during AOD. Specific topics, search terms, and search term combinations for each topic are listed in Appendix A. Boolean and MeSH terms were used to include a variety of combined terms to capture more information within a search. Articles were reviewed by title, abstract, and relevance of the subject for inclusion into the project. There were no date limitations for the articles searched since the issue of AOD is a recent area of research. Articles selected were English language only.

A secondary literature search was conducted using PubMed, CINAHL, and ProQuest databases to gather information obtained through gray literature (Roush, 2015). This included articles, reports, conference reports, committee reports, position papers, and unpublished research on delay of care during AOD. No date limitation was applied to the search for gray literature.

Ambulance offload delay is a global problem caused by the increasing demands placed on EDs to provide care for emergency and non-emergency patients, which results in ED overcrowding (Metropolitan Emergency Department Access Initiative [MEDAI], 2012). The focus of this project is the delay of patient triage assessment during AOD. The DQ Framework will be used to evaluate the change process that will be used to reduce the delay in triage assessment experienced by patients during AOD (Ayanian &

Markel, 2016; Fatemeh et al., 2013; Gardner et al., 2013). The literature review will focus on three themes related to delay in care which include: (a) ED overcrowding and AOD, (b) delay of care and outcomes, and (c) transfer of care.

Although healthcare facilities and systems have attempted to address ED overcrowding, AOD continues to increase (Cooney et al., 2013; O'Hara et al., 2015; Richardson, 2006; Sayah, Rogers, Devarajan, Kingsley-Rocker, & Lobon, 2014). Delay in treatment and poor patient outcomes associated with AOD is not well studied. According to the CHA (2014), delays in treatment have direct correlations to patient safety and inefficiency in system flow processes. Patient safety is affected by the lack of needed care that the patient experiences during AOD. Studies conducted on extended ED boarding times have found increases in morbidity and mortality (Crilly et al., 2014; Richardson, 2006; Sayah et al., 2014; Singer, Thode, Viccellio, & Pines, 2011; Yarmohammadian, Rezaei, Haghshenas, & Tavakoli, 2017). Delays in treatment include delays in medication administration resulting in failure to meet sepsis, pneumonia, and myocardial infarction Centers for Medicare and Medicaid Services (CMS) core measurements, delay to definitive care, and poor pain control (CHA, 2014; Singer et al., 2011). The financial cost hospitals incur by not meeting core measure standards is the loss of federal funding and the cost of extended hospital length of stay (LOS) due to morbidities (CMS, 2017a).

Factors attributed to ED overcrowding in California include: limited or no inpatient hospital beds, limited and no growth of hospital physical space, nurse patient ratios, hospital regulations limiting care areas, inability to rapidly turn over hospital beds, increase of complex medical conditions and comorbidities, increase of psychiatric patients requiring 5150 holds with limited mental health resources, delays in ancillary services such a laboratory and radiology studies, shortage of physician specialists, lack of primary care providers, increase in documentation requirements, and limitations for discharge options (CHA, 2014).

Although there are many factors that contribute to ED overcrowding, EDs are required to comply with the Emergency Medical Treatment & Labor Act (EMTALA) regulations. The EMTALA regulations require that all ED's provide emergency care to any patient that presents to the ED regardless of the patient's ability to pay (Emergency Medical Treatment & Labor Act, 2012). Patients become the responsibility of the hospital upon the ambulance arrival on hospital property. Patients must receive a triage and medical screening exam to determine if an emergency medical condition exists. The ED is obligated to provide treatment to stabilize the patient (Emergency Medical Treatment & Labor Act, 2012; CMS, 2006). The regulations acknowledge that hospitals may not be able to assume immediate responsibility from EMS personnel when the ED has reached capacity or staff is not available to provide care (California Legislative Information, 2017). In these circumstances, the hospital can request the EMS personnel continue to care for the patient until ED staff becomes available to assume care. However, patients must still receive a triage assessment to determine that no emergent intervention is needed and that the EMS personnel can appropriately monitor the patient's condition (California Legislative Information, 2017; Emergency Medical Treatment & Labor Act, 2012).

As the problem of ED overcrowding and AOD increases, changes in state and federal regulations are occurring to monitor and address the problem. The CMS added core measures for ED data collection which include the measurements of the median time from ED arrival to ED departure for admitted ED patients and the median admit decision time to ED departure time for admitted patients (CMS, 2012). California added additional language to the Health and Safety Code 1797.120 through the Assembly Bill 1223 Emergency Medical Services: Ambulance Transportation (California Legislative Information, 2017; Emergency Medical Services Authority, 2016). The AB1223 requires that Local Emergency Medical Service Agencies (LEMSA) record and report a standardized time measurement for AOD (California Legislative Information, 2017).

The lack of standardized terminology for AOD limits comparisons and generalizability across studies (CHA, 2014). There are many alternative terms found in the literature review for AOD such as ambulance patient offload delay, ambulance ramping, ambulance parking and wall time (CHA, 2014). Another factor that limits comparisons is a lack of a standardized time definition for AOD. Canada was one of the first countries to study AOD using greater than 30 minutes as the time frame definition (Cooney et al., 2013). Subsequent studies conducted in Australia, the United States, and the United Kingdom also used the greater than 30 minutes definition (Carter, Overton, Terashima, & Cone, 2014; Cone et al., 2012; Cooney et al., 2013; Crilly et al., 2015).

In 2012, Australia produced an ED Access Initiative that addressed AOD and included strategies to reduce AOD (MEDAI, 2012). In 2014, the CHA, in collaboration with the Emergency Medical Services Authority, established a common language, definitions and metrics pertaining to AOD. The collaboration led to the creation of the Toolkit to Reduce Ambulance Patient Offload Delays in the Emergency Department

(CHA, 2014). The toolkit includes standardized definition of terms and strategies for both EMS and hospitals to reduce AOD (CHA, 2014).

For the purposes of this review of literature and for the project as first described in Chapter 1, AOD is defined using the definition listed in the Toolkit to Reduce Ambulance Patient Offload Delays in the Emergency Department (CHA, 2014). The Toolkit defines *ambulance patient offload delay* as "the occurrence of a patient remaining on the ambulance gurney and/or the emergency department has not assumed responsibility for patient care beyond the LEMSA approved ambulance patient offload time (APOT) standard" (CHA, 2014, p. 9). San Bernardino County defines AOD as greater than 25 minutes. For the purpose of this project, greater than 25 minutes will be used as the timeframe. Transfer of care or handover is defined as the time ED staff assumes the responsibility of the ambulance patient and a verbal or written report occurs between the EMS personnel and ED staff (Cone et al., 2012).

The literature review identified three factors that contribute to the inefficiencies in system flow processes that have a direct correlation to AOD. The three factors include input, throughput, and output. Input factors apply to the needs of the community and the demand to treat patients who use the ED. Throughput includes the process flow through the ED and hospital. Output includes the options for discharge and placement opportunities (MEDAI, 2012). All three of these processes are interdependent and when one of these processes is not functioning effectively, the other processes will be negatively impacted (Moskop, Sklar, Geiderman, Schears, & Bookman, 2009). For the purposes of this project, input, throughput, and output flow processes will be addressed in this review.

Emergency Department Overcrowding and Ambulance Offload Delay

Emergency departments are placed in a unique situation as the ED is the hospital's entry point for the majority of patients admitted to the hospital. As an entry point, EDs are caught in the middle between input and output issues while continuously making adjustments to improve throughput. This patient care area is impacted by input inefficiencies resulting in increased demand, throughput inefficiencies limiting patient movement in the ED and inpatient areas, and output from delays in discharging patients from the hospital. System solutions are needed to reduce ED overcrowding and AOD. Addressing only one area of the flow process may inadvertently shift the problem to another flow process (Crilly et al., 2015).

Crilly et al.'s (2014) study evaluated the reduction of ED overcrowding and AOD by adding additional ED beds. The results found no improvement in patient outcomes or reduction of mortality and hospital LOS with the additional ED beds. The use of the National Emergency Department Overcrowding Score (NEDOCS), a validated electronic measurement tool, has been effective in predicting ED overcrowding (Cooney et al., 2013). Emergency department overcrowding is highly correlated with AOD (Cooney et al., 2013). Even though useful, the NEDOCS does not address the system problems that have caused ED overcrowding (Cooney et al., 2013; Hoot & Aronsky, 2006).

A common theme found in the review of literature is that ED overcrowding creates a potentially unsafe environment, resulting in negative effects for patients, including increased LOS and poor health outcomes (Crilly et al., 2015; Crilly et al., 2014; Singer et al., 2011). Studies were conducted to identify those who would be at a higher risk for experiencing AOD. The studies conducted found that patients greater than 65 years of age or patients meeting the “urgent” status in the ESI triage level have a higher probability of experiencing AOD (Cone et al., 2012; Crilly et al., 2015; Crilly et al., 2014). The ESI is a 5-level triage algorithm used in EDs to categorize patient acuity using a clinically relevant method. The groups range from least to most urgent based on acuity. The ESI Triage Algorithm is provided by the AHRQ (2011) on behalf of the ESI Triage Research Team (see Figure 3).

The designation “urgent” status is an ESI Level 3. These patients are not emergent requiring immediate bed placement; however, due to the medical complaint and the patient’s condition, may not be able to be placed in the lobby to wait for treatment. These patients will require the use of multiple resources for their care and have the potential for negative physiologic changes based on the medical condition. Delays in care for patients greater than 65 years and those meeting ESI Level 3 criteria was found to have an increase in mortality rates for patients with AOD times greater than 30 minutes (Crilly et al., 2015; Crilly et al., 2014; Singer et al., 2011).

Delay of Care and Patient Outcomes

Delay of care for ambulance patients occurs when throughput and output processes are impeded. Although there has been an increase in the number of studies in the area of AOD, very few studies have examined patient outcomes due to the delay of care that occurs during AOD. In 2015, The Joint Commission published an advisory on preventing delay of care in hospitalized patients. The Joint Commission reviewed 522 sentinel events associated with reports of delay in care occurring between 2010 and 2014. The results found that 415 of the 522 resulted in the patient’s death, 77 patients had permanent loss of function (e.g., disability and death) and 24 patients required increases in LOS. Three of the contributing factors to the sentinel events included: inadequate assessments, communication failures and understaffing (The Joint Commission, 2015). Although not all the sentinel events occurred in the ED, the same contributing factors can be generalized to patients experiencing AOD.

Two studies found that patients experiencing AOD had higher mortality rates ranging from 4 to 11% (Crilly et al., 2014; Richardson, 2006). The Queensland Government (2012) and the CHA (2014) of California in collaboration with the Emergency Medical Services Authority, produced guidelines to assist healthcare providers in reducing ED overcrowding and AOD, thus, resulting in improved patient care. Both of these documents support offloading non-emergent patients to triage; therefore, reducing the number of AOD occurrences. Adoption of best practices will reduce delay in care for the AOD population.

Evaluating the effects of the delay of care on patients' perceptions has also been examined. This area is not well studied. The Kingswell, Shaban, and Crilly (2015) study was the only qualitative study found that examined patient's perceptions during AOD. The study identified three themes that included: "a) understanding the healthcare system, b) making do within the system and c) being in the dark during ambulance ramping" (p. 185). The results found that patients' had limited or no knowledge of AOD and felt frustration due to poor communication and delay of care. The study found that although they experienced a delay in care, safety was not an issue as the EMS personnel were present and made the patient feel cared for while they waited (Kingswell et al., 2015). Due to the limited studies, further research is needed to validate the findings and identify potential new knowledge.

Transfer of Care

Delay in TOC or handover occurs when either throughput or output processes are negatively impacted. Extensive studies have been conducted on TOC (Cone et al., 2012; Dawson, King, & Grantham, 2013; Jensen, Lippert, & Ostergaard, 2013; Murray, Crouch, & Ainsworth, 2012; Shelton & Sinclair, 2016; Siemsen et al., 2012; Sujan et al., 2015; Toccafondi et al., 2012). One study evaluated the TOC process that occurs from EMS to ED staff (Wood, Crouch, Rowland, & Pope, 2015). The TOC is complex and is affected by both internal and external processes (Siemsen et al., 2012). The internal processes include staff perceptions of important information, lack of professional respect between and among staff, information not viewed as valuable by staff, staff frustration with frequent interruptions and repetitiveness due to missing team members upon patient arrival, chaotic ED environments, staff perceptions based on medical complaints, and lost or inaccurate data during multiple TOC reports (Dawson et al., 2013; Jensen et al., 2013; Murray et al., 2012). External processes include a lack of a standardized process for TOC that creates the potential for vital information to be missed during report (Dawson et al., 2013; Jensen et al., 2013). Commonalities across the literature include poor communication as being the main factor in ineffective TOC.

The use of process mapping, observations, and interviews have been effective in examining the concepts used during TOC, which assists in creating a safer TOC. The implementation of a standardized TOC process and creation of educational tools will improve the communication during TOC (Bost, Crilly, Patterson, & Chaboyer, 2012; Jensen et al., 2013; Wood et al., 2015). Other interventions include implementation of various TOC tools that have been shown to improve TOC; however, it is not a definitive solution. Effective solutions require the involvement of all stakeholders. The development and implementation of joint education and training in TOC with EMS personnel and ED staff may prove effective in reducing known barriers in the TOC process (Dawson et al., 2013; Jensen et al., 2013).

Summary

The relationship of ED overcrowding and AOD has been shown to be a patient safety risk. Therefore, the development of a standardized protocol will ensure that all patients are assessed regardless of the method of arrival, thus reducing delays in care. Effective input, throughput, and output process flow is essential to reduce AOD and improve patient outcomes (CHA, 2014; MEDAI, 2012). The literature review provides supporting evidence of the complexity of the ED and pre-hospital relationship and the impact on patient care. The increase in ED overcrowding and the consequential effects of AOD has gained global attention. Although efforts have been made to reduce ED overcrowding and AOD in places such as Canada, Australia, California, and the United Kingdom, a systematic approach that includes addressing input, throughput, and output is needed to find effective solutions.

METHODS

The purpose of this QI project was to develop and implement a standardized protocol that will reduce delay in triage assessment for all patients who arrive by ambulance with an anticipated AOD time of greater than 25 minutes. A detailed explanation of the methods used for this project will be presented, which will include the design, setting, sample, data collection, measures, procedures, and evaluation.

Design

Using the DQ framework of process, structure, and outcome, this QI project consisted of a pre- and post-evaluation design. The structure component is the identification of stakeholders to establish a communication base that will assist in the change process of the new protocol implementation. The stakeholders are the individuals who have influence over care practice for the ED population. Stakeholders included the ED manager, ED assistant managers, paramedic liaison nurse, ED charge nurses, ED staff nurses, and trauma nurses. The process component evaluated both the protocol and the protocol implementation. The outcome component includes the assessment of the pre-protocol vs. post-protocol timeframes using a retrospective analysis of data points collected from the hospital EMR. Data analysis was used to evaluate the process change.

An Institutional Review Board (IRB) approval was obtained from both the project hospital and California State University, Los Angeles (see Appendix B and C). Data was only being collected from the EMR and did not require any patient contact. All data were de-identified and recorded as aggregate data. All IRB rules and regulations were followed. De-identified patient data was stored in an encrypted password protected computer and kept confidential.

Setting

The setting for this project was a San Bernardino County hospital. The hospital is a 456-bed university-affiliated teaching public hospital that serves as a safety net hospital for the uninsured and underserved population. The hospital is identified as a Level II Trauma Center, Neurovascular Stroke Receiving Center 2 (NSRC-2), and burn center for Inyo, Mono, San Bernardino, and Riverside counties. The hospital contains a pediatric medical/surgical unit, and pediatric patients with single system medical or trauma conditions may be admitted to the medical intensive care unit. Pediatric patients that have multi-system conditions are transferred to a pediatric hospital.

The ED contains 43 beds with five cubicles in the triage area for medical screening and rapid discharge for patients with non-complicated minor medical conditions. The ED is also a designated base station by ICEMA, providing medical control for EMS providers. The base station is manned 24 hours with a mobile intensive care nurse (MICN). In addition, the ED provides medical clearance for psychiatric patients before admission to the psychiatric triage located in the 90-bed locked adult psychiatric unit on the campus. The project hospital is also the designated site for all prisoners who need emergency care. According to the hospital EMTALA log, more than 105,000 patients were treated in the ED of the project hospital in 2016.

Sample

Data were collected from the EMR of all patients arriving by ambulance to the ED. No patient contact occurred during the data collection for the project. The patient population included both males and females who were: (a) adults, (b) pediatrics, (c) prisoners, and (d) psychiatric patients. Although some of the patients in the ED are deemed as vulnerable populations according to human subject ethical regulations, all data were de-identified, thus resulting in no ethical concerns. Exclusion criteria included patients arriving by ambulance due to inter-facility transfers, patients in cardiac arrest, patients taken directly to the Labor and Delivery Unit, continuation of care trauma transfers, patients meeting trauma alert or activation criteria that are immediately placed in an ED bed, and EMR with missing or incomplete data elements.

Data Collection

De-identified data were collected from the hospital EMTALA daily log and patient EMR. The hospital uses the Meditech EMR system. Pre-protocol data were collected from the first week of March, the second week of April, and the third week of May 2017. Post-protocol data were collected from the first week of October, the second week of November, and the third week of December 2017.

Measures

Data elements collected from the EMTALA daily log included: (a) all patients transported by ambulance, (b) date of arrival to the ED, (c) age of patient, (d) sex of patient, and (e) ED diagnosis. Data elements collected from the patient EMR included: (a) patient race, (b) EMS documentation of patient arrival time, (c) transfer of care time, and (d) hospital documentation of patient arrival time, (e) triage time, and (f) ESI level.

Procedures

A draft protocol was developed by the DNP author and presented to ED management for approval (see Table 1). Upon protocol approval, a two-page summary that included background information, plan, and goals to reduce time of arrival to triage time was created by the DNP author (see Appendix E). Both the protocol and summary were presented at the August 2017 charge nurse meeting by the ED manager. In addition, the DNP author met with the ED Educator and ED Informatics Nurse to discuss the adaptation of the ED tracker to align with the draft protocol. The ED tracker was revised to include a tracker for the ambulance bay. The ambulance tracker provides easier monitoring of ambulance patients times and access for electronic documentation of the triage assessment.

Ambulance Patient Protocol

1. When a bed is not immediately available, ambulance patients will be assessed by a physician and redirected to the triage area, if appropriate
2. Ambulance patients not eligible for placement in the triage area and have an anticipated AOD time greater than 15 minutes will have electronic chart generated and receive an initial triage assessment in the ambulance bay
3. Patients on AOD are reassessed using the Emergency Severity Index reassessment intervals
4. EMS personnel will immediately notify the charge nurse if a change in patient condition occurs

Figure 4. Ambulance patient protocol.

The protocol was implemented in September 2017. A follow-up meeting with ED management, the ED Educator, and charge nurses took place in the first week of October following protocol implementation. During this time, focus was on evaluating the protocol and identifying barriers to protocol use. Feedback was obtained from the charge nurses who determined that further revisions were not feasible since issues related to time tracking were needed first.

Evaluation Plan

The goals of this quality improvement project are to reduce delay in triage assessment, reduce delays in care, and improve patient safety. To determine if there was a reduction of delay in care following implementation of the protocol, pre- and post-protocol data was analyzed using Intellectus Statistics™ (2017). Intellectus Statistics™ is an academic statistics tool that easily conducts statistical analyses (see Appendix F). The National Association of Graduate-Professional Students (NAGPS, 2017) has partnered with Intellectus Statistics™ to assist members with academic research.

Descriptive statistics were used to summarize demographics, time of arrival to time to triage, and ESI triage levels in the pre- and post-protocol data. An independent samples *t*-test, Mann Whitney, and Levene's test were used to compare variables of pre- and post-protocol data. The variables analyzed in the project were described in the measures section. See Table 1 for a complete list of the variables in this project. After the implementation and analysis, the results will be presented to ED management and the Chief Nursing Officer in the spring of 2018. In the event the results do not show an improvement, a new plan will be devised using the Plan-Do-Study-Act model.

Summary

The goal in the development and implementation of a standardized protocol is to reduce delay in triage assessment for patients who arrive by ambulance with an anticipated AOD time of greater than 25 minutes.

RESULTS

This chapter presents the results of the data analyses, including descriptive statistics related to the total number of ambulance patients, ambulance patients meeting AOD criteria, and comparison of documented time of arrival to triage time from EMS and hospital. Data analyses results were used to determine effectiveness of the protocol. Statistical analyses were performed using Intellectus Statistics™. Based on the high number of ambulance patients and time limitations, one-week samples were selected for pre- and post-data collection. Pre-protocol data were collected in 2017 from March 1-7, April 8-14, and May 15-21, which included 712 patients. Post-protocol data were collected in 2017 from October 1-7, November 8-14, and December 15-21, which was represented by 819 patients. A total of 1,531 patients arrived by ambulance during the pre- and post-protocol data collection. Following review of 1,531 EMRs, 636 patients were excluded from the study. The number of patients excluded from the pre-protocol data was 265 and the number of patients excluded from the post-protocol data was 371. Exclusion criteria included patients who were inter-facility transfers, patients in cardiac arrest, patients taken directly to the Labor and Delivery Unit, continuation of care trauma transfers, patients meeting trauma alert or activation criteria who were immediately placed in an ED bed, and patients with incomplete data elements (as noted in the methods section) in the EMR.

Descriptive Statistics Overall Sample

Descriptive statistics for the entire sample were calculated for each interval and ratio variable. Frequencies and percentages were calculated for received protocol, sex, race, prisoner, psychiatric, and ESI level. The category of Received Protocol was equivalent for both Yes (*n* = 448, 50%) and No (*n* = 447, 49.94%) groups. There were more Males (*n* = 471, 53%) who arrived by ambulance than Females (*n* = 424, 47%). There were more patients identified as Other Hispanic (*n* = 400, 45%) than any other race. Patients classified as prisoners were *n* = 38, which was 4.25% of the project sample. Patients classified as psychiatric were *n* = 20, which was 2.24% of the project sample. The most frequently observed category of ESI Level was 3 (*n* = 688, 77%). Frequencies and percentages of variables are presented in Table 1.

The average Age was 51.26 (*SD* = 20.23, SEM = 0.68, Min = 0.42, Max = 100.00). The time of arrival of an ambulance patient documented by EMS and the hospital did not consistently correspond, which was attributed to a lack of standardization for documentation of arrival time by both EMS and the hospital. Determination of arrival times for both EMS and the hospital documentation were obtained from observation and inquiry by the DNP author. The EMS staff documented time of arrival when the wheels of the ambulance stopped in the parking lot, or on arrival to the ambulance bay, or after the patient is transported to the triage area or placed in a bed if no delay in bed placement. The hospital documented time of arrival once an electronic chart was generated for the patient. Patients that were on AOD did not have an electronic chart generated until the patient was placed in a bed or taken to the triage area, which created the inconsistencies in patient arrival times. Time of EMS Arrival to Triage Time averaged 56.65 minutes (*SD* = 58.99, SEM = 1.97). Arrival by Hospital Time to Triage averaged 28.55 minutes (*SD* = 47.69, SEM = 1.59). The EMS arrival times were determined to be more accurate and used in analyses of hospital arrival to triage times. Skewness and kurtosis were also calculated in Table 2. When the skewness was greater

Table 1

Frequency Table for Overall Sample Variables

Variable	*n*	%
Protocol		
N	447	49.94
Y	448	50.06
Missing	0	0.00
Sex		
Male	471	52.63
Female	424	47.37
Missing	0	0.00
Race		
Other Hispanic	400	44.69
White	238	26.59
Black	205	22.91
Unknown	20	2.23
Other	13	1.45
Asian	11	1.23
Native American Indian	4	0.45
Pacific Islander	4	0.45
Missing	0	0.00
Prisoner		
N	857	95.75
Y	38	4.25
Missing	0	0.00
Psychiatric		
N	875	97.77
Y	20	2.24
Missing	0	0.00
ESI Level		
1	15	1.68
2	103	11.51
3	688	76.98
4	82	9.16
5	6	0.67
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

than 2 in absolute value, the variable was considered to be asymmetrical about the mean (DeCarlo, 1997).

When the kurtosis was greater than or equal to 3, then the variable's distribution was markedly different than a normal distribution which has a tendency to produce outliers (Westfall & Henning, 2013). The results showed a Skewness of greater than 3 for both Skewness and Kurtosis for EMS and Hospital Arrival to Triage Times, indicating that the distribution was asymmetrical and can be attributed to outliers for both pre- and post-protocol data.

Table 2

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	SE_M	Skewness	Kurtosis
Age	51.26	20.23	895	0.68	-0.01	-0.57
Time of EMS Arrival to Triage Time	56.65	58.99	895	1.97	3.02	15.02
Arrival by Hospital Time to Triage	28.55	47.69	895	1.59	3.99	22.98

Note. Due to rounding errors, percentages may not equal 100%.

Homogeneity of Variance

Levene's test for equality of variance was used to assess whether the homogeneity of variance assumption was met in all tests conducted (Levene, 1960). The results of the Levene’s test were not significant, indicating that the assumption of homogeneity of variance was met. All tests conducted were run with and without outliers with no significant changes in results.

Independent Sample *t*-Test for EMS Arrival to Triage Time Overall Sample

An independent samples *t*-test was conducted to examine whether the mean of Time of EMS Arrival to Triage Time was significantly different between the Received protocol groups. Before the analysis, the assumptions of normality were assessed. A Shapiro-Wilk test was conducted to determine whether Time of EMS Arrival to Triage Time could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were significant ($W = 0.74$, $p < .001$). This suggested that Time of EMS Arrival to Triage Time was unlikely to have been produced by a normal distribution; thus normality cannot be assumed and assumptions were not met. The result of the independent samples *t*-test was not significant, $t(893) = -1.16$, $p = .246$, indicating the null hypothesis cannot be rejected. This suggests the mean of Time of EMS Arrival to Triage Time was not significantly different between the Received Protocol groups. In other words, the Protocol was not effective in reducing Time of EMS Arrival to Triage Time. Table 3 presents the results of the independent samples *t*-test. Figure 5 presents the mean of Time of EMS Arrival to Triage Time for the Received Protocol groups.

Table 3

Independent Samples t-Test for the Difference Between Time of EMS Arrival to Triage Time (No) and Time of EMS Arrival to Triage Time (Yes)

	Received Protocol						
	No		Yes				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
Time of EMS Arrival to Triage Time	54.36	60.38	58.94	57.55	-1.16	.246	0.08

Note. Degrees of Freedom for the *t*-statistic = 893. *d* represents Cohen's *d*.

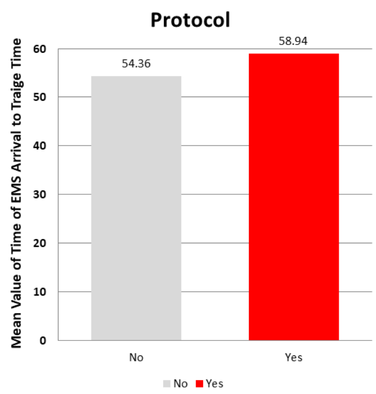

Figure 5. The mean of time of EMS arrival to triage time by levels of protocol.

Based on the violations of the *t*-test assumptions, a Mann-Whitney *U* two-sample rank-sum test was conducted as an alternative nonparametric test. The Mann-Whitney *U* test examined whether there were significant differences in Time of EMS Arrival to Triage Time between the levels of Received Protocol. There were 447 observations in Received Protocol group No and 448 observations in Received Protocol group Yes. The result of the Mann-Whitney *U* test were not significant, ($U = 93994.5$, $z = -1.59$, $p = .113$). The mean rank for group No was 434.28 and the mean rank for group Yes was 461.69. This suggests that the distribution of Time of EMS Arrival to Triage Time for group No was not significantly different from the distribution of Time of EMS Arrival to Triage Time for the Yes group. Table 4 presents the result of the Mann-Whitney *U* test. Figure 6 presents a boxplot of the ranks of Time of EMS Arrival to Triage Time by Protocol.

Table 4

Mann-Whitney Test for Time of EMS Arrival to Triage Time by Protocol

	Mean Rank				
	Received Protocol				
	No	Yes	*U*	*z*	*p*
Time of EMS Arrival to Triage Time	434.28	461.69	93994.50	-1.59	.113

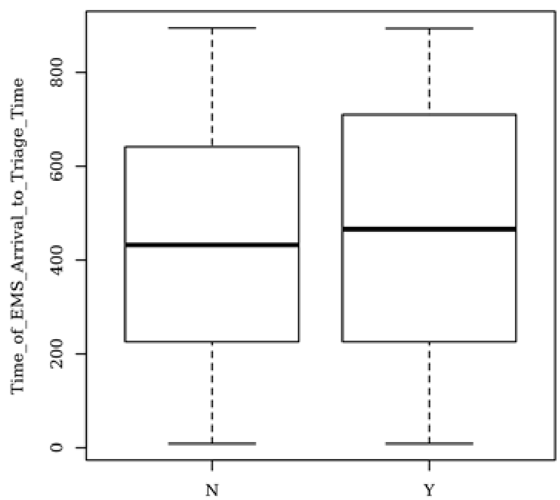

Figure 6. Ranks of time of ems arrival to triage time by protocol.

Descriptive Statistics Time of EMS Arrival to Triage Time Binned

Frequencies and percentages were calculated for Time of EMS Arrival to Triage Time binned. The most frequently observed category of EMS Arrival to Triage Time binned was over 25 minutes (*n* = 542, 61%). Frequencies and percentages are presented in Table 5.

Table 5

Frequency Table for Time of EMS Arrival and Triage Time Binned Variables

Variable	*n*	%
Time of EMS Arrival to Triage Time binned		
25 or less	353	39.44
Over 25	542	60.56
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Descriptive statistics were calculated for EMS Arrival to Triage Time binned greater than 25 minutes. Summary statistics were calculated for each interval and ratio variable. Frequencies and percentages were calculated for Received Protocol, Sex, Race, Prisoner, Psychiatric, and ESI Level. The most frequently observed category of Protocol was Yes (*n* = 278, 51%). The most frequently observed category of Sex was Male (*n* = 278, 51%). The most frequently observed category of Race was Other Hispanic (*n* = 249, 46%). The observed prisoner category was n = 21, with a 3.87%. The observed psychiatric category was n = 13, with a 2.4%. The most frequently observed category of ESI Level was 3 (n = 433, 80%). Frequencies and percentages are presented in Table 6. Summary statistics are presented in Table 7.

The observations for Age had an average of 50.91 (*SD* = 20.19, SEM = 0.87). The observations for EMS Arrival to Triage Time had an average of 84.41 minutes (*SD* = 61.39, SEM = 2.64).

Table 6

Frequency Table for EMS Arrival to Triage Time Binned Greater Than 25 Minutes Variables

Variable	*n*	%
Protocol		
N	264	48.74
Y	278	51.29
Missing	0	0.00
Sex		
Male	278	51.29
Female	264	48.71
Missing	0	0.00
Race		
Other Hispanic	249	45.94
White	147	27.12
Black	112	20.66
Unknown	13	2.40
Other	8	1.48
Asian	7	1.29
Pacific Islander	4	0.74
Native American Indian	2	0.37
Missing	0	0.00
Prisoner		
N	521	96.13
Y	21	3.87
Missing	0	0.00
Psychiatric		
N	529	97.60
Y	13	2.40
Missing	0	0.00
ESI Level		
1	5	0.92
2	53	9.78
3	433	79.88
4	47	8.67
5	4	0.74
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Table 7

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	SE_M	Skewness	Kurtosis
Age	50.91	20.19	542	0.87	-0.00	-0.60
EMS Arrival to Triage Time	84.41	61.39	542	2.64	3.21	15.16

Note. Due to rounding errors, percentages may not equal 100%.

t-Test Analysis of EMS Arrival to Triage for AOD Times Greater Than 25 Minutes

An independent samples *t*-test was conducted to examine whether the mean of Time of EMS Arrival to Triage Time was significantly different between the Received protocol groups for times greater than 25 minutes. A Shapiro-Wilk test was conducted to determine whether Time of EMS Arrival to Triage Time could have been produced by a normal distribution. The results of the Shapiro-Wilk test were significant, ($W = 0.71$, $p < .001$). This suggests that Time of EMS Arrival to Triage Time was unlikely to have been produced by a normal distribution; thus normality cannot be assumed. This showed that the assumptions for the independent samples t-test were violated.

The result of the independent samples *t*-test was not significant, ($t\ (540) = 0.83$, $p = .409$), indicating that the intervention had no effect on Triage Time. This suggests the mean of Time of EMS Arrival to Triage Time was not significantly different between the Received Protocol groups. Table 8 presents the results of the independent samples *t*-test. Figure 7 presents the mean of Time of EMS Arrival to Triage Time for Received protocol groups.

Table 8

Independent Samples t-Test for the Difference between Time of EMS Arrival to Triage Time (N) and Time of EMS Arrival to Triage Time (Y)

	Received Protocol						
	No		Yes				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
Time of EMS Arrival to Triage Time	86.35	57.52	82.17	65.26	0.83	.409	0.07

Note. Degrees of freedom for the *t*-statistic = 540. *d* represents Cohen's *d*.

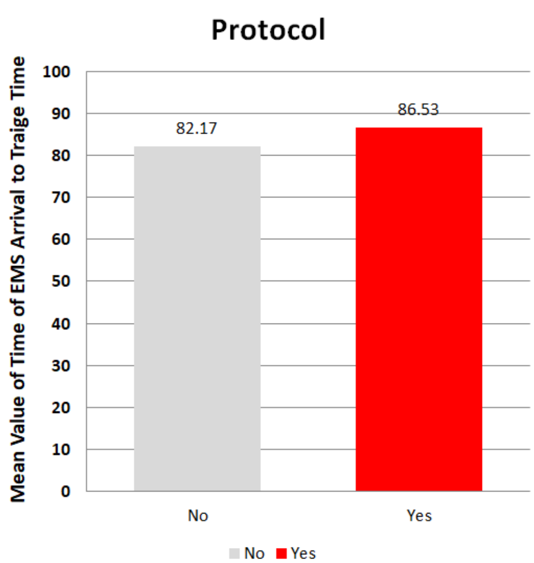

Figure 7. The mean of time of EMS arrival to triage time by levels of protocol.

Based on the violations of the *t*-test assumptions, a Mann-Whitney two-sample rank-sum test was conducted as a nonparametric alternative. The Mann-Whitney *U* test examined whether there were significant differences in Time of EMS Arrival to Triage Time between the Received Protocol groups. There were 278 observations in the Received protocol group No and 264 observations in the Received Protocol group Yes. The result of the Mann-Whitney *U* test were significant, (U = 32726.5, z = -2.18, p = .029). The mean rank for Received Protocol group No was 256.46 and the mean rank for Received Protocol group Yes was 285.78. This suggests that the distribution of Time of

EMS Arrival to Triage Time for group No was significantly different from the distribution of Time of EMS Arrival to Triage Time for the Yes group. This result indicates that the protocol was not effective in reducing Time of EMS Arrival to Triage Time for patients on AOD greater than 25 minutes. Table 9 presents the result of the Mann-Whitney *U* test. Figure 8 presents a boxplot of the ranks of Time of EMS Arrival to Triage Time by Received Protocol.

Table 9

Mann-Whitney Test for Time of EMS Arrival to Triage Time by Protocol

	Mean Rank Received Protocol				
	No	Yes	*U*	*z*	*p*
Time of EMS Arrival to Triage Time	256.46	285.78	32726.50	-2.18	.029

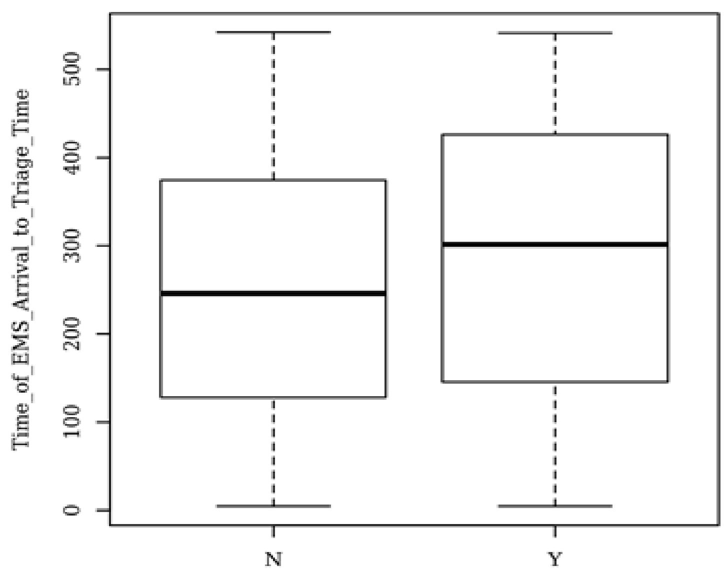

Figure 8. Ranks of time of EMS arrival to triage time by protocol.

The results of the project showed no significance in reducing Time of EMS Arrival to Triage Time following protocol implementation. The Time of EMS Arrival to

Triage Time for patients on AOD greater than 25 minutes actually showed an increase. Early on, the DNP author recognized that some charge nurses (CN) were compliant to the protocol, while others were not. Protocol compliance was identified as a possible significant limitation of the QI project. Additional tests were run comparing CN-A, who was compliant to the protocol to CN-B who was not compliant. These CNs were identified through observation by the DNP author. All data for CN comparison was collected post-protocol implementation. To maintain anonymity of CNs, specific dates that data was collected was not listed. The total number of ambulance patients for CN-A was 75 compared to 76 for CN-B.

Chi-Square Test of Independence

A chi-square test of independence was conducted to examine whether CN-A and CN-B and Time of EMS Arrival to Triage Time binned were independent. There were two levels in Time of EMS Arrival to Triage Time binned: Less than 25 minutes and 25 minutes or greater. Prior to conducting the analysis, the assumption of adequate cell size was assessed, which requires all cells to have expected values greater than 0 and 80% of cells to have expected values of at least 5 (McHugh, 2013). All cells had expected values greater than 0, indicating the first condition was met. A total of 100.00% of the cells had expected frequencies of at least 5, indicating the second condition was met.

The results of the chi-square test were significant, $\chi^2(1) = 4.71$, $p = .030$, indicating a relationship between CNs and EMS Arrival to Triage Time Binned. In comparing observed numbers, CN-A had a larger number of less than 25 minutes binned compared to CN-B who had a higher number of 25 minutes or greater binned. The observed values showed that CN-A had a lower number of 25 minutes or greater binned compared to CN-B, who had a lower number less than 25 minutes binned. Table 10 presents the results of the chi-square test. Significant differences were found in relation to the CN and use of the protocol. This indicates that CN compliance with the protocol made a significant difference in reducing time of EMS arrival to triage time.

Table 10

Charge Nurse Observed and Expected Frequencies

	EMS Arrival to Triage Time Binned	
Charge Nurses	less than 25	25 or greater
Charge Nurse A	73[69.54]	2[5.46]
Charge Nurse B	67[70.46]	9[5.54]

Note. $\chi^2(1) = 4.71$, $p = .030$. Values formatted as Observed [Expected].

DISCUSSION

Patients arriving by ambulance do not receive an initial triage assessment until transferred to triage or placed in a bed. For patients experiencing AOD, a delay in a triage assessment ranges from a minimum time frame of minutes to hours. The purpose of this DNP project was to reduce the time of patient arrival by ambulance to initial triage assessment for patients with an anticipated AOD time greater than 25 minutes.

Findings

The initial findings did not support that the protocol was effective in reducing time of arrival to triage time for patients arriving by ambulance when AOD times were greater than 25 minutes. Noncompliance with protocol implementation was identified as a significant variable that affected project results. Concern for making a Type I error led to further testing. Further analysis was conducted comparing a protocol compliant CN with a protocol noncompliant CN. The results were significant and support the hypothesis that the protocol would be effective in reducing time of arrival to triage time for patients arriving by ambulance when AOD times were greater than 25 minutes.

In addition, analyses identified that documentation of time arrival were markedly different between EMS and the hospital. The mean average for time of arrival to triage time from EMS documentation was 56.65 minutes compared to the hospital documentation of 28.55 minutes. This time difference can be attributed to the hospital's delay in registering patients until the patient is placed in a bed or directed to triage. Documentation of time of arrival by EMS additionally varied from the time when the wheels of the ambulance stopped in the parking lot to time of arrival in the ambulance bay. The EMS documentation of time of arrival was determined to be more accurate and based on paramedic selection of arrival time options. Thus, EMS documentation of arrival time was used in the reported findings. Immediately registering patients upon arrival meets EMTALA compliance and provides accurate data essential to evaluating process change effectiveness.

Project hospital results were consistent with data results found in the literature review. Data results showed 77% of the patients arriving by ambulance met ESI Level 3. For patients on AOD greater than 25 minutes, 80% met ESI Level 3.

Education and Implementation

Using the Donabedian framework, the Structure was identified as the ED. The Process included the implementation of a new protocol, changes in charge nurse responsibilities, changes in staffing assignments, changes in the electronic tracker, and changes in registration process. The Outcome included the analysis, results of the data collection, and staff feedback.

The PDSA model was used to evaluate the protocol, revisions, and re-evaluations. The Plan included the collection of the pre-protocol data and development of the protocol. The Do included the implementation of the protocol, obtaining staff feedback, performing observations, identifying problems, and collection of post-protocol data. The Study included data analyses, summarization, and sharing of results with ED management. The Act included discussions with ED management and CNs on potential protocol revisions.

The DNP author conducted several cycles of the PDSA model; however, additional cycles are still needed to address barriers associated with protocol implementation. Protocol compliance was a significant barrier to implementation.

Additional barriers included inadequate staffing and delays in tracking of ambulance patients due to the multiple responsibilities of charge nurses, which take them away from the ambulance bay area.

Conclusions and Recommendations

Although the results showed no statistical significance in the sample population, a closer inspection of protocol use by two CNs was conducted by the DNP author. One CN was considered to be a super user and the other CN was noted not to follow the protocol. The results demonstrated how protocol compliance reduced time to triage. In 2017, in the project hospital, AOD times increased 28.4% from 2016 (ICEMA, 2018). This data supports the need for continuation of the protocol with tighter implementation oversight followed by an evaluation time frame. Reliability and use of the protocol will be looked at carefully during the second phase of the evaluation. Tighter controls will be placed on daily checks of the CN by an objective auditor. Additional education will be provided. Limited staffing and space affect protocol compliance. The ED management team requires administrative financial support to develop creative staffing options that support triage flow processes during times of limited staffing. Staffing mixes should include registered nurses, licensed vocational nurses, and emergency room technicians.

The topic of AOD is not well studied; however, current research reveals a variety of potential improvement opportunities. Continued efforts to reduce time to initial triage assessment of ED patients on AOD are needed as well as the development and implementation of strategies for ongoing reassessments. Tracking AOD patterns for increases in occurrences for the day of the week and time of day would be helpful in adjusting staffing. Adding additional resources during high incidence times would assist in reducing time of arrival to triage times. Improving population health of patients experiencing AOD can be achieved through quality improvement investigations at both the hospital and LEMSA levels. Identification and tracking of patients experiencing deterioration during AOD can be used to make global improvements with positive outcomes. Additionally, as patients remain on ambulance gurneys ranging from minutes to hours, exploring the effects of AOD on patient satisfaction would be valuable. Patient satisfaction results impact ED Hospital Consumer Assessment of Healthcare Providers and Systems scores that are publicly reported (CMS, 2017b).

Prompt patient initial assessment improves patient safety through identification of those with higher acuity requiring immediate intervention. The effects of AOD can be potentially detrimental for those seeking emergency medical care. Ambulance offload delay continues to escalate and will not be eliminated until effective system changes are made that simultaneously address input, throughput and output processes. While efforts to eliminate AOD are crucial, reducing time of arrival to triage time will ultimately result in improved patient safety and outcomes.

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APPENDIX A

REVIEW OF LITERATURE SEARCH TERMS

Topic	Search Term	Search Term Combinations
ED Overcrowding	ED Overcrowding	ED overcrowding OR ED capacity OR ED diversion
	ED Overcapacity	
	ED Diversion	
Ambulance Offload Delay	Ambulance offload delay	Emergency medical technicians OR paramedic crew AND emergency department AND handover AND Ambulance offload OR delay in ambulance offload OR ED wall time AND ambulance parking Ambulance offload delay AND delay of care AND outcome for ambulance offload delay ED AND ambulance AND patient AND safety ED AND patient experiences OR patient feelings AND ambulance AND ambulance offload delay
	Paramedics	
	Emergency medical technicians	
	Ambulance parking	
	ED wall time	
	Safety of ED ambulance patients	
	Ambulance patient safety	
	Patient feelings during AOD	
	Patient experiences during AOD	
	Patient experiences in ED	
	Ambulance ramping	
	Ambulance parking	
	Ambulance wall time	
Delay of Care and Outcomes	ED delay of care	Paramedic OR emergency medical technician AND ED delay of care OR transfer of care OR paramedic handover ED AND ambulance patient AND ambulance offload delay AND outcomes Ambulance patients AND delay AND outcomes
	Delay transfer of care	
	Pre-hospital transfer of care	
	Paramedic transfer of care	
	ED ambulance patient outcomes	
	Ambulance offload delay outcomes	
	Effects of ambulance offload delay outcomes	
Transfer of Care	Paramedic handoff	Emergency medical technicians OR paramedic crew AND emergency department AND handover AND Waiting AND hospital AND safety ambulance AND
	Paramedic handover	
	EMT handover	
	EMS transfer of care	
	Paramedic report	

APPENDIX B

ARROWHEAD REGIONAL MEDICAL CENTER INSTITUTIONAL REVIEW BOARD APPROVAL

400 N. Pepper Avenue, Colton, California 92324-1819 | Phone: 909.580.1000
www.arrowheadmedcenter.org

ARROWHEAD
REGIONAL MEDICAL CENTER

The Heart of a Healthy Community

June 27, 2017

Institutional Review Board
Office of Research, Scholarship, and Creative Activities
Golden Eagle Building 314
California State University, Los Angeles
Los Angeles, CA 90032

To Whom It May Concern:

Jan Serrano, Doctor of Nursing Practice student at California State University, Los Angeles has requested permission to conduct the research project named below at Arrowhead Regional Medical Center (ARMC). This letter notifies you that the IRB at ARMC will grant permission to the investigator to conduct this research at the location listed below pending IRB approval from California State University, Los Angeles.

Research Project Title: Protocol for Emergency Department Patients on Ambulance Offload Delay

Principal Investigator: Dr. Cinthya Vasquez Sotelo, DNP, FNP-C and Jan Serrano, MSN

Study Site Location: Arrowhead Regional Medical Center
400 N Pepper Ave
Colton, CA 92324

Permission granted by:

Jennifer Miller, DrPH, MA
IRB Coordinator
Arrowhead Regional Medical Center

APPENDIX C

CALIFORNIA STATE UNIVERSITY, LOS ANGELES INSTITUTIONAL REVIEW BOARD APPROVAL

Office Memorandum

DATE:	December 12, 2017
TO:	Cinthya Vasquez Sotelo, DNP, FNP-C
FROM:	California State University, Los Angeles (Cal State LA) IRB
PROJECT TITLE:	[1076570-1] PROTOCOL FOR EMERGENCY DEPARTMENT PATIENTS ON AMBULANCE OFFLOAD DELAY
REFERENCE #:	16-242
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	December 12, 2017
EXPIRATION DATE:	December 11, 2018
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 5

Thank you for your submission of New Project materials for this project. The California State University, Los Angeles (Cal State LA) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please make sure that you follow the procedures for informed consent outlined in the APPROVED proposal as required by federal regulations.

Please note that any modification to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate modification forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to irb@calstatela.edu using the "Adverse Effects Report Form." All federal and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of December 11, 2018.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

- 1 - Generated on IRBNet

If you have any questions, please contact Claire Bakewell at irb3@calstatela.edu or irb@calstatela.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within California State University, Los Angeles (Cal State LA) IRB's records.

APPENDIX D

PROJECT SUMMARY FOR CHARGE NURSES

August 8, 2017

Delay of Care During Ambulance Offload Delay

Purpose and Significance

Prompt transfer and treatment of patients arriving to the emergency department (ED) by ambulance is crucial. The ED is impacted by input inefficiencies resulting in an increase demand for treatment. There are also throughput inefficiencies limiting patient movement in the ED and inpatient areas. Output inefficiencies cause delays in discharging patients from the hospital. As a result, EDs are experiencing overcrowding, due to limited staffing and availability of resources. Ambulance offload delay (AOD) is attributed to ED overcrowding. Patients can remain on the ambulance stretcher for several minutes or hours without receiving immediate triage assessment. Patients are often left untreated; with limited treatment options and limited oversight.

Patients experiencing AOD are vulnerable to poor health outcomes due to changes in condition that is not identified early or treatment delay occurs (Crilly et al., 2014). In 2016, the Arrowhead Regional Medical Center had an ambulance offload delay rate of 34.2% for patients arriving in the ED, reflecting an increase of 6.6% from 2014 (Inland Counties Emergency Medical Agency, 2015).

Problem

Based upon current protocols, patients arriving by ambulance do not receive equivalent care as those arriving by private vehicle. Patients arriving by ambulance are not immediately triaged by a RN and do not receive reassessments at the same rate as those arriving by private vehicle. Patients experiencing AOD are susceptible to safety risks due to the delay in care. Delays in treatment have direct correlations to patient safety and inefficiency in system flow processes (California Hospital Association, 2014).

Studies conducted on extended ED boarding times have found increases in morbidity and mortality (Crilly et al., 2014; Richardson, 2006; Sayah, Rogers, Devarajan, Kingsley-Rocker & Lobon, 2011; Society for Academic Emergency Medicine, 2011; Yarmohammadian, Rezaei, Haghshenas & Tavakoli, 2017). Delays in treatment include delays in medication administration resulting in failure to meet sepsis, pneumonia and myocardial infarction CMS core measurements, delay to definitive care, and poor pain control (California Hospital Association, 2014; Society For Academic Emergency Medicine, 2011).

Regulatory Requirements

All patients arriving at the hospital, regardless of arrival mode, should receive equivalent care. Developing and implementing a protocol change would ensure consistent care for all patients and would result in improved outcomes. Patients must receive a triage and medical screening exam to determine if an emergency medical condition exists. The ED is obligated to provide treatment to stabilize the patient (Emergency Medical Treatment & Labor Act, 2012). The regulations acknowledge that hospitals may not be able to assume immediate responsibility from EMS personnel when the ED has reached capacity or staff is not available to provide care (California Legislative Information, 2017). In these circumstances the hospital can request the EMS personnel continue care for the patient until ED staff becomes available to assume care. However, patients must still receive a triage evaluation to determine that no emergent intervention is needed and that the EMS personnel can appropriately monitor the patient's condition (California Legislative Information, 2017; Emergency Medical Treatment & Labor Act, 2012).

Plan

The relationship of ED overcrowding and AOD has been shown to be a patient safety risk. Therefore, the development of a standardized protocol will ensure that all patients are assessed regardless of the method of arrival, thus reducing delays in care.

For ambulance patients that are not immediately assigned a bed, a triage assessment will be completed in the ambulance bay. Re-assessment of patients will mirror policies:

304.00 Intake Process of Patients to the Emergency Department

404.10: Emergency Severity Index (ESI) Triage Category Principles and Medical Screening Examination

Feedback

The policy was written to be vague, providing charge nurses flexibility in managing ambulance patients. Your feedback is valuable. Any suggestions will be appreciated to help make this transition easier for all staff.

APPENDIX E

INTELLECTUS STATISTICS NOTICE OF CONFIDENTIALITY

StatisticsSolutions
Advancement Through Clarity

Statistics Solutions acknowledges that we may have access to confidential and proprietary information (proposals, data files, transcripts, etc.), in which you may make available to us. In return, Statistics Solutions agrees not to disclose or disseminate the confidential information without your expressed prior written consent.

All confidential information is kept on a secure hard drive, and confidential written information is kept in a locked filing cabinet.

The term "confidential information" shall not include such information as is or becomes part of the public domain through no action or admission of Statistics Solutions, or which becomes available to Statistics Solutions from third parties without acknowledgement by Statistics Solutions.

Best regards,

James Lani, Ph.D.
President/CEO
Statistics Solutions

APPENDIX F

TABLE OF EVIDENCE

Table 1

ED Overcrowding and Ambulance Offload Delay

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
1) Pre- and post-evaluation of intervention to reduce ED overcrowding (Sayah et al., 2014)	Retrospective analysis DV: ED patients IV: System wide process improvement 2006	Massachusetts Hosp, (pre)January 2005-June 2006, (post)April 2008-December 2011. Exclusion: Data between May 2006-March 2009 not included to ↓confounding variables d/t mult changes during implementation phase.	Data from 2 electronic databases. Care timeline developed & time stamps to measure each step. 5 teams responsible to evaluate 5 flow processes: ED pt flow, laboratory turnaround time, no delay in nurse report, MD admitting orders, Inpatient dischgs. Quarterly amb diversion hrs mean, Press Ganey percentile scores, median ED LOS, median door-to-provider, core measurements. Weekly mtgs.	ED operations statistically significant↓ in: door-to-provider-time, LOS, ED diversion hrs, core measure times, LWBS, pt satisfaction. Findings: Inefficiencies in ED throughput and resultant delay in care has negative outcomes for patients and pt satisfaction.	Success: admin support for throughput obstacles, aligned leadership team, stakeholder involvement. Well-developed mission and education of mission for everyone. Limitations: Med size urban hosp, generalizability may be limited, ETR confounding variable. Appropriateness: Throughput inefficiencies contribute to ↑ ED LOS & long pt boarding times directly r/t ED overcrowding.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
			Independent *t*-test of mean pre/post intervention.		
1.Evaluating use of "turnaround" times as a measure for AOT 2. Evaluating CAD data for validity in measuring AOT for policy decisions (Carter et al., 2014)	Observational study, Richmond Ambulance Authority providers blinded at time of data collection DV: Pts brought in by ambulance IV: Documentation of "clear hospital" and "care transferred" times	Richmond, Virginia Richmond Ambulance Authority EMS Service (sole EMS service in Richmond, VA) Convenience sample: *N* = 1732 amb runs, includes all hrs of day, sample mirrors amb arrival patterns No calculations done to determine needed sample size (Scant literature to base calculations) Inclusion: All pts brought in	Delivery interval = "time care trans" minus "arrive hosp" Recovery interval = "clear hosp" minus "time care trans" Richmond Ambulance Authority devices used to capture: "arrive at hosp" "care trans" "clear hosp" PM manually marks "trans of care" decreasing any bias of to time markers CAD data to measure total turnaround times and compare with observed data. Devices sync w/ national atomic clock	Median turnaround time 29.47 min, turnaround > 1hr 9.4% cases & 13.1% turnaround > 1 h at lg hosp Hosp varied in + facility crowding/acuity. Correlation exists between delivery and turnaround with 70% r/t delivery time, turnaround times can never be zero d/t tasks Findings: Long turnaround times = long delivery time. ED polices/procedures affect turnaround time Need for automated data capture for research question answer & decision-	Correlation between delivery and turnaround times. Turnaround concepts complex. No evidence turnaround time could be used in decision making. Limitations: Ambulance had strict target turnaround times prior to study possibly affecting generalizability. Confounds: completing documentation, clean amb, restock while waiting to offload, gaps/incomplete data, ED overcrowding. Missing data during part of the study time frame. Appropriateness: Correlation of turnaround time and delivery statistically significant but complex & not enough information to make policy decisions. Delivery 70% of turnaround time. Systems problem

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
		by ambulance Exclusion: Did not disclose if any exclusions		making.	& fixing only one process may just offload problem to another process.
1. Comparison of AOD times with Canadian standards (<30 minutes) 2. Identify correlation between ED overcrowding & NEDOCS score 3.Correlation of AOD to race/ gender (Cooney et al. 2013)	Observational-pilot study DV: ED amb pts, ED overcrowding IV: Ambulance offload times	University Hosp Level I trauma center Syracuse, NY, 1 yr study. Separate adult and ped ED w/separate staffing Convenience Sample: N=483 pts Exclusions: None	DV & IV times documented from direct observation NEDOCS scores. Standard NEDOCS groupings used Demographics: race, gender eval for assoc w/ AOD	AOD 0-157 min Median 11 min, 27.9% AOD r/t delay in EMS report to staff, 72.1% AOD r/t delay of availability of stretcher Findings: AOD dependent on delay of EMS transfer of care report & unavailability of gurney. NEDOCS score predictive of AOD. No difference between race and gender	AOD median is < Canadian standards. AOD related to ED overcrowding. NEDOCS predictive of AOD & can make destination decisions. Future studies: ESI scores to rate acuity. Correlation between AOD and NEDOCS. No availability of stretcher= 70% of delay. Limitations: Sample only represented 3% pts transported by amb. Variations in acuity not differentiated. Only adult ED stats used creating potential for inaccurate statistics. NEDOCS scores are user dependent. Appropriateness: AOD throughput issue. States limiting PM role in hosp ↑ delay of care. AOD r/t ED

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
					overcrowding. AOD related to delay in care.

Notes: Dischgs = Discharges; ED = Emergency Department; Gps = Groups; Hosp = Hosptial; Hr = Hour; LWBS = Left without being seen; LOS = Length of stay; Mult = Multiple; NEDOCS = National Emergency Department Overcrowding Score; Pts = Patients.

Table 2

ED Overcrowding and Ambulance Offload Delay

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
Explore patient experience of amb ramping (Kingswell et al., 2015)	Interpretive phenomenology, DV: Pts brought in by ambulance to the ED IV: Semi-structured interviews Observations, feelings, opinions documented. Flow of time & space perceptions	Lg regional public teaching hospital, Brisbane Australia, ED Beds=21, 6 mo study, Interviews: private, ED or inpt room by 1st author. Audio-recorded and transcribed. Validated by 2nd researcher. Convenience purposive sample: *n* = 7 pts interviewed (4 male & 3 Female), ages 41-88, pts identified through ED log Inclusion: ≥ 18, delay triage > 30 min Exclusion: unable to provide written consent, in custody of police or department of correction	3 themes found 1. Understanding the healthcare system 2. Making do within the system 3. Being in the dark during ambulance ramping Findings: Pts: limited understanding of supply and demand in ED's. Choose amb on how they feel, not what they know. Poor communication = poss frustrated pts. Pts need education on speaking up.	Communication with hosp staff essential for pts to feel safe. Pts need patience ↑communication during ramping important. Ramping ≠ neg exp. Limitations: Potential participants may have been exclude d/t inaccurate data. Purposive sampling may affect generalizability. Appropriateness: Identified pts experience r/t ramping and areas to improve pt experience. Pts felt safe as they were not alone. Early assessment by provider essential for pt safety. Study supports concern for pt safety and pt perception of safety during AOD.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
1) Explore system wide influences on PM decision making 2) Explore influences on care transitions & potential risk factors (O'Hara et al., 2015)	Exploratory multi-method qualitative study. 2 phase process. Ethnographic. Key variables; 1) Electronic diaries 2) Focus gps	3 England amb services. Urban, rural and coastal areas. Phase 1: preliminary understanding of care pathways (annual reports, policies & protocols), staff roles & service configuration. Phase 2: Examine decision-making by PM & specialist paramedic within 3 amb services. Amb and non-amb researchers Sample: Self-selection N=50 57 staff over 34 shifts. Review documentation, interview, observation, electronic diaries & focus gps. 10 staff completed electronic diaries, 3 focus gps w/ 21 staff, semi-structured interviews w/ 16 key staff	9 transition decisions identified. Transition decisions range from clear protocol driven decisions to complex r/t social circumstances and co-morbidities. social circumstances and co-morbidities had ↑ uncertainty & ↑ risk 7 system influences: demand, performance care options, risk aversion, training, communication & resources. Findings: Transition decisions and influences overlap and are interrelated. ED transports default option to prevent delay risks & pt w/o care. Demand for amb transports creating strain& tension on system.	System weaknesses (structural & attitude) influence PM care complex decisions emphasizing the need for further study. Limitations: Small qualitative study, no direct measurements of pt safety, no linked data limited broader evaluation of system influences, perspective of service providers would provide broader insight. Appropriateness: PM transport decision-making. ED safety net option. Possibilities of being out of service on AOD can affect decision to transport to an ED. Non-emergency transport create strain on ED resources. Limited feedback for PM. ↑ demand of amb services. Non-transport to an ED ↑ pt safety risks.

Notes: Dischgs = Discharges; ED = Emergency Department; Gps = Groups; Hosp = Hosptial; Hr = Hour; LWBS = Left without being seen; LOS = Length of stay; Mult = Multiple; NEDOCS = National Emergency Department Overcrowding Score; Pts = Patients.

Table 3

Delay of Care and Patient Outcomes

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
1. Comparing pt outcomes for AOT < 30min and > 30 min 2. Identify predictive factors for ED LOS > 4hrs (Crilly, et al., 2015)	Retrospective multisite cohort study DV: All pts BIBA to ED IV: Time of ED triage & time offloaded from stretcher	Queensland, Australia, 3 major public teaching hospitals that treat adult & pediatrics. ED Beds = 122, Hosp beds= 963.The Queensland Ambulance Service EMS system includes 17 stations & 1 rotary wing, 1 yr study Sample data: N=40,783 Inclusions: all pts. arriving by amb Exclusions: incomplete data, ukn sex, incorrect age, data discrepancy, incomplete/inaccurate data, duplicate record	Data from 3 databases linked using deterministic linking Demographics: Ambulance: Unit #, age, sex, triage code, date, time of arrival on scene, scene departure, arrive to ED, triage time, time off stretcher, time ED departure ED Information System: Age, sex, mode of arrival, Triage Scale, chief complaint, time of arrival, triage,	Delayed >30 min N=6122 (15%). Cause: varied among all 3 hosp, urgent gp highest delayed Findings: Better pt outcomes for AOT< 30 min, >65 a higher AOT delay group, no variances gender or illness. Independent predictors of ↑ED LOS > 4 hrs include: admission, age, 65+, triage cat 2, 3 or 4, AOT > 30 min, No diff in mortality.	Outcomes: ↑ AOT < 30 min. Age > 65 at ↑ risk for AOT. Similar results USA & France. ↓ LOS for non-admitted pts. 13 predictors for ED LOS > 4hrs. Linking data: accurate AOT view. No diff in mortality rates for delay vs. non-delayed. Solutions need to prevent shifting problems to another part of system Limitations: Inconsistent terminology for AOT: affect comparisons and generalizability. Databases may contain inaccurate data as user dependent. Appropriateness: Relationship of AOT to neg outcomes. Identifies predictors for AOT.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
1. Identify predictors of admission 2. Describe patient outcomes of amb pts before and after opening additional ED beds. (Crilly et al., 2014)	Retrospective comparative cohort study DV: All patients arriving by ambulance IV: Addition of 41 ED beds	Queensland, Australia, 3 major public teaching hospitals that treat adult & pediatrics, 2 hosp share operational capacity. ED Beds = 122, Hosp beds = 963.The Queensland Ambulance Service EMS system includes 17 stations & 1 rotary wing, 2 yr study. Sample data: Queensland Ambulance Service, ED Information System & Hospital Based Corporate Information System databases. *N* = 79,196 Inclusions: all pts. arriving by amb Exclusions: Incomplete data, ukn sex, incorrect age, data discrepancy, incomplete/inaccurate data, duplicate record	Data from 3 databases linked using deterministic linking Demographics: Ambulance-Unit record #, name, age sex, triage code by communication center, date and time of dispatch, date and time arrival at scene, date and time on-scene departure, ED transported to, date and time ED arrival, date and time ED triage. Emergency Department Information: Unit record #, name, age, sex, mode of arrival, triage category, CC, date and time of arrival, date and	2000 ambulance arrivals. 2year ↑in median age statistically significant, unclear if clinically significant. 1.5% ↑ category 1 and 2 pts, Findings: Predictors of admission found were: age ≥ 65, ATS category 1,2, or 3, ICD diagnosis r/t circulatory/respiratory diseases, ED LOS > 4 hrs	Outcomes not improved were AOD > 30 min, admits holds showing ↑mortality 4%-11%. ED expansion did not improve AOD > 30 min, following ATS eval times frames & ED LOS > 8 hrs. Limitations: Inaccuracies of data provided. Improvements to individual hosp not evident d/t 3 hosp study. May not relate to clinical significance. Confounds: policy for both pre-hospital and ED. Potential network effect with other private hospitals. LOS > 4 hrs correlation to admission could not be ascertained. Appropriateness: ↑ ED beds did not improve AOD times. Pt outcomes not improved when AOD > 30 min. Predictors of admission can help in strategy development to intervene early with care. Adding beds did not affect AOD. AOD neg affects pt outcomes.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
			time of triage, date and time seen by MD, date and time ED dischg,		
1) Identify a measurement between ED overcrowding and 10-day mortality rate. (Richardson, 2006)	Retrospective stratified cohort Key variables: Overcrowded shifts, Non-overcrowded shifts	Austrailian ED, adult and peds, 2002-2004. Convience sample.successive 12 week seasonal blocks, 8-hour shifts (0000,0800, 1600), power calculation:30,000 N = 736 shifts Exclusions: 20 overcrowded shifts excluded d/t inadequate # of non-overcrowded shifts	In-patient death within 10 days of ED admission.	1) Pts less likely to begin treatment within triage category times 2) Overcrowded shifts = 144 deaths, Non-overcrowded = 101 deaths 3) ↑ mortality seen in older pts Findings: 10-day mortality rates ↑ in mortality when treated in overcrowded ED. Supports a prospective study. During overcrowded times, pts triaged higher score but care below standard. Mortality rate 70% higher in category 4 (potentially serious) pts. Poss d/t under triage during overcrowding times.	No significant changes in pts presenting during overcrowding vs. non-overcrowding times. ↑ mortality rates in pt presenting during overcrowded times. Presenting acuity and treatment are contributing factors in mortality. Limitations: No data on quality of care or causes of mortality. Possible admission bias during overcrowding times. Appropriateness: Pts presenting during overcrowding may be receiving lower quality care d/t stretched resource times. Higher mortality rates for pt presenting to the ED during overcrowded times.

Notes. Amb = Ambulance; AOD = Ambulance offload Delay; CC = Chief Complaint; ED = Emergency Department; Pts = Patients

Table 4

Handovers

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
Describe components of turnaround time, quantify handover delays and examine variables that can be used to predict handover delays (Cone et al., 2012)	Retrospective study using descriptive statistics DV: Pts BIBA to an ED IV: Handover intervals < 30 min, 30-60 min & > 30 min	New South Wales, Ambulance Service Of New South Wales transports, January, April, July & October 2009, Paramedics = 3,000, amb = 1000, aircraft = 20 Sample: *N* = 141,381 from Ambulance database Exclusions: Pts transported on 31 day of a 31-day month, secondary responses for same pt calls cancelled enroute by caller and handover delay 0-4 min	Paramedics manually enter times in mobile device that populates the CAD software system. CAD data matched with Ambulance Service Of New South Wales data for data point times. BTF system used to categorize pt acuity. Handover delays defined as > 30min	Lg hosp received 55% of transports, 59% call were categorized as urgent. Median turnaround time 29.47 min. Max turnaround time 9hrs 51 min. Turnaround time > 1hr 9.4%, 13.1% in lg hosp. Median handover delay 17.29 min, median turnaround time 31.25 min Predictors of handover delays include paramedic vs EMT presence, hosp size, age > 16, arrival between 1200 and 1800 and major cities	The study used 3 categories to identify handovers: 30min, 30-60 min & > 60 min. Delays in handover ↑during winter months and is more common in lg urban hosp. Concern that creating tight stringent recovery times might result in falsification of delivery times Limitations: Data accuracy from databases, 55,602 cases excluded d/t missing data Appropriateness: Identified factors causing handover delays. Study supports patients in the urgent category more likely to experience AOD.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Measurements, Operational Definitions of Variables	Results/Findings	Conclusions/Study limitations/Appropriateness
1) Evaluate accuracy of pt info transfer from pre-hospital to ED documentation (Murray et al., 2012)	Retrospective review, comparison of pre-hospital records to ED records	University teaching hosp ED in England, May 2006, PM & nurse consultants collected data Convenience sample: Chronological collection, *N* = 100 patient records from resuscitation log Exclusion: Pts not transported by amb, Charts that had missing data in PM notes, ED deaths.	Electronic medical record data points: History of event leading to emergency call, pt's medical history, prescribed medications, allergies & treatment rendered by PM	26 records had discrepancies between pre-hospital and ED notes including: meds, allergies, medical problems, pt history, pre-hospital care & times. Findings: 26% of pertinent information not gathered, translated or received correctly.	Written info or is lost or changes during handover. Need to evaluate data of patients brought to triage area or had delay in assessments. Appropriateness: Handover process flawed. Pertinent information either not relayed or received accurately. Potential safety risk for pts.

Notes. Amb = Ambulance; BIBA = Brought in by ambulance; CAD = Computer Aided Design; Pts = Patients; Lg = Large; Hosp = Hospital

Table 5

Handovers

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
1) Improve availability of EMS reports for physicians (Shelton, Sinclair, & Sunnybrook Health Sciences, 2016)	Prospective review, Focus group Key variables: Pts arriving by ambulance Education for clerical staff Electronic dashboard Non-active ED pts EMS records sent directly to medical records	ED in Canada Convenience sample: Measures: Pt transfer from EMS to ED stretcher until EMS report received by fax, time from receiving EMS report until time placed in pt chart	No significant changes for external processes but improvement seen in fax to pt record.	Transmission of EMS record to ED needs improvement. Online option may be more useful than fax. Limitations: EMS stakeholders were not involved in process resulting in no change in pre-hospital process. Appropriateness: Supports the complexity of handovers poor communication between pre-hospital and ED in pt care.
Purpose: 1) Explore content communicated during handover 2) Explore verbal behaviors during handover 3) Understanding & improving	Design: Discourse Analysis of audio-recorded observation by RA & phone recordings DV: handovers Key variables:	Setting: 2 English National health Service amb services & 3 English National health Service hosp (6 hosp total), Nov 2011 thru July 2012, 0800-2200 time frame.	Results: 203 handover s recorded. 67 excluded to background noise, poor recording quality or tech failures. PM handover 60-65% descriptive, 75-80% unidirectional and focused pt presentation, 1.5-5% r/t pt social & psychological needs.	Conclusions: Narrow focus on handover, limits identifying improvement needed. Both descriptive & collaborative conversations necessary for joint-decision making. Standardization should include collaborative concepts & relevant pt social & psychological info. Limitations:

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
handover (Sujan et al., 2015)	1) handover PM to ED MD 2) handover PM to ED nurse 3) handover ED to internal med MD	Sample: Convenience sample Exclusion: 1 Amb service declined participation	Findings: 1) Main focus of conversations physiologic, social & psychological need discussed less frequently. 2) Unidirectional transfer of info 3) Standardization of handover practice needs to accommodate collaborative conversation.	Presence of reactivity d/t awareness, focused on description of handover, not accuracy of info, no outcomes collected, non-recorded conversations or other handwritten handover materials researchers not aware of. Appropriateness: Inclusion of social & psychological in handover. Handover should include transfer of information and collaborative conversation.
1) identify & elaborate factors influencing amb to ED handover 2)Identify opportunities more improvement in handovers (Jensen et al., 2013)	Retrospective review of literature search Key variables; Amb to ED handover	Handovers from amb to ED staff, N=18 papers found through database search. Inclusion: Handover studies published since 1995, >15 yrs of age, priority of papers that had face-to-face- meeting with ED and amb personnel.	Describe challenges with information, communication gaps Describe suggested strategies Evaluate cultural & organization aspects Only 50% ED staff included pre-hospital data in care Information gaps: inaccurate pre-hospital data on ED records, poor recall of verbal report, lack of active listening, absence of all team members 79%, fragmented communication	Limited studies conducted on pre-hospital to ED handovers. Not enough research for evidenced-based strategies. Handovers are a transfer of responsibility not just information sharing. Need structured process. Barriers: lack of professional recognition. Strategies: creating common language One of WHO top five priorities. Appropriateness: Handovers are internationally recognized as a pt safety risk. TJC & Australian Medical Association included handover as a pt safety parameter.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
			Findings: Structured & standardized handover will ↑ transfer of information, mult handover tools found in literature	
1) Identify components of handover between PM & ED staff that impact effective transfer 2) Evaluate how components of transfer can be improved (Dawson et al., 2013)	Retrospective analysis of research papers & literature reviews. Key variables: Handover reports	Computer databases search. Inclusion: Peer-reviewed research, published 2001-2012, English language, face-to-face handovers, PM, amb, ED, EMT, handover, handoff, deteriorating pt Exclusion: Discussion papers, pre-hosp or radio notifications, intra-professional & inter-disciplinary handovers, shift-to-shift reports, disaster medicine, medical informatics, communication technologies	Themes: professional relationships, respect & barriers to communication, multiple or repeated handovers, identification of ED staff, significance of VS, need for structured handover tool, documentation, other communication methods, education & training Issues: structured handovers, create respectful, improve communication, & staff recognition.	Improving professional relationships, inclusion of handover tool, eliminate multiple handovers & training will improve handovers. Appropriateness: Ineffective handovers create potential pt safety risks.

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
1) Identify causes of adverse events r/t poor handover practice (Toccafondi et al., 2012)	Semi-structured interview & observations of handovers Key Variables: handover observations of handovers us 5 data elements & interviews	Teaching hosp in Florence, Aug 2011 thru Oct 2011 Sample: 1st setting: 2 MDs high acuity, 2 MDs low acuity, 3 ICU nurses, 3 high dependency unit. 2nd setting: I MD high acuity & 1 surgery floor, 3 ICU nurses & 2 surgical ward nurses. 15 pt handovers from ICU to lower acuity, 2 focused gp interviews	3 critical elements found: 1) quantity, accessibility & relevance of info 2) agreement between sender & recipient units 3) shared understanding and common agreement on type of info shared. Findings: 1) lack of continuity of info provided in TOC from higher acuity to lower acuity 2) lack of common concepts necessary for handovers 3) assumptions that dx is sufficient to deduct anticipatory needs 4) medical team has pre-handover conversations creating common concepts 5) whereas nurses do not 6) pre-handover exchange between MD may result in less detailed documentation.	Identifying common ground communication in handovers improver TOC information and improve safe transfer practice Appropriateness: Identifying common ground concepts for TOC improves communication and safety for patients.
1) explore factors that affect handover safety 2) identify solution to optimize handovers	Interpretive phenomenology Critical Incident Technique used. Key variables: Pts brought in by ambulance to the	Lg University hosp in Denmark, 2008-2009 Sample: Convenience, 23 nurses, 3 NAs, 13 MDs, 5 paramedics, 2 orderlies, one rad tech.	Interviewers trained on interview guide. Qualitative phenomenological method of text summarizing. Steps: 1) seeking general sense 2) organizing data into categories 3) identify meaning of each	The safety risk in handovers is complex and involves technology, environment, attitudes, workloads, process issues. All 8 factors need to be addressed when seeking a solution. Limitations: Only one hosp used, affecting

Purpose (Author(s), year) (Resource)	Design & Key Variables	Setting & Sample	Results/Findings	Conclusions/Study limitations/Appropriateness
(Siemsen et al., 2012)	ED Semi-structured interviews	Depts: ED, med/surg, ICU, radiology, orderly unit, 2 ambulance stations. Both senior & Junior staff Inclusion:	category 4) synthesize meanings 8 non-exclusive factors that impact handover & safety identified: communication, information, organization, infrastructure, professionalism, responsibility, team awareness, culture. Findings: Handovers are complex & pose a risk to pt safety. Average # of handover is 20 for pt hosp stay. Safety culture of handovers still immature in healthcare. Handovers not standardized and inconsistent. Value not seen by staff. Similar results found in other studies.	generalizability. Interviews were voluntary w/ possible non-response bias. Difficult finding time to conduct interview d/t time constraints. Using fault/based approach. Appropriateness: The study is useful in identifying the safety risks w/ handover reports and affects when AOD is extended.

Notes: Amb = Ambulance; BIBA = Brought in by ambulance; CAD = Computer-aided design; Pts = Patients; Lg = Large; Hosp = Hospital