2015

Emergency Medical Services to Emergency Department Patient Handover: A Delphi Study of Interprofessional Content Expectations

Candance Harding Van Vleet
Medical University of South Carolina

EMERGENCY MEDICAL SERVICES TO EMERGENCY DEPARTMENT PATIENT HANDOVER: A DELPHI STUDY OF INTERPROFESSIONAL CONTENT EXPECTATIONS

By

Candance Harding Van Vleet

A doctoral project proposal submitted to the faculty of the
Medical University of South Carolina in partial fulfillment for the degree
Doctor of Health Administration
In the College of Health Professions

EMERGENCY MEDICAL SERVICES TO EMERGENCY DEPARTMENT

PATIENT HANDOVER:

A DELPHI STUDY OF INTERPROFESSIONAL CONTENT EXPECTATIONS

By

Candance Harding Van Vleet

Approved by:

Chair, Project Committee	Michael Meacham, JD, MPH	(Printed Name/Degree) Date
Member, Project Committee	Julia Aucoin, DNS	(Printed Name/Degree) Date
Member, Project Committee	Mark Holland, PhD	(Printed Name/Degree) Date
Member, Project Committee	Denise Wilfong, PhD	(Printed Name/Degree) Date
Dean, College of Health Professions	Lisa Saladin, PhD	(Printed Name/Degree) Date

Abstract of Doctoral Project Report Presented to the
Interprofessional Studies Program in Health Administration & Leadership
Medical University of South Carolina
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Health Administration

EMERGENCY MEDICAL SERVICES TO EMERGENCY DEPARTMENT PATIENT HANDOVER: A DELPHI STUDY OF INTERPROFESSIONAL CONTENT EXPECTATIONS

By

Candance Harding Van Vleet

Chairperson: Michael R. Meacham, JD, MPH
Committee: Julia Aucoin, DNS
Mark Holland, PhD
Denise Wilfong, PhD

Emergency Medical Service (EMS) patient handover impacts subsequent Emergency Department (ED) care. This study sought to determine the core and provider specific handover elements necessary for EMS to ED patient handover. In addition, the study examined the significance of patient acuity on handover content expectations. Prior to this research, there was no evidence-based guidance regarding information necessary for continuation of prehospital care. A 2 round modified Delphi method was used to collect interprofessional expert opinion. The panel of emergency medicine experts (emergency medicine physicians, emergency registered nurses, and paramedics) participated in 2 surveys where they determined the importance of given elements to 5 different acuity level patient scenarios. The findings show profession did not affect content expectation group means (Round I p=0.91, Round II p=0.44). Therefore the possibility exists for a prehospital handover element checklist to meet the needs of all emergency care providers involved in prehospital transfer of care. Ultimately 3 EMS handover content lists were generated: universal, interprofessional, and acuity. The universal list has 20 elements, interprofessional consensus has 17 elements, and the acuity list has 16. These results highlight the difference between interprofessional handover expectations and National EMS Education Standards.

Dedication

For my grandmother, Thelma Pearce.

“An education is something no one can ever take from you.”

Acknowledgments

This dissertation is the result of the support and guidance of many with whom I owe my deepest gratitude.

- The paramedics, physicians, and nurses who participated as Delphi panelists. I am extremely grateful for their time and willingness to share their professional expertise.
- Lee Van Vleet, my husband who is always there for me without question. I am truly blessed he is in my life. A huge thank you to his parents Dr. David and Norma Van Vleet who raised the best husband anyone could ask for.
- My committee members. Michael Meacham who accepted the responsibility of being my chair; Julia Aucoin whose extensive knowledge of the dissertation and research process guided my doctoral studies; Mark Holland who offered his wisdom and experience; and Denise Wilfong, my champion from the very beginning until the end.
- Antonio Fernandez who provided statistical support to a novice researcher and became a friend in the process.
- The Western Carolina University Emergency Medical Care Program. From my first bachelor's degree and through this doctoral study, the Faculty and Alumni continue to offer their support and expert counsel.
- Cristal Harrison, my best friend for her unconditional acceptance, fierce loyalty, and never-ending friendship. Zina Sutton for her enthusiasm, positivity, and laughter.
- Last but not least, thank you to my parents Joan & Eric Bomhard for their love and encouragement. My mother made many sacrifices to ensure that I had every opportunity to succeed. Completing this dissertation is just the beginning of repaying the debt of gratitude I owe her for this commitment to my education.

Table of Contents

List of Figures

List of Tables

Chapter One: Introduction

Anyone who has ever been a patient in an Emergency Department (ED) has a story to tell. Their anecdotes may involve long wait times, overcrowding, or a general air of chaos. Many would suspect this tumultuous environment is the root cause of most ED medical errors. However the Joint Commission reports nearly 70% of sentinel events are secondary to communication errors (Joint Commission, 2007). Every Emergency Medical Services (EMS) patient handover to ED personnel takes place in this chaotic environment. At the time of this study there is limited research about this complex interaction and the necessary communication processes associated with patient handovers.

Background of the Study

Approximately 70% of EMS patients require care and transport to an ED (Lindstrom & Losavio, 2005). The National Highway Traffic Safety Administration's (NHTSA) National EMS Scope of Practice Model document states EMS personnel "treat nearly 20 million ill and injured patients per year in the U.S." (NHTSA, 2007). The 2010 Centers for Disease Control and Prevention (CDC)/National Center for Health Statistics' National Hospital Ambulatory Medical Care Survey found that there are 129,843,000 annual visits to the nation's EDs. Of these patients, 16.3% or 20,774,880 arrive by ambulance and require EMS to ED handover communication (CDC, 2010b). Available studies demonstrate this handover is fraught with information loss and dissatisfaction

among healthcare providers (Benner et al., 2008; Carter, Davis, Evans, and Cone 2009; Scott, Brice, Baker, and Shen, 2003; Bruce and Suserud, 2005).

In the United States public safety is the function of local government and involves police, fire, and EMS. Although EMS is a member of the public safety triad, the responsibility of EMS delivery varies widely. Despite the variation in responsibility, the mission to provide care and transport of sick and injured patients is consistent across the country.

Rendering care and transporting the sick and injured was first seen in history during the Napoleonic Wars. Dominique Larrey, one of Napoleon Bonaparte's surgeons, organized ambulance services for care and evacuation of wounded soldiers in 1792 (Marshall, 1915). Over the next 100 years provision of emergency services was isolated to active war zones. During these campaigns, historical documents suggest soldier training included basic care techniques with instructions for transport to a central area for definitive care (Tintinalli, 2010).

Initial modern EMS efforts endeavored to take this military knowledge and practice and apply it to the civilian world. These early EMS attempts resulted in ambulance services or rescue squads with well-meaning, but disorganized, ill-prepared, and meagerly equipped personnel (NHTSA, 2007). In 1966, with the rising number of vehicular fatalities and injuries, the National Academy of Sciences published a report called "Accidental Death and Disability: The Neglected Disease of Modern Society." This "white paper" was the first of its kind to categorize a nationwide inadequacy of prehospital care. Its recommendations included ambulance standards, policies, regulations, and the need for local consistency among ambulance services (NHTSA,

2007). NHTSA's EMS mission remains today "To reduce death and disability by providing leadership and coordination to the EMS community in assessing, planning, developing, and promoting comprehensive, evidence-based emergency medical services and 9-1-1 systems" (NHTSA, 2013).

Individual state offices of EMS (OEMS) direct the provision of prehospital care via rules and regulations. Each OEMS has a wide range of responsibilities including ambulance specification standards, personnel credentialing, and state medical direction. Although EMS education requirements remain under NHTSA purview; OEMS expectations of EMS personnel vary from state to state.

A National Emergency Medical Services Advisory Council report on Standardized Certification, Licensure, and Credentialing reveals 39 separate prehospital credentials nationwide (National Emergency Medical Services Advisory Council, 2009). There is a wide spectrum of attempts to standardize EMS education and credentialing ranging from congressional bills to Institute of Medicine (IOM) reports (H.R. 3144, IOM, 2006). Although States may offer a variety of EMS credentials, the National Registry of Emergency Medical Technicians (NREMT), recognizes the following national EMS credentials:

First Responders (FR)

Emergency Medical Technician-Basic (EMTB)

Emergency Medical Technician-Intermediate (EMTI)

Paramedic

The paramedic role is a relatively new healthcare discipline in comparison to nursing or medicine. The initial on scene patient assessment as well as treatment en route

to definitive care offers valuable information to initial and subsequent healthcare providers. Emergency medicine colleague unfamiliarity with paramedic information acquisition and processing as well as treatment capabilities can lead to medical errors and potential fatalities. Therefore high quality patient care requires thorough interprofessional prehospital to ED communication.

Current education standards informing prehospital care provider communications to the receiving ED staff includes a comprehensive list of handover elements (NHTSA, 2009). These elements include:

1. Unit identification and level of provider
2. Estimated time of arrival
3. Current patient condition
4. Patient's age and sex
5. Mental status
6. Chief complaint
7. Brief and pertinent history of the present illness
8. Major past illnesses
9. Baseline vital signs
10. Pertinent findings of the physical exam
11. Emergency medical care given
12. Response to emergency medical care

Despite the education standards, multiple studies cite issues with EMS handover ranging from poor retention of information (Scott et al., 2003), inadequate EMS and ED

documentation of content (Stiell, Forster, Stiell, & van Walraven, 2003), and insufficient quality (Thakore & Morrison, 2001).

The 2006 IOM report on EMS encourages effective communication as a necessary measure to create a safe prehospital care handover (Institute of Medicine, 2006). In addition, receiving ED staff appreciates a concise and thorough verbal prehospital patient care handover report. While the national paramedic curriculum outlines eleven essential components for EMS bedside handover, there is a scarcity of literature validating these suggestions.

There is an abundance of literature addressing in-hospital nursing and physician handover; however there is a shortage of studies focusing on EMS personnel and prehospital handovers. Consequently, the lack of research-based practice has led to paramedics relying on longstanding educational standards. These standards endorse the same handover content regardless of patient acuity (NHTSA, 2009).

The available EMS handover literature suggests the need for standardizing prehospital to ED transfer of care. Meisel, Peacock, and Mechem (2010) found significant inconsistencies in EMS handover. Their prospective observational research sought to describe the environment as well as content during EMS to ED handover. The study found discrepancies in verbal content handover when compared to EMS written documentation. However these discrepancies were not associated with any environmental factor. Budd, Almond, and Porter's (2007) study on trauma patient handover practice illustrates interprofessional perceptions of inadequate EMS handover structure. Lastly Bost, Crilly, Patterson, and Chaboyer (2012) exploration of EMS to ED handovers found

handover quality is contingent upon "personnel expectations, prior experience, and working relationships."

Since 2005, the Joint Commission's National Patient Safety Goals (NPSG) recommend a standard handover process in order to avoid communication related errors during transfer of care (Scalise, 2006.) Substandard patient care handovers can lead to treatment errors, care delays, patient complaints, incorrect resource allocation, increases in ED length of stay, and rising health care costs (Australian Council for Safety and Quality in Health Care, 2005). NPSG recommendations and patient care risks reinforces the acute need to evaluate EMS personnel handover.

This study used a modified Delphi research technique to obtain expert opinion from paramedics, emergency registered nurses, and emergency medicine physicians. Using their experience in either giving or receiving EMS to ED patient handovers, these experts reviewed five fictional case studies and used a 4-point Likert scale to select the importance of each given element's inclusion in a verbal EMS bedside handover. In addition, expert opinion delineated interprofessional expectations of core and provider specific element of EMS to ED handover.

Problem Statement

The high levels of stress and urgency in today's EDs, as well as subsequent hurried communications, negatively impacts prehospital care handover to emergency nurses and physicians. Patient handover is an opportunity for unsafe practices to become ingrained in day-to-day healthcare provider interactions. Therefore it was imperative to determine interprofessional handover content expectations to prevent EMS information

loss and patient handover errors. These expectations provide a foundation for EMS to ED patient handover standardization.

The importance of patient handover is of such importance, The Joint Commission (TJC) lists handover as a patient safety goal (Scalise, 2006). TJC highly recommends both verbal and written handover occur when patient care transfers from one setting or provider to another. This recommendation, in association with unsubstantiated handover requirements, justified the need to determine interprofessional expectations of necessary transfer of care elements. This research provides information about how to improve handover effectiveness while mitigating dissatisfaction, negative experiences, and communication mediated medical errors.

In the inpatient arena, nurses and physicians typically receive a thorough verbal report prior to patient arrival; EMS provides cursory pre-arrival patient information to a nurse via radio or telephone. However, it is atypical for receiving physicians to receive frequent notifications about impending EMS patient arrivals. In addition to the logistics of communication, critical patients require more hands on care by the paramedic resulting in less time for communication of a thorough pre-arrival patient report.

From an outside perspective, EMS to ED patient handovers can appear to be straightforward. Tredinnick-Moir's (2013) study found that 82% of 45 paramedic-to-nurse handovers were associated with negative experiences. This mixed-method study attributes these negative experiences to role ambiguity, generalization about other's competence, and workplace incivility. Furthermore the study found EMS and ED staff perceptions of patient handover was dominated by opinions of each group's interpersonal behaviors and opinions. An assumption, such as the belief patient care begins once the

patient is in the ED, leads to an oversight of prehospital care and interventions that may result in dangerous care practices. Therefore communication of EMS care information is necessary to ensure critical interventions are initiated or continued.

ED handovers encompass two-way information exchange (Behara et al., 2005). Positive interprofessional relationships improve this information exchange (Burzotta & Noble, 2011). Gender, culture, generational differences, hierarchy of medical personnel, complicated care, and interprofessional rivalries play a role in interprofessional relationships and communication effectiveness (Woods, Jackson, Ziglar, & Alston, 2011). It must be noted the association of certain behaviors and expectations with all professionals of the same discipline negatively impacts communication. Tredinnick-Moir's (2013) study found nurses and paramedics base the ease or effectiveness of patient handover communications on previous handover experiences. This indicates there are long-term consequences of both positive and negative communication exchanges.

An ED's culture, physical environment, patient volume, acuity levels, nurse to patient ratios, and resource availability contributes to handover effectiveness (Behara et al., 2005). These ED factors as well as an EMS handover containing unnecessary information or lacking structure or inclusive of unnecessary information contribute to ineffective handovers. This research provides information to improve handover effectiveness with an aim toward mitigating dissatisfaction, negative experiences, and communication related medical errors.

Purpose of the Study

The purpose of this study was to determine interprofessional expectations of EMS to ED handover content. The current gold standard of handover content is the 2009

NHTSA's National EMS Education Standards. This standard outlines 12 components to be given during verbal EMS to ED patient handover. At the conclusion of this study, expert opinion specified core versus provider specific handover content expectations and the relationship of this content to patient acuity.

Research Questions

The objective for this dissertation was to determine interprofessional expectations of essential handover content necessary for an EMS to ED patient handover. The following research questions form the basis of this research:

1. What are the core and provider specific elements necessary for an EMS to ED patient handover?
2. What are the core and specific handover elements when applied to each of the five levels of acuity?

Significance of the Study

The significance of this study is four fold. Currently air and ground EMS agency transports account for 16.3% of total ED patient volume (CDC, 2010b). The lack of a current EMS handover structure increases the likelihood of communication related medical errors exponentially. This study determined interprofessional EMS handover expectations that could potentially result in the improvement of overall communication and the avoidance of communication related errors.

Second, there are at least 24 different handover mnemonics to assist healthcare providers in remembering key details to convey during handover (Riesenberg, Leitzsch, & Little, 2009). The purpose of these mnemonics is to act as a structure for communicating patient information as well as a memory trigger for critical information;

however few of the mnemonics are directly applicable to EMS handover. The information produced in this dissertation offers a foundation from which a pertinent, structured EMS to ED handover can be developed.

This study can fill an important gap in EMS literature. Much of the recent EMS to ED handover research concentrates on handover information retention and loss (Scott et al., 2003; Benner et al., 2008; Meisel et al., 2010; Jensen, Lippert, & ØStergaard, 2013). At this time, there is no research available describing pertinent prehospital information necessary for the continuation of care. This inaugural handover study summarizes expert opinion of the core and provider specific handover elements necessary for safe and effective patient handover.

The lack of a structured EMS to ED handover can precipitate medical errors. Chaos theory aptly applies to the type of long-term consequences of substandard EMS to ED handover. Chaos theory is the sensitivity of a dynamic event to initial conditions. The primary example used to explain this sensitivity is Edward Lorentz's "butterfly effect." Lorentz, a meteorologist and early adopter of chaos theory was conducting an experiment in which he made an inadvertent change. In his weather experiment calculation, Lorentz shortened a 6-digit data entry number by 3 decimal points. His assumption was that leaving off 3 decimal places would have a benign effect on the experiment. However the change resulted in a drastic alteration in the final outcome. Lorentz began using the term "butterfly effect" to illustrate how the smallest changes (e.g. the mere flapping of a butterfly's wings in South America) to the initial conditions may have profound consequences later (e.g. a hurricane in the United States) (Wheatley, 2006). Application of chaos theory in EMS to ED handover is seen when the smallest change or loss of

information regarding prehospital treatment interventions leads to the profound consequences of treatment duplication, care delays, and rising healthcare costs.

Assumptions

This study made the following four assumptions:

- The Delphi methodology was the appropriate research technique to obtain expert opinion on EMS to ED patient handover;
- The participants are highly capable healthcare providers;
- The participants are active healthcare providers taking part in EMS to ED patient handover; and
- The participants completed the survey in a distraction free environment.

Limitations of the Study

This study sample included emergency care professionals from urban and rural emergency departments and EMS agencies. Each ED and EMS professional has varying degrees of expertise and experience. The varying experience levels among the members of the Delphi group are a limitation. For instance, providers may assess patient clinical presentations differently depending on their individual clinical experience and resource availability. Exposure to large volumes of critical patients desensitizes some providers to acuity levels associated with the Emergency Severity Index (ESI) triaging tool. For instance, a rural ED physician may believe a patient is critical and needs transfer to a hospital with significantly more resources however the physician at an urban teaching hospital may see this same patient as acute but not emergent or urgent. Therefore the Delphi panelist's experiences and practice locations can impact their assessment and professional expectations of the EMS to ED handover.

Distractions and interruptions play a major role in sentinel events (Chisholm, Collison, Nelson, & Cordell, 2000). Distractions such as transferring the physical care of a patient often occur simultaneously to EMS prehospital care information handover (Laxmisan et al., 2007). The number of competing tasks seeking the practitioner's attention also distracts from EMS patient handover. This study required subject matter experts to review five case studies and determine which core items are necessary for EMS to ED patient care handover. During the survey the presence and volume of distractions of the Delphi panelist were unknown.

Key Terms

Emergency Department: The area of a medical facility or hospital dedicated to the treatment of acutely ill or injured patients.

EMS Handover: The act of releasing care from the prehospital care paramedic to an ED care provider.

Emergency Medical Services: A local, regional, national or international system of prehospital acute medical or trauma care. It includes all aspects of out-of-hospital care and transport of patients.

Emergency Medical Technician (EMT): An entry-level prehospital care provider who has received basic training in the emergency care of patients.

Emergency Severity Index (ESI): A five level triage tool to determine the acuity of patients presenting to an ED. Nurses use their assessment skills to determine acuity of patients and the anticipated number of resources necessary for treatment.

First Responder: A non-medical person trained in first aid; the initial person responding to a scene. It is typically a firefighter or police officer.

Paramedic: The most advanced prehospital care provider who has received training in advanced emergency care of patients. Training includes completion of an Associates or Bachelors Degree.

Organization of the Study

The remainder of this paper is set out as follows. Chapter Two provides a literature review identifying previous studies involving handover. Chapter Three outlines the method for collecting answers to the research questions. Chapter Four provides the results of the research. Section Five discusses these results, identifies implications for future research, and concludes the paper.

Chapter Two: Review of the Literature

The purpose of this study was to determine interprofessional expectations of EMS to ED handover content. To date, much of the specific EMS to ED patient handover literature focuses on handover content. This literature review includes the emergency care environment, safety implications, handover barriers, communication methods, and handover content. Figure 1 provides a conceptual framework for reviewing the current literature in order to build a case for the proposed study.

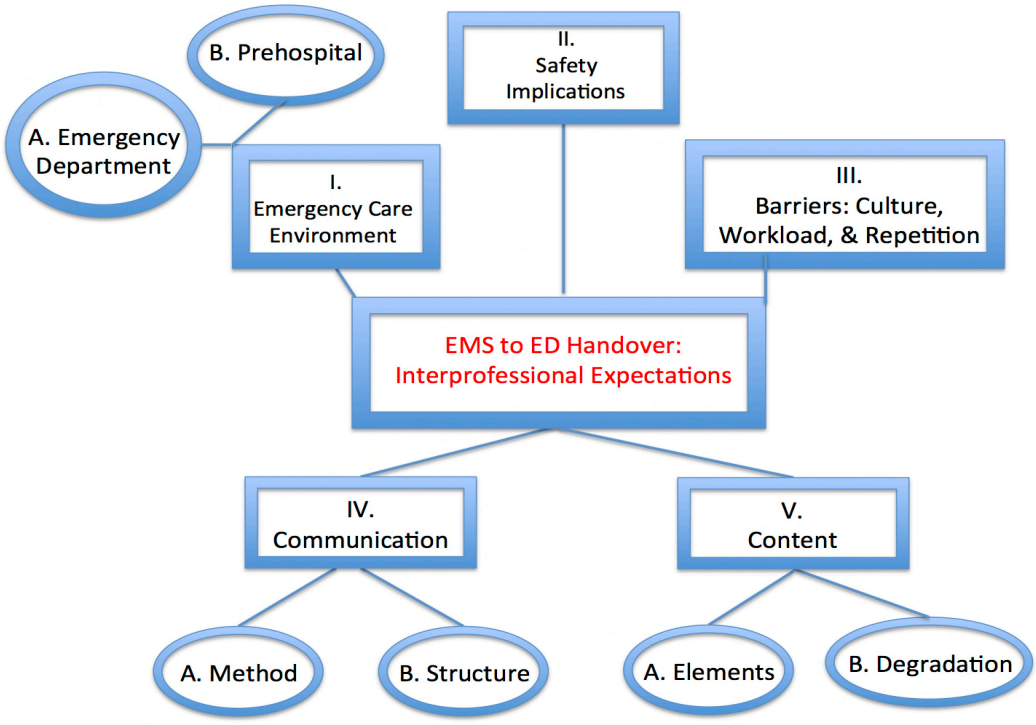


Figure 1 Conceptual Framework for Literature Review

Emergency Care Environment

The emergency care environment consists of prehospital care and the ED. The purpose of handover is to convey what has happened in the prehospital setting to the staff in the ED. Several studies describe the environment and identify inherent characteristics that influence EMS to ED handover.

Emergency Department.

The ED environment can be characterized as fast-paced, dynamic, and chaotic. EDs are also synonymous with unscheduled care, unavailable patient history, unpredictable patient presentations, and overlapping patient care duties (Beach, Croskerry, & Shapiro, 2003). In addition, ED patient handovers occur among care providers with varying experience levels, roles, and knowledge in a high-pressure environment.

High-risk industries such as aviation, firefighting, and the U.S. Armed Forces, have incorporated team training to address communication failures. Team training enhances team dynamics, improves message transmissions, and eliminates preventable errors (Hamman, 2004; Sundar et al., 2007). As a result of successes in these other industries, the medical field has embraced team training programs as a solution to communication related medical errors (Clancy, 2006). The philosophy in team training programs is simple; teams make fewer mistakes than individuals. Although team training has been successfully implemented in a variety of industries, the complex environment and communication needs of an ED require giving careful consideration to added stressors such as patient volume, in-patient bed readiness, and availability of resources. Therefore implementation of team training is not a panacea for all communication issues.

There are substantial communication requirements in EDs. Coiera, Jayasuriya, Hardy, Bannan, and Thorpe (2002) performed an observational study to quantify the types of communication patterns of ED physicians and nurses. Twelve participants, six ED nurses and six ED physicians were observed. The subjects either worked in a rural ED or a large urban teaching ED. Researchers followed participants during a variety of shifts including morning, afternoon, or evening. Field documentation and conversations were analyzed to determine the types of communication ED professionals engage. Coiera et al. (2002) defined a communication event as the transmission of information from one person to another through a communication channel. Several types of formal communication channels including entering text in medical records, receiving test results, and reviewing medical literature were included in the analysis. Informal channels included in the analysis were telephone calls, face-to-face conversations, pages, whiteboard use, and email.

The researchers spent 35 hours and 13 minutes of monitoring observations resulting in 1,286 separate communication events. Their analysis determined the group as a whole engaged in an average 36.5 communication events per hour. The physician group engaged 33.6 events per hour while the nursing group engaged in 39.8 events per hour. Further review of the data shows the research participants were engaged in two or more overlapping communications 10% of the observation time. The researchers found 30.6% of all communications were categorized as interruptions. Physicians encountered more interruptions (33.3% of communication events) compared to nurses (28% of communication events). These interruptions are concerning as interruptions negatively impact memory and lead to errors (Parker & Coiera, 2000).

The majority of ED communications (94.8%) were conversations among clinical staff. The most frequently used communication method, face-to-face conversations, were present in 89% of events. Informal communication channels represented 92.4% of nursing communications and 86.6% of physician communications. Formal channels were less frequently relied upon (10.4% for nurses; 14.2% for physicians). This research illustrates the substantial reliance on informal communication techniques and reinforces the importance of determining verbal handover expectations during EMS to ED staff face-to-face interactions.

Noise is a confounding environmental factor influencing communication in the ED environment. Excessive noise levels contribute to high blood pressure, high heart rates, and poor sleep quality in patients (Welch, Cheung, Apker, & Patterson, 2013). Therefore the World Health Organization (WHO) recommends noise levels not exceed 40 dB for patient care areas. Noise has staff repercussions as well. In terms of staff performance, noise levels > 77 decibels (dB) are associated with a reduction in short-term memory and cognitive ability (Murthy, Malhotra, Bala, & Raghunathan, 1997). Orellana, Busch-Vishniac, and West's (2007) study of the Johns Hopkins Hospital ED looked at the noise levels in the triage, urgent care, central nursing station, general treatment area, and critical care rooms. At the time of the study the Hopkins ED measured approximately 18,500 square feet and saw 59,000 patients per year. The results found ED noise levels in all areas varied with the low and high ranges for all ED areas from mid-40 dB to a high of low-90 dB. Average noise ranges for all ED areas studied were 65-75 dB. Investigators also found noise averages were consistently 5-10 dB higher than in-patient areas. In addition there was no time of day variation in noise levels in the ED; results

demonstrated noise levels were consistent during the 24 hours of recordings (Orellana et al., 2007).

Noise levels can impact ED communication in three different ways-omission, ambiguity, and overall volume (Vincent & Wears, 2002). Excessive noise levels can lead to distractions or interruptions thereby contributing to communication omissions. These same excessive noise levels work in tandem to distort a sender's message. This distortion can result in communication ambiguity. For example, an EMS handover may include the trauma patient did have a loss of consciousness however due to excessive noise levels, information can be misconstrued and receiving staff may hear the patient did not suffer a loss of consciousness. This one detail can influence the patient's plan of care. Lastly is the overall volume's influence on the ED provider. As previous research as shown (Murthy et al., 1997), high decibel levels can impact recall of information, short-term memory, and overall cognitive function.

Welch et al. (2013) also found nurses and physicians have different communication needs. Regardless of the size of the ED, nursing staff primarily relies on spoken communication. Nursing uses face-to-face conversations and telephones for much of their communication needs whereas physicians may use both spoken and written techniques to communicate. Especially with the adaptation of Computerized Physician Order Entry (CPOE), technology has greatly impacted physician communication techniques.

Fluctuating patient volume demands, interruptions, and high acuity levels contribute to the ED environment as a whole. While clinical staff is unable to control patient volume or acuity, ED workflow interruptions can be reduced. Interruptions are

well integrated into the course of daily ED work; so much so that ED clinical staff have incorporated in-patient practices that are known to prevent interruptions. For example, techniques such as No Interruption Zones, Computerized Physician Order Entry (CPOE), and Speak Aloud when programming infusion pumps have been implemented to prevent errors related to interruptions (Prakash et al., 2014).

Chisholm et al. (2000) researched the number and types of interruptions EM physicians face in their daily work. Three different EDs, a 32-bed urban teaching hospital, a 22-bed suburban hospital ED, and a 12-bed rural hospital ED were the sites for this investigation. The study consisted of a time-motion 180-minute observation period along with task-analysis inquiry. The authors created their own data collection form to log tasks performed as well as physician interruptions. Chisholm et al. define an "interruption" as any event that required the physician's attention but did not require redirection away from their current task. A 'break-in-task" was an event requiring the physician's attention for more than 10 seconds as well as requiring a change of work from their current task.

The 30 EM physicians who participated had an average of 5.9 years of experience and 100% were American Board of Emergency Medicine diplomates. The study found the mean number of interruptions per observation period was 30.9. Additionally there were a mean number of 20.7 break-in-tasks per observation period. Physicians saw a mean total of 12.1 patients in the 180-minute observation periods with a mean of 5.1 patients managed simultaneously. The volume of interruptions ($r = 0.63$; $p < 0.001$) and break-in-tasks ($r = 0.56$; $p < 0.001$) were positively correlated to the volume of patients managed simultaneously.

The investigators conclude EM physicians have become accustomed to working in an interruption prone environment. While the study did not investigate the outcomes of the interruptions, it does demonstrate the increased interruption rate seen in a variety of ED facilities. This work highlights the volume of EM physician interruptions and calls attention to the potential risk for ED patient medical errors.

Similarly, Kosits and Jones (2011) completed a descriptive study of the rates and types of interruptions faced by ED nurses. The study was completed in three academic medical center EDs with a total patient volume of 210,000. A convenience sample of ten registered nurses from each ED (for a total of 30 nurses) was observed for the study. The nurses represented all shifts (day, evening, and night) and each academic ED. Each nurse was observed for 2 hours.

After a literature review, an interruptions data collection tool was developed and observed interruptions were then placed into two categories: communication and self. A communication interruption was the result of the need for face-to-face, phone, or paging system messaging whereas a self-interruption is when a nurse interrupts their activity to do another. Face-to-face communications accounted for 95% of the observed interruptions with nurses frequently interrupting other nurses. During 60 observation hours, 200 interruptions were witnessed resulting in an average of 3.3 interruptions per nurse per hour. The rate of nursing interruptions ranged from 2 to 12 per nurse. Researchers found the most interruptions occurred during the evening shift.

The activity most interrupted (37% of the observations) was documenting in the medical record. Medication-related tasks were the second most interrupted activity at a rate of 27.5%. Interestingly the authors report handover communications interruptions

were considerably less at a rate of 3.5%. As a result, the recommendations from this study focus on creating ED areas for medication preparation free from interruptions. In addition, the authors suggest regularly scheduled interdisciplinary huddles to improve overall communications and reduce interruption intervals.

Of note, nursing handover is seen as laborious and thus actual content can be variable (Klim, Kelly, Kerr, Wood, & McCann, 2013). The ED nursing environment has intrinsic characteristics such as a higher number of nursing interventions per patient, rapid changes in patient stability, and an accelerated time between arrival and disposition when compared to the traditional in-patient unit. ED care requires all health care providers be cognizant of the competing demands such as changing patient statuses, provider availability, and departmental resources.

Every patient care area in a hospital faces its own sets of stressors. Investigators sought to gain better insight into ED stressors by studying ED staff in a London, England, United Kingdom (U.K.) teaching hospital ED, which has an annual volume of 98,000 patients per year. Flowerdew, Brown, Russ, Vincent, & Woloshynowych (2012) used semi-structured interviews, to garner the opinion of ED physicians and nurses with a range of ED experience. Respondents were asked about specific perceived work pressures, individual response to work pressures, impact of pressure on team member behaviors, and possible pressure reduction strategies. Twenty-two volunteers, 16 physicians and six nurses responded. Sixteen of the 22 participants cited the United Kingdom government target of a 4-hour ED length of stay (ED arrival to admission or discharge) as the most stressful aspect of their work. The overall workload, staff shortages, ED teamwork issues, and hospital teamwork problems round out the top five

staff stressors.

Investigators identified pressure-induced behavioral changes related to communication, departmental oversight, and staff leadership issues. The interviews described a reduction in dialogue among team members during high-pressure days. Junior physician staff was more likely to work independently requesting less oversight or input from senior physicians. This was attributed to junior staff perceptions that senior staff members were irritable or distant. Five of 22 respondents admitted to terse communications with other staff members and seven of 22 admitted to shortening their interactions with patients as a result of ED pressures.

Periods of high pressure resulted in more administrative oversight and increased concerns regarding the impact of hospital status has on the ED. In addition senior physician staff found themselves less likely to oversee direct patient care. Instead these physicians were more attentive to inpatient bed availability, staffing issues, and hospital status.

High-pressure days also impacted how senior staff members directed department workload. This workload management ranged from checking in more frequently with junior staff, prompting development of patient care plans, and senior staff avoidance of teaching commitment. The study reveals some providers admitted to slowing down their performance and refusing to see additional patients until workloads could be reduced.

This study discusses staff opinions about easing ED stressors. Of particular interest were respondent attitudes about self-control. Seventy-three percent of respondents stated keeping one's composure under pressure was a necessity to dealing with departmental stress. In other words, staff should be able to manage their own stress

levels and not let personal stress affect co-workers. Respondents also cited improvements in ED leadership and teamwork behaviors as potential solutions to work pressures. Lastly, 55% of staff described the improvement of task-sharing behaviors could reduce ED pressures.

The determination of the root causes of ED to in-patient admission transfer failures was completed by (Horwitz et al., 2009). The authors questioned 139 respondents including physicians, physician assistants, hospitalists, and internal medicine house staff members about their experiences with adverse events or "near misses" related to inadequate handovers. Using qualitative methods, participant's answers were coded, sorted, and analyzed by three researchers to develop an understanding of the vulnerabilities in ED to in-patient handover. Inter-rater reliability was assessed using the kappa statistic. The score for the three researchers was k>/= 0.7 on all but one data regarding information not communicated and failed transfer results.

Forty or 29% of the respondents had patients with a medical mishap after ED to in-patient transfer. The 36 mishaps included 36% with diagnosis errors, 39% had treatment issues, 36% with incorrect dispositions. Physician respondents described six cases of patient's requiring care upgrade to the intensive care unit.

Of the uncovered vulnerabilities-communication, environment, information technology, patient flow, and responsibility allocation-communication was a chief component of many of the reported mishaps. The omission of a recent set of vital signs in 10 of the 36 disclosed errors (28%) were the most common communication error cited. Omissions or inaccuracies at any time is concerning for their potential to influence down-stream care.

An additional communication vulnerability discussed is group affiliation. Dealings between physician groups are an opportunity for potential in-group/out-group bias. Internal medicine physician respondents voiced their concern regarding ED physician diagnosis abilities, overall judgment, and professionalism. Hospitalists and Internal Medicine physicians (in-group) stereotyped ED physicians as lacking thoroughness and having a propensity for misdiagnosis. Lastly, this type of in-group membership has particular expectations about diagnosis certainty and correct management of out-group participants.

This study found potential for improvement in interpersonal communication. First, nurse-physician communication was rare suggesting that increasing interdisciplinary communication would improve patient care. Secondly, there was a lack of ED notification about down-stream, internal medicine discovered errors, omissions, or concerns. Consequently ED physicians lose the opportunity to correct misconceptions or learn from poor outcomes. Ultimately, the study revealed respondents had contradictory expectations about handover content.

The ED environment is fast-paced and exciting. It is also vulnerable to stressors and communication breakdowns. The generation of interprofessional handover expectation should improve the safe transition of patients from prehospital to emergency care.

Prehospital care.

Paramedic responsibilities focus on scene management, patient assessment, patient care, and transport (Price, Bendall, Patterson, & Middleton, 2013). In terms of paramedic transition into a profession, there are four major hurdles to address: shifting

from vocational to baccalaureate/graduate education, transitioning into an acknowledged profession, expansion of role and scope of practice, and extending clinical oversight of care. This shift towards becoming a recognized profession has resulted in a substantial growth in prehospital care literature over the last two decades.

Prehospital care environments differ from one emergency call to the next. EMS requests for service range from austere environments, to residences, office buildings, and major roadways. It is important to note EMS environmental information can be relevant to the patient's ED care. EMS handover is generated from patient assessment, treatment given, responses to therapy, as well as the scene environment. Upon arrival at the ED, paramedics determine what information is pertinent to communicate to receiving ED staff.

People access prehospital care for their illness or injury at different rates. Jacob, Jacoby, Heller, and Stoltzfus (2008) analyzed the clinical and demographic information of ED patients arriving by EMS and by other means. The study took place at a community teaching hospital ED seeing approximately 57,000 patients per year. There are forty-five paid and volunteer ambulance services caring for and transporting patients to this hospital.

The researchers questioned 311 consecutive, consenting patients about their choice or non-choice of using ambulance transport, knowledge of ambulance costs, and self-perception of the severity of their illness. The researchers accessed medical records to obtain insurance status, chief complaint, triage rating, and discharge diagnosis. The ED physicians were asked about the consented patient's need for ambulance transportation, discharge diagnosis, and ultimate disposition. The consented patient arrivals were

representative of day and night shifts along with weekday and weekend hours.

One of the 45 ambulance services in the community transported 71 of the 311 patients or 22% to the ED. Of this patient population, ambulance users were more likely to be older with an average age of 53 versus non-users age 35 ($p < 0.0001$). The ambulance users also had higher triage scores (average of 103) versus non-users (average 156) with $z=-4.40$, $p < 0.0001$ as determined by a nonparametric Mann-Whitney rank sum test. A chi-square test ($\chi^2(1, 309) = 17.51$, $p < 0.0001$) demonstrated that ambulance users were more likely to be admitted (average 37.3%) versus non-users (average 14.5%).

When reviewing the reason for ambulance use, 46.4% of users advised another person called an ambulance for them, 18.3% advised they were "too sick" to use an alternative method of travel, 9.8% had "no other way" to get to the ED. Categorization of ED patient rationale for non-use included: 53.7% indicated they were "not sick enough" to warrant prehospital care, 21.2% had someone to bring them to the ED, while 9.5% admit they "could not afford" ambulance transportation. There was no statistical difference ($p < 0.925$) in the insurance status between ambulance users and non-users. Ambulance users presented similarly to day (22%) and night shifts (21.2%). The five most frequent chief complaints among ambulance users included pain/injury (35.2%), trauma (23.9%), respiratory (18.3%), neurologic (12.7%), and gastrointestinal/genitourinary/reproductive (11.3%). The most frequent chief complaints of the non-users was pain/injury/trauma (33.3%), non-cardiac pain (29.2%), gastrointestinal/genitourinary/reproductive (20%), ears/eyes/nose/throat (11.3%), and respiratory (9.6%). Lastly, physicians approved of the ambulance usage in 68% of the user group and 92% of the non-user group. Ultimately the researchers found EMS

patients were older, sicker, and choose to use prehospital care appropriately.

A 2010 CDC survey found 16.3% of ED patients arrived by ambulance (CDC, 2010a). However, many including receiving ED staff, EMS administration, and insurance providers scrutinize the medical necessity of these EMS transports. Weaver, Moore, Patterson, and Yealy (2012) reviewed National Center for Health Statistics (NCHS) data from 1997-2007 to determine trends in medically necessary and unnecessary EMS transports.

Medically necessary EMS transports were defined using a 2006 study where 5-board-certified physicians created an algorithm based on the International Classification of Diseases, Ninth Revision (ICD-9) and ICD-9 Clinical Modification listings. This algorithm was applied to the 1997-2007 NHAMCS data sets to determine medical necessity for EMS transport (Patterson, Moore, Brice, & Baxley, 2006). Additionally patients requiring hospital admission were deemed as medically necessary as suggested by the Neely Conference Criteria for Medical Necessity in EMS regardless of algorithm assignment Cone, Schmidt, Mann, & Brown (2004).

Similar to earlier reported studies, most medically necessary EMS transports were for patients with a mean age of 54 years. Interestingly, insurance coverage among medically necessary EMS transports fluctuated significantly over the survey period with Medicaid representing approximately 12% in 1997 to 27% in 2007. The diagnoses of the medically necessary EMS transported patient population also remained relatively constant over the survey period. In 1997 the top four medically necessary EMS treatment and transported diagnoses were chest pain (5.1%), congestive heart failure (3.5%), syncope (3.4%), and seizures (3.3%). In 2007 the top four diagnoses were chest pain

(4.4%), syncope (3.8%), abdominal pain (2.8%), and seizures (2.4%).

Weaver et al.'s (2012) results found ED visits increased over the 10-year survey period from 95 million visits in 1997 to 119 million visits in 2007. However, the proportion of EMS transports remained constant at approximately 16% of all ED visits. This information can be extrapolated to mean the volume of EMS to ED patient handovers will continue to rise.

Many patients choose ambulance transport and prehospital care believing this will eliminate long waits in the ED. In fact, an analysis of NHAMCS data found EMS transport of patients with certain chief complaints do have shorter wait times for evaluation by an EM physician (Richards, Hubble, & Crandall, 2006). Richards, Hubble, and Crandall (2006) reviewed the 1997-2000 NHAMCS data that included 61,130 records, weighted to reflect 268.3 million ED visits. For this group of records, EMS transports represented 14.4% of ED patients.

Further review of the EMS transported population by triage category revealed the majority of patients were triaged as emergent or requiring physician evaluation within 15 minutes. The most frequent category for walk-in patients was urgent or requiring evaluation within 15-60 minutes. In their review of wait times for all triage scores the mode of arrival did impact median time to be seen. The analysis revealed patients arriving by ambulance had the shortest wait time (14.1 minutes, range 4.3-34.2 minutes) to be seen by a physician versus walk-in patients (26 minutes), public service arrivals (27.8 minutes), or unknown method of arrival (29.3 minutes).

Lastly, the researchers determined the data set demonstrates arrival by ambulance is a strong predictor of hospital admission and critical care admission. Regardless of

triage category, patients arriving by ambulance had an overall higher admission rate of 33.7% vs. 8.9% of walk-in patients. This information suggests patients who receive EMS prehospital care are more likely to be sicker, will be admitted and therefore will require a thorough interprofessional report to ensure a safe handover.

EDs divert incoming ambulance patients to reduce overcrowding thereby improving the time waiting room patients are seen by EM physicians or mid-level practitioners. To gain insight into the patient population ambulance diversion impacts, Squire, Tamayo, Tamyo-Sarver (2010) studied the demographics and characteristics of ED patients arriving by ambulance. The researchers initial assumptions were ambulance users were from lower socioeconomic classes, racial minorities, elderly, or uninsured.

The study used National Hospital Ambulatory Medical Care Survey (NHAMCS) data from 1997 to 2005. The NHAMCS is administered by the National Center for Health Statistics. It uses a multi-stage probability sampling procedure to select counties, then hospitals, and finally emergency service areas. During the survey years of 1997-2000 and 2003-2005 between 352 and 406 representative EDs completed the surveys. A total of 192,546 ED patients had a documented mode of arrival to the ED with 30,455 or 15% of patients arriving by ambulance and 162,091 or 85% arriving by walk-in or self-transport. Of note, transferred patients, those with unknown arrival methods, and police/public/county transports were excluded from the patients reviewed for this study.

When analyzing the entire population, there was not a statistically significant association between ambulance use and race/ethnicity. The breakdown of ED arrivals by ambulance and insurance type found 34.1% of EMS patients had Medicare, 14.4% uninsured, 12.9% had public insurance, and 10.8% had private insurance. Age was also a

factor in ambulance use. The data showed 72% of ambulance use was by patients age 65 years or greater.

The analysis of the entire sample population found 57% of critically ill patients arrived by ambulance whereas 43% arrived by walk-in or self-transport methods. Critically ill patients were defined as those ED patients admitted to the ICU, transferred to the operating room, transferred to the cardiac catheterization laboratory, requiring advanced airway management (intubation), requiring cardiopulmonary resuscitation, or those who died in the ED. Descriptors of the critically ill, ambulance user population found these patients were more likely to have Medicare insurance, public insurance, or uninsured altogether. In addition the study found critically ill Latino patients were less likely to use ambulance transport (45%) than other races.

Squire et al.'s (2010) study found patients with Medicare and patients older than 65 years rely heavily on ambulance transportation to EDs. This is a significant finding considering the proportion of this patient population is steadily increasing; ultimately accounting for 20% of the total US population by 2030 (Kinsella & Phillips, 2005). These results, in addition to the disproportionate use of ambulance transportation by critically ill patients support the imperative of improving EMS to ED patient handover.

The prehospital care environment creates challenges for accurate patient assessments as well as crew safety. Specifically, vehicle designs differ while applicable safety mechanisms may be difficult to operate or nonexistent. In a review of 466 ambulance accident from 2007-2009, paramedics sustained injuries in 358 (Sanddal, Sanddal, Ward, & Stanley, 2010). The fatality risk is two and a half times higher for EMS workers than other American workers; with the overwhelming risk (approximately 74%)

is associated with ground ambulance accidents followed by cardiovascular/strokes (13%) and assaults (11%) (Maguire, Hunting, Smith, & Levick, 2002; Maguire, O'Meara, Brightwell, & O'Neill, 2014). The ground ambulance accidents included both crewmembers providing care, driving, and those crewmembers that were pedestrians struck while on an incident scene.

In their description of the EMS working environment, specifically ground ambulance transportation of ill or injured patients, Suserud, Jonsson, Johansson, and Petzall (2013) undertook a qualitative study to determine safety perceptions among ambulance crew members. The study took place in western Sweden where EMS crews consist of ambulance nurses and paramedics. Suserud et al.'s 2013 sample included 24 ambulance nurses and nine paramedics who participated in one of five separate focus groups. The EMS crews represented rural and urban service areas. The age range was 29 to 60 years old with a mean of 14.1 years of pre-hospital care experience and 11.5 years experience at ambulance stations. The interviews illustrated nine factors that impact care in the ground ambulance environment: planning before departure, safety belts usage, high speed driving, patient first, safety second, design and placement of equipment, noise levels, driving styles, family presence, and documentation requirements.

A multitude of factors contribute to a prehospital care environment that is intrinsically hazardous for patients and crewmembers. Communication is a component of five of the nine factors identified. Focus group interviewees described the need for pre-arrival crew planning, appropriate equipment design for radio communications, high noise levels preventing communication with patient and crewmembers, inter-crew communication in the presence of family members, and issues with information transfer

from scraps of paper into an electronic health record.

There is limited research on EMS noise levels. Pepe, J. Jerger, Miller, and S. Jerger (1985) sought to determine the hearing loss pervasiveness among EMS personnel and its association with job-related noise, specifically siren exposure. The study of 184 adult male firefighters took place in Houston, Texas where the Houston Fire Department provides EMS. Ages ranged from 21 to 59 years old and employment experience ranged from six to 436 months. The researchers were able to calculate the total career noise exposure for each firefighter based on personnel files, call records, and the type of service apparatus assigned.

Advanced Life Support (ALS) vehicles or ambulance siren sounds were measured in a variety of ways. The ambient noise of the area, a large parking lot of a sports arena was found to be 42-58 dB. The ambulance cab interior with a low idling engine and door windows up was measured at 95 dB and the same vehicle with windows down measured at 110 dB. Once the ambulance began to move noise levels increased 3-5 dB. Patient compartment noise levels were 8-10 dB lower that can be attributed to the location of the sirens. In this study Houston Fire Department ambulances had sirens mounted on to the roof of the front cab compartment.

Ultimately the researchers found the study participants had an increased rate of hearing loss (66%) compared to a control group of non-noise exposed men (11%). Specifically there was a marked increase in high frequency loss (18.5%) versus mid frequency loss (5%) in their "better ear." Additionally the loss of high frequency hearing in the "poorer ear" was 28.8% with long term siren exposure compared to mid-frequency loss (11%). Obviously hearing loss is a substantial barrier to interpersonal

communication, however as mentioned earlier, exposure to high levels of noise, such as siren noise also impacts the memory of care providers.

Despite the prehospital care literature growth, there is limited information regarding the origin of prehospital adverse events. Price et al. (2013) investigated factors and associated patterns involved with EMS adverse events. The study took place in a busy Australian ambulance service that responds to 1.1 million emergency calls per year. The service area, 800,000 square kilometers consists of rural and urban areas. The ambulance service employs 3400 paramedics who were asked to voluntarily participate in a survey regarding factors associated with near misses or medical mishaps. Because this survey was anonymous, paramedics were encouraged to submit and report on factors about incidents that may not have been reported previously.

A total of 370 adverse events were reported. The authors created a 12-question survey where participants could select any of 71 factors that contributed to their reported prehospital care mishap. The author's review of human factors literature identified 71 factors could be grouped into five domains: patient, scene, organization, workload, and paramedic. Each paramedic was asked to consider a previous patient scenario where something went wrong or a mistake occurred and attribute the identified factors in the survey or free text additional information as needed.

An average of 10 (range 5-15) associated factors were attributed to each reported incident. The severity of the adverse event was not associated with a specific volume of contributory factors. Interestingly, 63% of the incidents had not been previously reported to the Incident Reporting System (IRS) prior to the study. Many respondents (33%) admit to not reporting the adverse event out of concern for disciplinary action. Serious adverse

event outcomes were associated with eight distinct factors: deteriorating patient, uncertainty regarding patient condition or situation, paramedic panic, initial well-patient presentation, transition between low and high acuity cases, diagnosis uncertainty, patient with decreased level of consciousness, and atypical assessment signs and symptoms. In addition the study identified two patterns of error convergence and serious outcomes. The first pattern factors include: deteriorating patient, uncertainty regarding patient condition or situation, patient with decreased level of consciousness, failure in team communication, complex case presentation, rural environment, lack of resources, delay in needed resources, crew frustration, confined work space, and required use of rarely used skills or knowledge. The second most common convergence pattern included factors: initial well-patient presentation, diagnosis uncertainty, transition between low and high acuity cases, patient with decreased level of consciousness, atypical assessment signs and symptoms, patients with multiple co-morbidities, patient is a poor historian, poor communication between paramedic and patient, bystanders providing conflicting patient history, atypical patient condition or syndrome, poor caller data, call comes at end of paramedic's shift, and difficult bystanders.

While high risk factors were identified, the study could not determine if a certain factor order or presentation was associated with serious adverse events. Price et al.'s 2013 data reveal communication failures occur at an excessive rate, however they were not associated with serious outcomes. The authors proposed combining the communication related factors identified in the earlier eight distinct adverse effect factors does result in potential data loss and negatively impacts patient care.

Price et al. (2013) suggest methods to reduce prehospital adverse effects. The first

suggestion is training paramedics to manage uncertainty. This training would include Crew Resource Management courses in conjunction with simulation-based training where paramedics are given the opportunity to assess and manage complex patients in fluctuating circumstances in an educational setting. Secondly is the implementation of separate administration channels for managing incident reports. The creation of a "just culture" builds an environment where incidents can be reported with thorough investigations allowing for all contributory factors to be identified (Khatri, Brown, & Hicks, 2009).

The prehospital environment is synonymous with extensive hazard risks. In addition to these risks, stressful situations such as deteriorating patients and uncertain patient conditions were identified as factors related to serious prehospital adverse events. The handover process should include the communication of information and the reduction of safety risks. This study reinforces the need to reduce prehospital adverse events by eliminating communication breakdowns associated with EMS to ED patient handover.

Safety Implications

EMS to ED patient handover is a dynamic and complex process. It significantly impacts patient safety and delays in treatment. Thus far safety aspects found within EMS handover literature revolve around communication issues, information gaps, and health risks. Identification of factors impacting the culture of safety in EMS is essential to the overall improvement of prehospital care. Current literature illustrates the lack of a consistent safety framework in the prehospital community. Therefore EMS to ED patient handover research is a contribution to a culture of safety and the creation of an EMS safe

practice.

The JC developed NPSG in 2003 to assist organizations in identifying key patient safety areas. The NPSG guide accredited organizations toward efforts to improve overall patient safety. In 2006 improving patient handover became a NPSG following an increasing trend of handover related errors. A variety of health care organizations receive this safety guidance from JC. However EMS safety oversight is left to the EMS agency itself resulting in a wide variance in safety cultures across agencies (Patterson et al., 2010).

There is limited research about prehospital patient safety risks. A study describing staff perception of EMS agency safety culture identified the wide variance of safety attitudes and climates across 61 EMS agencies. A total of 1,595 front-line staff completed a survey to assess six categories of safety; these categories include safety climate, job satisfaction, perceptions of management, teamwork climate, working conditions, and stress recognition (Patterson et al., 2010). Staff members included paid and volunteer EMTs, paramedics, first responders, prehospital nurses, and EMS physicians. The study found diverse scores among respondents. EMS agencies with fewer employees, lower call volumes, and high volume of acute patient situations had higher safety climate scores. Analyses of respondents also showed paramedics were found to have the lowest positive perception scores in every safety category except for stress recognition. The authors demonstrate the ability to measure the culture of safety exists in the EMS community.

Zimmer et al. (2010) investigated the rate of unsafe acts and communication events that occur during an EMS patient encounter by examining German paramedic

practice using a simulation model. The study included the evaluation of 80 professional paramedics from Frankfurt am Main Fire Department and their performance on one of four randomly created patient scenarios. Paramedic demographics included eight women and 72 men having an average age of the 30.8 years and an average of 7.1 years of professional experience. Each team, consisting of two paramedics selected by lot, performed one of four of the randomly chosen pre-established scenarios. The pre-established scenarios were cardiac arrest due to ventricular fibrillation, bronchial asthma, pulmonary embolism, or multiple trauma. The paramedic team's actions were analyzed using a 72-point unsafe act checklist and a 20-point communication checklist. The unsafe act checklist used for this study was created and derived from German textbooks, European guidelines, and paramedic teaching plans. The researchers' communication checklist used "psychological insights" for its content. Each scenario began with an initial dispatch and concluded with a verbal patient handover to the emergency physician portrayed by a final year medical student with previous EMS experience.

The volume of unsafe acts varied depending on the pre-established scenario. The least number of unsafe acts (mean 4.0 +/- 1.6, confidence interval (CI) 3.0-5.0 and a median of 3.5, occurred in the pulmonary embolism scenario. Whereas paramedics in the multiple trauma scenario demonstrated the largest volume of unsafe acts (mean 9.3 +/- 3.2, confidence interval (CI) 7.8-10.7 and a median of 9.0. The most frequent unsafe acts seen in the multiple trauma scenario included patient history, physical inspection, and application of oxygen.

Twenty of the paramedics underwent communication training prior to participation in the simulation. Therefore these participant results were excluded from the

communication checklist analysis. The remaining 20-paramedic communication checklists undergoing analysis found only 53.7% verbally reported the care they delivered to the receiving emergency physician. In this simulation study the handover elements most commonly under reported during verbal handover was the patient's name, pain level, wound treatments, and positioning.

Zimmer et al. recommend several solutions to address the unsafe acts and communication issues identified in the study. First is the creation of a risk management program and instrumentation to identify potential unsafe act risks. Secondly is the endorsement of structuring care and handover by developing standard operating procedures. Thirdly was the recommendation of a comprehensive communication-training program to both identify unsafe acts early and improve ED verbal handover.

Studies on patient safety tend to focus on the negative consequences of lapses in communication. Research on emotional connectivity and recall found people are more easily able to recall critical or unfavorable events in greater detail (Kensinger, 2007). Many well-known catastrophic events have been linked in the media to communication failures (Challenger explosion, Eastern Airlines Flight 212 Crash, and the ValueJet Flight 592). However, communication failures have been linked to thousands of less well-publicized medical mishaps yearly (Sutcliffe, Lewton, & Rosenthal, 2004). A qualitative study of twenty-six residents in a 600-bed teaching hospital recalled 70 medical mishaps in the past three months. Of these 70 mishaps, 64 or 91% were linked to a communication failure. The most commonly reported contributor was the physician's lack of pertinent information that accounted for 30 of the 70 mishaps or 42.8%.

Overarching communication themes were found in each of the resident's

relationship with attending physicians, community practice physicians, specialists, and nurses. These themes included hierarchy or power differences, lack of communication, and mode of communication. Residents were able to provide evidence of distorted communication from each of these themes.

Once the researchers drilled down into the detail it appears relationship factors play a significant role in information exchange. Self-preservation, hierarchy and power are noteworthy contributors to communication failures. In this study, residents were reluctant to provide handover information that would have them appear ignorant or incompetent. In addition, residents would withhold their opinion if reporting information was in direct conflict with an attending's opinion or plan or care for fear of offending or worsening a relationship with a superior. These behaviors were instrumental in creating suboptimal patient management and medical mishaps.

However Sutcliffe et al.'s pivotal conclusion in this 2004 study was more than lack of information impacts communication. Furthermore, the complexity of patient handover points to the need for dynamic interventions to improve outcomes and prevent mishaps. The recommendations from this study included coordinating needed information exchange to the communication medium (verbal versus written handover) and implementing communication practice guidelines for structuring handovers.

The patient handover process is as diverse as each patient requiring it. In the process of studying safety in emergency care, Behara et al. (2005) undertook an ethnographic look at shift change handovers at five different EDs in the United States and Canada. The EDs represented different types of facilities including large, inner city, private tertiary referral center, and community practice ED. All of the facilities were

aligned with resident training programs; only one facility did not have residents providing ED care. In the course of their research, Behara et al. found each group had completely different methods of patient handover. Some handovers were at the patient bedside while others were in areas removed from removed from care activities.

Despite the extent of external variations, there were handover elements that were contiguous across all EDs. First, all patient handovers were two-way conversations; where oncoming providers sought further explanation or highlighted care omissions or inconsistencies. All of the observed handovers became joint creations where off-going providers and ongoing were active producers of the final handover content. Secondly, handovers also contained pertinent facts about the EDs as a whole including information regarding workflow as well as support services. Thirdly, all patient handovers were presented in a consistent order. Each ED provider started with a particular room or bed to prevent oversight of any patients. Interestingly, among all of the consistent factors in patient handovers, the researchers found all ED handovers were initiated and concluded by the oncoming provider. Patient handovers were dynamic and flexible. Influencing factors included the volume of patients requiring handover, pressing matters needing urgent attention, acutely ill patients requiring provider presence, and the amount of provider confidence or credibility each has in the other. The study did not elaborate on specific confidence or credibility characteristics that may enhance or stifle patient handover.

The ultimate product of Behara et al.'s work is a four-component framework for patient handovers. These components include the type of work handover requires, essential content, structural matters, and dynamic characteristics. Each of these

components includes subcomponents that enhance the overall handover framework. The type of work or process accounts for the level of difficulty and the safety hazards involved in an ED patient handover. Standardization was difficult with this patient group due to the dynamic nature of patient presentations. The authors ultimately conclude it is difficult to insert a one-size-fits all handover model in this handover population.

The authors reveal patient handover universally consists of essential content and the subcomponents of information, authority, and responsibility transfer necessary during patient handovers. This is of concern when ED patients are accepted for admission into the hospital, however care continues in the ED because either there is not an inpatient bed available or the admitting physician is unable to assume care. In addition the patient handover essential content subcomponent also includes the transfer of information related to expectations of the patient's condition, the strategy for care plan deviations, and patient information that is certain and what is tenuous.

ED patient transition also consists of three structural matters. These matters are volume of handovers required, similarity of handover participants, and the likelihood of the receiving provider dealing with the same patient again. For instance ED physicians can receive report from another ED physician (like) or ED physicians can receive report from paramedics (unlike). Like transitions often include multiple patients whereas unlike patient transitions typically involve a single patient. Like transitions can have safety implications such as shared misinterpretations where all handover providers misinterpret clinical information similarly. However safety issues in unlike transitions can have various misinterpretations between care providers. Behara et al. (2005) suggests structured, technology facilitated patient handovers would be useful in instances where

the probability of future provider interactions is low.

The last component of ED patient handover framework was the dynamic characteristics of each patient. The observed patient handovers would revolve around the need for ongoing interaction. Patients are classified as:

1. having straight forward issues with little need for future interaction
2. requiring observation prior to the progression of some clinical decisions
3. initial assessments have begun however definitive diagnosis is still uncertain
4. having complex and as of yet unknown plans of care.

These dynamic characteristics help oncoming providers understand the status of the department as well as future actions required for the patients received.

The conceptual framework in this study highlights the complex nature of the ED patient handover. Ultimately the Behara et al. 2005 study concludes ED patient handovers are highly diverse and therefore do not lend themselves to one solution to improve patient safety. Thus implying it is unwise to rely on a formal handover structure or information system to address the safety aspects seen in the complex ED environment.

Current research on the safety aspects of patient handover has covered many healthcare professions and many root causes. A study of physician intern handovers at an academic medical center concentrated on communication failures as the primary reason for adverse events or near misses. Arora, Johnson, Lovinger, Humphrey, and Meltzer (2005) interviewed internal medicine interns to analyze communication failures in patient handovers. Twenty-six individual interviews asked interns about adverse events or near misses from verbal and written handovers over the last month of call and the worst event related to a communication failure in the last year. Factors instrumental in

communication related errors or near misses include the failure to pass along critical information about a current patient problem such as medications needed, treatment required, or pending test results or consults. The intern interviews also found there were significant issues with the communication process they followed. For example written handovers included hand-written notes that were illegible or confusing. In terms of verbal handovers, they found a lack of face-to-face communication resulted in time consuming rework to determine the needs of the patient. The rework included re-interviewing patients who may or may not be aware of their plan of care, seeking out additional healthcare providers familiar with the patient, or potential reordering diagnostic tests or procedures.

This 2005 study included intern recommendations to improve patient handovers. Interns endorsed verbal handover preferences such as communication of anticipated events, transmittal of concise and pertinent information, and face-to-face discussions. Written handover content preferences included patient resuscitation status, active medical issues, initial assessment, and pending results. The intern's feedback offers a foundation for the researcher's suggestions of handover communication training, use of a "standard language," and a structured handover template. The authors readily admit the applicability of this information is limited by confounding system issues such as various institutional practices, workloads, interpersonal attitudes, and time constraints. However, the pertinence of improving communication strategies and techniques are applicable to the study of EMS to ED patient handovers.

Much of patient handover research investigates the effectiveness of a standardized handover tool or protocol. Manser, Foster, Gisin, Jaeckel, and Ummenhofer (2010)

developed and tested an instrument to analyze the quality of patient handovers. The testing specifically sought to determine what elements were necessary to ensure safe patient handovers. Their instrument was based on a review of prevailing assessment tools, interviews with three experienced healthcare providers, and field observations. The final handover quality assessment tool, containing 16 handover characteristics, was used to analyze 126 patient handovers in a tertiary care hospital. The handover events selected for observation include paramedic to ED staff, anesthesia to post anesthesia care unit (PACU) staff, and PACU staff to floor nurse. These areas were selected based on handovers in these environments often follow tight time-constraints and frequently have simultaneous processes occurring during patient handover. Using an exploratory factor analysis, the researchers found three factors associated with handover quality: information transfers, shared understanding, and working atmosphere.

Information transfer included the transfer of specific clinical information. Shared understanding focuses on team member's quest for thorough information exchange by engaging in refining questions. While the working atmosphere consisted of the relationship between the clinicians such as rapport, tensions, and respect.

The research team concluded it is possible to measure handover quality; their findings illustrate a safe and organized patient handover is reliant on more than a structured information exchange. Handover must incorporate human factors such as teamwork in addition to a degree of flexibility to ensure safe patient handovers.

Investigators in a European teaching hospital ED with an annual volume of 80,000 visits per year sought to illustrate the communication pathways of an ED patient population. Their study also included determination of vulnerable communication areas

with the ultimate goal of redesigning processes to improve overall patient safety. An ED patient flow and communication process map was developed beginning with EMS or by foot arrival and ending with the patient's physical departure for their in-patient bed. This mapping identified 21 discrete communication steps for patients arriving by EMS and 19 steps for patients arriving by foot.

The process map underwent a hazard analysis where each step was reviewed for ways communication errors could occur. Identification of hazards was accomplished by individually interviewing 16 multidisciplinary emergency team members (seven physicians, six nurses, one ED technician, one porter, and one receptionist). Each participant was asked to review the ED communication process map and identify potential issues at each step. Furthermore, each team member was asked to discuss in detail if the issue occurs regularly and observed severities. Once the interviews were transcribed and combined, investigators could identify specific issues or failure modes for each step. The results found each of the 21 communications steps had one to seven identified failures.

Each failure mode was given a hazard score by determining the frequency of reported occurrence (frequent, occasional, uncommon, or remote) and the severity (catastrophic, major, moderate, or minor). A hazard score analysis matrix assisted in merging probability (frequency) and severity into single hazard score ranging from 1 to 16.

The identified communication failures hazard scores ranged from 3 to 9. The three highest scoring hazardous communication steps were identified as EMS handover, abnormal lab result feedback, and in-patient physician handover. EMS handover to triage

or charge nurses had a hazard score of 9. The failure mode effect of EMS handover was concern for unrecognized critical patients and their receipt of a low acuity triage score. The other top communication failures, each having a hazard score of 9 were the lack of formal processes in relaying abnormal lab results and handover to in-patient physicians. The lack of a formal abnormal lab processes was found to delay timely interventions need for the ED patient population. The failure effect for in-patient handovers was the delay in assessing and caring for potentially critically ill patients.

A qualitative investigation of patient handover sought to determine the true influence of communication on ED safety. Eisenberg et al. (2005) collected data through direct observations, critical incident reports, and event histories to determine ED communication practices and the impact of these practices on patient handover. However the data analysis was primarily based on the structured observations. These observations took place at two teaching hospitals in the United States. The first site was an inner city environment whereas the second ED is in a suburban setting. Each was a Level 1 Trauma Center providing emergency care with EM residents and faculty. The urban ED served 110,000 economically and socially disadvantaged patients per year. The suburban ED site treated 65,000 patients per year.

Researchers participated in observations and unstructured interviews for 32 days. Observations included monitoring a variety of ED communication intensive areas and roles including triage, general care, charge nurse, and physician assessments and handovers. Once data analysis concluded, the primary objective was determining at risk communication processes. Eisenberg et al. found four specific ED communication activities that heavily influenced patient management and care. These activities included

triage, testing and evaluation, handoffs, and admitting.

Eisenberg et al. borrowed from Browning's 1992 theory of lists and stories to frame their conversation around ED communications (Browning, 1992). The theory explains how organizations use two types of transmission to communicate. First is the use of a list, grounded in facts and formulas, providing technical information and driving action. The physician's prescribed plan of care for the patient is an example of a list in the ED. The second type of communication includes the use of stories. Stories are the teller's perspective and interpretation. Patient stories are more emotional and integrate all aspects of the patient's health experience. Although open for interpretation, patient stories are the basis on which provider's determine initial plans of care. ED communication is an ongoing exchange between lists and stories.

The triage process relies on nurses to interpret patient stories and create an action plan. This action plan or list determines the next step of the patient's care; actions may include either returning to the waiting room or progressing to an open ED bed for further care. The triage nurse is also responsible for interpreting the EMS story and list. The triage process is susceptible to error due to the overall lack of patient health history, the heavy volume of patient presentations, and time pressures to quickly list and action the most pressing chief complaint from the patient's story.

The phase of ED care that includes testing and evaluation is a prime target for communication related safety mishaps. Safety concerns include the need for timely notification of abnormal test results to allow for provider determination of treatment requirements. In addition, there is a significant need to synthesize multiple health care provider interpretation of patient stories. Eisenberg et al. found hierarchy induced

communication issues most apparent during the testing and evaluation phase of care. Researcher observations included nursing conversations regarding the perceived inability to express concerns or objections with physician's care plans. This disempowerment struggle was equally as applicable to emergency physician residents and their reluctance to communicate with EM faculty or specialist consultants.

Multiple opportunities exist for safety lapses during ED patient handover. EM physician handover served two functions. The primary function of emergency physician and nursing handovers is the transfer of care and responsibility to the oncoming physician; the second function in these large teaching hospitals is the education of EM residents present for the information exchange.

Researchers found patient stories played a significant role in handover as well. Physician's classified patients as "having a good story" and therefore having a straight forward diagnosis and treatment plan to being "a work in progress" with the interpretation being that patient's story was complex and therefore substantial effort is still required to make a diagnosis. Complex stories can mislead physicians thus creating inaccurate plans of care.

Hospital EDs account for almost half of a hospital's admissions (Oster & Bindman, 2003; Pitts, Niska, Xu, & Burt, 2008). Actual hospital admission requires an accepting physician or in a large teaching facility an accepting service (i.e. general medicine, trauma, cardiology, etc.) This patient acceptance process relies on an EM resident or attending to relay the patient's story and action plan thus far. If patients are admitted but remain in the ED due to inpatient bed unavailability, they are vulnerable to becoming lost in the system. The admitting physician's orders may not be implemented

in a timely fashion or the patient is moved into a hallway awaiting impatient bed placement. Each of these cases identifies significant safety concerns for the now admitted ED patient.

Eisenberg et al.'s (2005) observations and data analysis led to a number of suggestions to improve the safety of ED patients. First is to gather as much background information as possible from EMS, nursing homes, assisted living facilities, or primary care physicians when possible. The researchers propose the acquisition of more background information enhances the accuracy of the first patient story to action list conversion. The next suggestion is to standardize consulting physician and ED staff communication. Third is the incorporation of some nurses in the physician rounds. The inner city ED found integrating nurses into physician rounds improves hierarchy related communication barriers. The researcher's fourth suggestion is the creation of triggers to ensure physicians have chosen the right care path. Fifth is an improvement in ED and hospital wide communication to ensure certain issues are not labeled as ED only issues when in fact they belong to the organization as a whole. Sixth, similar to other studies previously mentioned is handover education. These researchers recommend education should include the ongoing cognitive requirements of incorporating patient stories into action lists. Lastly is guidance for future health care research to include qualitative methods to generate robust descriptions of health care communications.

Identification of factors impacting the culture of safety in EMS and ED is essential to the overall improvement of prehospital care. Current literature illustrates the lack of a consistent safety framework in the prehospital community as well as the complexity of ED communication requirements. Therefore EMS to ED patient handover

research is a contribution to an overall culture of safety and the creation of an EMS safe practice. Yet no matter how much attention is directed towards safety, opportunities to improve are always present as new barriers arise within existing effective processes.

Barriers

Barriers to effective handover communication range from simple omission errors to ingrained interprofessional hierarchical boundaries. Welsh, Flanagan, and Ebright (2010) defined handover barriers as activities or events that decrease handover clarity or impeded comprehension. It is important to note nursing, physician, and paramedic providers have diverse communication foci supporting the need to determine interprofessional expectations in EMS to ED patient handover.

Haig (2006) identified handover barriers can be classified into three areas: culture, environment, and structure. Culturally, healthcare has retained its hierarchical form for many years. Although interprofessional team training has been sporadically implemented to improve hierarchical communication barriers, it is not a globally accepted practice. From the environmental perspective, interruptions, demands on time, social interactions, and noise contribute to handover barriers (Anderson et al., 2010; Haig, 2006). Structurally, handover is inhibited by data omissions, failure to obtain clarification, and underutilization of checklists.

Solet, Norvell, Rutan, and Frankel (2005) also suggest the message medium imposes a communication barrier. For instance, direct handover provides the verbal message as well as non-verbal cues. Reliance on EMS written documentation of prehospital care prevents receipt of a robust verbal prehospital handover.

Multitasking is also a barrier to handover communication. The safety risks of

multitasking are well established (Chisholm et al., 2000; KC, 2014; Laxmisan et al., 2007). For critically ill patients, paramedics often provide prehospital information exchange while receiving ED staff members are simultaneously assisting with the physical transfer of the patient to an ED bed. This multitasking example demonstrates how receiving ED staff members are asked to tax their memory capabilities during an EMS handover. Communication errors, such as the failure to recall important prehospital care elements given while multitasking, can lead to inefficiency, team tension, delays in care, resource wasting, patient inconvenience, or procedural errors (Lingard et al., 2004).

Information technology has become a staple in supporting healthcare communications. Prior to leveraging information technology to support prehospital information retention, Sarcevic and Burd (2009) performed an observational study to process map how paramedics provide trauma patient information to a Level 1 trauma center ED.

Although the researchers observed 50 resuscitation events, 18 trauma patient handovers were selected because they were videotaped and available for analysis. The first notable finding was the number of health care providers at each patient presentation. There was an average of four EMS crewmembers at each trauma patient handover. Although researchers were unable to tabulate the total trauma team members, they estimated "several dozen" were present.

Among the goals of the study were determination of how EMS crews conveyed information, the content reported at bedside, and what memory aids were used to capture and retain prehospital care information prior to arrival. ED staff members were observed to establish how EMS information is received and the type of follow-up questions asked

after initial handover were documented. In addition ED physicians and nurses were questioned about EMS information applicability and importance to later resuscitation efforts. The observations found the EMS to ED handover process was unstructured and typically followed a story telling pattern followed by a question-answer format.

The researchers interviewed an EMS educator to gain better insight into how EMS handover should be structured. The educator reported paramedics follow ATLS reporting guidelines, however in his opinion paramedics omit information they deem irrelevant or unnecessary at the time of handover. The study findings demonstrate EMS handover of trauma patient is divided and is occasionally given by more than one EMS crewmember. Researchers observed the first EMS handover as a briefing to the trauma team and lasted "several minutes." The second handover, providing additional details to the scribe, occurred while the trauma team began their patient assessment and necessary interventions. EMS crewmembers were noted to use scraps of paper as memory aids for patient information that were later transcribed into an electronic written document.

Divided EMS handovers are another example of multitasking as a barrier to effective handover. The scribe is listening and documenting additional EMS details while the trauma team is calling out assessment findings. The primary EMS crewmember was seen on multiple occasions answering questions from the trauma team while another EMS crewmember was giving detail information to the scribe. These instances of parallel processing resulted in divided attention and handover interruptions.

Interestingly, the researchers noted the trauma team seldom asked EMS crewmembers about the rationale for their care and treatments. In all 18 patient events, the trauma team did not ask for further clarity. This behavior inhibits both EMS crews

and trauma teams from gathering new information that could be pertinent to the injured patient's care.

The trauma team did ask EMS crews 77 questions in 18 resuscitations (4.3 +/- 2.8 per event). The five most frequently asked questions were: mechanism of injury details (n=19), name and birthdate (n=12), summary of events (n=9), vascular access (n=9) and on scene and en route vital signs (n=6). There were a total of 714 questions asked in 18 events with 19% (n=135) directly related to prehospital care. Of these 135 questions, 58 were prehospital care related and asked after EMS crew departure. After crew departure ED staff questions related to vascular access (n=18), patient history including allergies and home medications (n=10) and demographics (n=9). As previously mentioned, paramedics may have deemed this information as unnecessary or included in the written documentation and omitted it from verbal report. The authors did not differentiate if the information was present during review of the patient recordings. However they did report answers to the questions were typically provided by team members who remembered the EMS handover information or by accessing the EMS medical record.

Techniques are needed to reduce handover barriers caused by time pressures, interruptions, or the changing information needs of providers as patient care evolves. In the trauma patient population, Sarcevic and Burd (2009) illustrate trauma team members require different information at different times. The study results reveal an important finding; a one fits all EMS to ED handover model may be a challenge. Instead it may be necessary to differentiate handover content expectations as well as content presentation order.

Yong, Dent, and Weiland (2008) reviewed the usefulness of EMS handover

information, ED staff perception of handover techniques, and consequences of poor EMS handover. A quantitative questionnaire survey was administered to study participants receiving EMS patient handover. A trained observer monitored each EMS handover to record staff type receiving patient, completeness of handover, EMS pre arrival notification, information conveyed orally, handover interruptions, and staff attitudes impacting handover. After each handover, either the ED nurse or physician completed a questionnaire regarding EMS handover specifics. The EMS agency ethics committee did not approve questioning paramedics due to the time requirements required therefore only ED impressions of EMS handover were obtained.

The study had a 65% response rate with ED staff returning 51 of 79 questionnaires. Paramedic information was found to be relevant or very relevant in 94% of patients presenting with altered level of consciousness, 90% of trauma patients, 88% of chest pain complainants, 86% of substance intoxications, and 67% of behavior-related presentations. ED staff members were also asked to rate EMS information content usefulness. EMS report of presenting problem was found to be useful or very useful 49/51 (96%). Subsequent usefulness ratings included prehospital treatment 44/51 (86%), mental state 41/51 (80%), medications 38/51 (75%), physical assessment findings 37/51 (73%), and social history 26/51 (51%). These findings are intriguing considering Sarcevic and Burd (2009) reported ED staff often asks about this information once EMS departs. ED staff perceived 33 out of 49 (67%) EMS handovers did not present key information necessary for ongoing patient care.

Similar to other studies, repetition was noted in the Yong et al. (2008) study. Paramedic handover occurred twice in 91% of patients and three times for 3% of patients.

Triage nurses had to ask EMS for information clarity in 241 out of 548 (44%) patient handovers. The five most frequent elements in EMS handover information were: presenting problem (98.9%), vital signs (76.9%), past medical history (74.0%), current medications (46.4%), and prehospital treatment (44.5%). Regardless of reporting verbal and written handover information as useful and accurate in 80% of observations, ED staff only referred to written EMS documentation 50% of the time.

The researcher's results highlight limited paramedic handover to physicians. Of the 324 ambulance arrivals, nurses completed the bulk (52.7%, n=171) of post-handover surveys in comparison to physicians (6%, n=21). These results are indicative of another EMS handover communication barrier. Paramedics typically provide acute patient handovers to the receiving ED physician and nurses, while non-acute information is only given to nurses.

Disconnected EMS information flow is a barrier to effective handovers. Physicians rely on nursing staff to provide secondhand prehospital information. Bost et al. (2012) found EMS is responsible for 31.4% of ED presentations. Given the volume of EMS patients, physician receipt of EMS handover for this entire patient population is unreasonable. However identification of interprofessional expectations will aid paramedics in providing pertinent patient information to any and all receiving staff thereby improving retention of prehospital handover.

Paramedics and ED staff have differing perceptions of what aspects support and prevent effective prehospital handover. A qualitative study in Australia used semi-structured interviews of 19 paramedics, 15 ED nurses, and 16 ED physicians to ascertain each provider's perception of prehospital patient handover (Owen, Hemmings, & Brown,

2009). Individual participants were asked open-ended questions. As a result three distinct narratives emerged from the interviews.

First was the challenge of describing and understanding a patient's prehospital presentation. Citing their inability to understand paramedics' frequent use of "militaristic" type language, ED staff reported they would rely on non-verbal cues from patients to gauge the patient's true acuity. Interviewed paramedics expressed frustration with translating information such as mechanism of injury severity in the presence of the patient's not demonstrating or complaining of specific injuries.

As previously reported, Owen et al. also found multitasking to inhibit prehospital handover communication. ED staff asserted they often were unable to actively listen to handover due to competing tasks and demands. Lacking an understanding of the external demands of the paramedic, one physician participant suggested the only task the paramedic has upon arrival to the ED is to give patient handover. The physician went further to suggest it was the paramedic's responsibility to identify the care team leader and speak report loudly over the cacophony of voices to ensure their verbal handover was being heard. Paramedic participants voiced frustration with needing to give multiple handover repetitions at the request of different ED staff members. To prevent this repetition, paramedics reported they would strategically hold the patient on the EMS stretcher during prehospital handover; perceiving this action improved ED staff attention to handover.

The last narrative was communication fragmentation. The study identifies handover repetition and method as contributing causes of poor communication. All participants reported multiple iterations of prehospital handover resulted in lost or altered

information. Moreover ED staff reported paramedic handover was too verbose and lacked structure resulting in loosing staff attention.

This study's paramedic participants reported there is a lack of formal handover training and reporting format. Receiving ED staff participants endorsed their information retention would improve if EMS used a standard reporting algorithm. However it must be understood that interprofessional handover communication is more complex; it is complicated by a lack of understanding of other's language and responsibility set. Although this study's participants generally endorsed standardization to reduce prehospital handover barriers, they believed professional expertise and judgment should dictate handover format when necessary.

Data collected in a prospective, observational, task analysis study found gaps in communication between EMS, triage nurses and ED physicians. Fairbanks, Bisantz, and Sunm's (2007) study took place at a large, high-volume university medical center ED in the United States treating 93,350 patients in 2005. Ten ED staff (2 attending ED physicians, 2 senior ED residents, 2 junior ED residents, 2 registered nurses, and 2charge nurses) was observed in the 42-bed acute and critical care area along with 10 ED staff members in the 19-bed pediatric area. Staff members' synchronous and asynchronous communications were documented.

During 39 hours and 12 minutes of observation time of the 20 participants, 1,665 total communication events were recorded. The results showed an average of 49 communications per participant per hour. In addition, there was an array of communication associated with the charge nurse role indicating its importance to information exchange. The primary care nurse had communication linkages with all other

ED staff demonstrating another critical connection in communication.

The concerning finding of their study is the communication gap between EMS and triage nurses from the receiving physician or primary care nurse. The communication pathway documented illustrates EMS and triage information is exchanged secondhand orally or written. This pathway places a barrier between the primary emergency care providers and prehospital information.

EMS operations and staffing is dependent on its global location. For instance, Italian prehospital providers include physicians, nurses, and volunteer emergency rescuers. Di Delupis, Mancini, di Nota, Pisanelli (2014a) report Italian EMS operations and training lack standardization resulting in unsatisfactory prehospital handover to ED staff. These researchers implemented a communication tool called Identify Situation Background Assessment Recommendation/Responsibility (ISBAR) to evaluate prehospital handover to the emergency department triage nurse (Di Delupis et al., 2014b). The tool elements included patient identification, provider information, patient demographics, chief complaint, past medical history, current medications, allergies, provider clinical assessment including primary survey, illness severity, vital signs, working diagnosis, treatments initiated, and anticipated treatment plan.

The Di Delupis et al. (2014b) study involved observing 240 prehospital handovers. Rescuers performed 72% of the handovers while a combination crew of physician or nurse with a rescuer completed 28%. Ninety percent of all prehospital providers (rescuer, physician, or nurse) failed to introduce themselves when initiating handover. Patients were introduced by name 36% of the time. Reasons for ED care was communicated 62% of the time and 26% of all providers gave details about the patient's

prehospital clinical course. Allergies were presented 8.8% of the time. Prehospital assessment and treatments were sporadically reported at 33% and 35% respectively. Lastly, the ISBAR tool was complete in 2.5% of the handovers.

The researchers differentiated the providers into two categories: health providers (physicians, nurses) and other providers (prehospital volunteer or paid rescuers). Upon review findings demonstrated health provider patient handovers were more likely to cover the ISBAR tool elements. For instance, 94% of the health provider handovers included the reason for the emergency call and in 48% by other providers. As mentioned previously, prehospital care operations and education are not standardized in Italy. Therefore the lack of handover completeness can be ascribed to inadequate education.

The authors acknowledge the Italian volunteer rescuer system is not validated by the health care system. During the course of the study, participants voiced prejudgment biases against the other provider group. While the authors did not report specific comments or rates of bias, they concluded this bias negatively impacts the handover process by resulting in fragmented, partial, and disorderly information exchange.

An evaluation of EMS patient handover presentations completed at a 472 public hospitals in Queensland, Australia determined several factors inhibit EMS to ED handover (Bost et al., 2012). The researchers observed 38 handovers and interviewed 20 participants involved in EMS patient handover. The participants included: paramedic students (n=8), advanced care paramedics (n=22), intensive care paramedics (n=4), registered nurses (n=30), and physicians (n=10).

Bost et al. (2012) concluded four factors impact handover success: constant interruptions, workload, the transfer of care responsibility, and interprofessional

relationships. Constant interruptions leading to a need for content repetition was identified in this as well as other previously mentioned studies. Paramedics gave non-critical patient handovers to as many as three different ED staff members. In terms of handover location, the authors report EMS handover frequently occurred at the ED entrance ambulance ramp. Location and types of handovers ranged from giving information to the senior physician in the back of the ambulance to hallway reports to the charge nurse.

There is a correlation between workload, fatigue, and patient errors (Kuhn, 2001). The workload for emergency care providers is frequently exhausting and is intensified with ED overcrowding. When EDs are over capacity, EMS is unable to transfer patient care responsibilities. The participants of the Bost et al. (2012) study reported times when the receiving ED was at capacity, EMS patients waited in hallway queues for beds to come available. Often ED physicians performed quick assessments on these patients and ED nurses initiated treatments. However all of the survey participants advised the responsibility for bedside care for this patient population remains with the paramedic. Although the authors could not find official guidelines for this edict, ED and EMS study participants reported patient care responsibilities remained with the paramedics for as long as the patient was on the EMS stretcher. To give perspective on the wait times involved, one paramedic participant reported waiting 90 minutes to handover a patient. This example of workload and transfer of care responsibility stress on ED and EMS staff complicates even the simplest prehospital handovers.

When EMS handover takes place, study participants have found the giving and receiving of handover has been an on-the-job acquired skill. Observations of study

handovers found paramedics did not follow a specific structure, were frequently interrupted and were required to multitask. In addition there was segmentation of handover based on the patient's acuity level.

Bost et al. (2012) found patient handover and information sharing ease dependent on the working relationship between the ED staff member and the paramedic. Familiarity and previous work experiences either facilitated or inhibited EMS handover. Several ED staff members recounted times when EMS handover was assumed to be complete, only to discover later the initial presentation overlooked critical information resulting in patient care delays. Consequently these ED nurses and physicians report a lack of trust with all subsequent EMS handovers. Once barriers are managed it is important to provide consistent communication methods and structure.

Communication

The prehospital care environment is characterized as an ever-changing situation often hindered by weather, traffic, bystanders, noise, and fluctuating patient acuity levels (Slattery & Silver, 2009). Therefore EMS acquisition and communication of prehospital information is susceptible to message distortion.

Method.

Greenwood and Heninger's (2010) published case study of a trauma patient who died during transfer from a community hospital to a trauma center. The case was an investigation of a patient who deteriorated en route to the trauma center. The treating prehospital care providers, in this case two EMTs (one direct care provider and the other a driver) had multiple conversations and misunderstandings. The primary misunderstanding resulted in a failure to rendezvous with an awaiting paramedic unit at

an assigned location. Although advanced life support (ALS) interception was eventually made and care interventions took place, the patient became pulseless and apneic 3 minutes prior to ED arrival and ultimately died. The autopsy determined the patient bled to death from his open femur fracture. The poor communication was the basis for a lawsuit against the ambulance service. At the jury trial, significant attention was given to the delay in ALS care and the communication problems among crewmembers, dispatch, and intercepting ALS ambulance.

Greenwood and Heninger advocate for two structured forms of communication to reduce this distortion. First is a read-back process. This process includes active involvement in the communication, clarity opportunities, and loop closure communication. Verbal information is sent, received, and verified to correct distortions before message errors can lead to medical mishaps. The read-back process was deemed imperative during pivotal stages of any high-risk activity and when vital information is to be exchanged. In EMS operations, the authors suggest vital information include prehospital interventions performed, equipment settings, medications with dosage amounts, and location of illness or injury.

During instances when safe operations are at risk, a critical assertion strategy allows for any crewmember, regardless of rank to communicate concerns to the rest of the team. In the healthcare arena, silence in the form of absence of communication, failure to respond to requests, or quiet speech has been identified to cause risky situations. Greenwood and Heninger suggest the critical assertion strategy generates the expectation for all members to speak up to express their concerns about risky situations. These two structured communication techniques, read-back process and critical assertion

strategy would have potentially improved the communication in the earlier case discussion by ensuring ALS interception location was known by all responding parties.

In addition to continuity of care, EMS pre-arrival information results in ED resource allocation. For instance, EMS pre-arrival alerts of incoming critically ill trauma patients initiates staff response and resource allocation at Trauma Centers. Budd et al. (2007) identified improvement opportunities in trauma activation by surveying high volume EDs (over 50,000 patients/year) and all 32 ambulance services in England and Wales regarding method, content, and structuring of patient pre-arrival and bedside handover communications. In this study 39.4% of ED responders felt air or ground ambulance crews used a standardized structure when communicating trauma patient information. In contrast, ambulance crews responded they used a standardized structure 53.3% of the time. Most (56.8%) of the pre-arrival notification to receiving EDs was sent via a third-party ambulance control center. This method of communication prevents two-way dialogue and increases the probability of communication related content errors. The authors suggested several opportunities for improvement: creation of a trauma activation protocol, establishing a communication strategy to relay vital patient information, and adoption of a standardized handover format.

In their seminal paper, Thakore and Morrison (2001) were among the first to investigate EMS to ED handovers. ED medical staff and ambulance staff participated in a descriptive survey on handover quality in EMS patients arriving to resuscitation rooms. Specifically, medical staff was surveyed about ambulance staff handovers in multiple trauma, serious head injury, chest pain, self-poisoning, pediatric emergency, or cardiac arrest patients.

Thirty (64%) of ED staff and 67 (61%) of ambulance staff completed the survey; among the responding ambulance staff, 19.4% had previous formal handover training. Sixty-nine percent of the medical staff felt ambulance handover quality varied. Only 17% of the medical staff believed transfer of patient care was delayed by ambulance handover. From the ambulance staff perspective, 83.3% were certain of their radio report structure skill, 72.7% felt there was enough time to provide handover, and 24.2% believed medical staff listened to the EMS handover. The authors ultimately endorse the use of a uniform structure consisting of patient's history of precipitating events, pertinent physical exam, vital signs, and general medical condition to improve handover communication.

The ramifications of poor communication are disastrous in areas such as National Aeronautics and Space Administration (NASA), railroad operations, ambulance dispatch, and power plants (Patterson, Roth, Woods, Chow, & Gomes, 2004). An observation of these environments found workers employed 21 different handover strategies. The strategies found to improve organization and handover information transfer included: off-going staff members writing of a one-paragraph synopsis in the shift journal, incoming person evaluating the visual monitors prior to receiving shift report, a review of the previous shift's documents and electronically captured data, and shift handover is given by the person who had operational responsibility. Unfortunately the nature of EMS to ED handovers does not lend itself to these strategies.

Paramedics involved in the Jenkin, Abelson-Mitchell, and Cooper (2007) study used a hand-written patient report form to document care. When surveyed 80% of participants felt the form design was clear, 75% found the order of items understandable, and 59% believed the form did not have necessary information, and 53% found

information difficult to find. The authors also suggest handover repetition should be expected due to the volume of information delivered, competing demands on staff attention, and surge of adrenaline when faced with a critical patient. ED staff explained handover repetition occurs because further details of the patient's history, treatment clarification, and medication details are necessary. Interestingly the paramedic participants reported ED staff most often (47.3%) requested supplementary information about the social history of the patient. This element was not included in the list of previously discussed essential elements. In addition the authors suggest building national standards and guidelines containing specific handover content for paramedics and ED receiving staff. Lastly they recommend a 2-phase communication process to facilitate initial essential element handover followed by patient stabilization then ending with necessary but not time-critical information.

Structure.

EMS to ED handover occurs when a number of interventions must occur simultaneously. Research has shown once people exceed three concurrent activities, there is a decrease in task performance precision and speed (Halford, Baker, McCredden, & Bain, 2005). Studies on working memory found we are able to retain 7 +/- 2 pieces of information (G. A. Miller, 1994). Sohn and Doane (2003) found people supplement working memory task performance by tapping into their long term working memory and prior experience. The known retention of a limited number of handover elements and receiving staff lack of experience with each patient substantiates the need for EMS handover structure development.

Patients arriving by ambulance requiring handover and triage create high levels of

stress among receiving nurses. A Swedish qualitative study involving six ED nurses acting as key informants attribute the stress to brief handovers occurring during tense or busy conditions (Bruce & Suserud, 2005). Of note, in September 2005 every Swedish ambulance was required to have a registered nurse and paramedic crew configuration. The registered nurse was responsible for providing bedside patient handover during patient care transfer in the ED. The criteria for participation in the study were that each nurse had to have greater than three years of emergency nursing experience. The ED nurses found the ease or complexity of the handover process to be dependent on the presenting patient's chief complaint.

Bruce and Suserud (2005) propose efforts should be made to create an organized and consistent handover. Their recommendations included the following information:

- Who called an ambulance;
- Are relatives aware the patient is in the ED;
- Where did the patient develop the illness or injury;
- What did the home environment look like;
- Was evidence of illicit activity on scene;
- What was the mechanism of injury;
- Any witness to accident or illness;
- Patient complaint upon EMS initial presentation;
- What prehospital treatment was given;
- What is the patient's medical history?

Specifically the authors found interest on the part of the receiving nurse a requirement for exemplary handover. To facilitate this interest, Bruce and Suserud

proposed the previously listed questions would act as a framework for communicating patient information. The authors hypothesize the ideal handover hinges on interprofessional interest and structural guidelines.

Scholarly literature provides evidence checklist implementation has improved safe practice in a variety of industries (Degani & Wiener, 1993; Hales & Pronovost, 2006; McDowell & McComb, 2014; Pronovost et al., 2006). Winters et al. (2009) argue checklist application in health care is necessary but must allow for evolution. In their clinical review of checklist implementation, the authors found high reliability organizations rely on several types of checklists. These include static parallel, static sequential with verification, static sequential with verification and confirmation and dynamic. A single individual reading from an organizationally approved set of guidelines or instructions completes static parallel checklists. Static sequential with verification checklists consist of an authentication procedure where one person verbalizes a task or piece of information and the second person verifies completion or accuracy. The static sequential with verification and confirmation checklist is applied in team settings where multiple people are responsible for task verification and completion. The main difference in this checklist is one pre-designated person verbalizes the tasks while the responsible person confirms task completion. Lastly and often seen in health care are dynamic checklists; these lists are similar to algorithms or guidelines that facilitate complex decision-making.

Sharing of checklist content among all parties allows for task and information crosschecking and team support. Further delineation can include development of standard versus high-risk operation checklists. Specifically high-risk checklists can be beneficial

in situations requiring crisis communication of facts or tasks. Unfortunately there are few checklist development strategies (Hales & Pronovost, 2006). Therefore checklist development can be subject to inadequate design. Moreover, inordinate checklist use can result in fatigue, non-compliance, or failure to use professional judgment when contradictory information requires re-evaluation of the situation (Winters et al., 2009).

Although a literature review is essential to the creation of handover structure, several human performance factors should be considered when creating any checklist (Degani & Wiener, 1993; Winters et al., 2009). Human performance factors encourage placing critical items at the beginning of any checklist; while lengthy lists should be avoided or partitioned into like categories. In addition the design should consider the needs of those using it. Design teams should include future users, information experts, and human factors specialists. This recommendation reinforces the use of a Delphi methodology approach. Tapping into the collective wisdom of different emergency care providers will avoid groupthink and promote the sharing of interdisciplinary perspectives.

A 2009 systematic review of 46 handover journal articles describes 24 different mnemonic devices used to structure health care handovers (Riesenberg et al., 2009). Performance data was scant with only 8.7% (4 of 46) reporting outcomes. These four articles were considered weak due to their limited sample sizes and failure to validate instruments used. The most frequently cited mnemonic (69.6%) was SBAR (Situation, Background, Assessment, and Recommendation). These authors suggest handovers are too complex for rigorous adherence and dependence on handover mnemonic clichés. Unfortunately many health care organizations are rushing to implement a mnemonic driven handover despite the lack of research evidence.

Several studies have sought to implement a standardized EMS handover with differing success rates (Aase, Soyland, & Hansen, 2011; Iedema et al., 2012; Talbot & Bleetman, 2007). The goal of the Aase et al. study was to determine the functioning and perceptions of an implemented interprofessional standardized handover. In 2007 Norwegian ED and EMS managers and front-line staff created a standard handover protocol. A handover training program ensued using two simulation scenarios.

Following two years of handover tool use, Aase et al. focus group interviews of 22 staff members (both ambulance personnel and ED nurses) revealed differing perceptions about the EMS handover protocol. All staff members felt satisfied with the flow of handover information. Although EMS staff identified handovers as being more detailed and structured after protocol implementation, nursing reported EMS handovers remained individual and varied. All of the participants expressed transferring and receiving staff's experience level and proficiency impacted handover success.

The structured handover was readily accepted into EMS provider practice due in part to their routine use of protocols. However nurses felt the structured handovers were impractical. In addition the nurses voiced departmental demands such as walk-in patients' arrivals competing with ambulance patients resulting in nurse attention shifting away from EMS regardless of the handover structure used. The study found attitude and cultural differences ultimately weakened the idealized goals of the project. The authors recommend a re-examination of the handover content, refining of structure usability (pocket checklist), while determining and addressing barriers to interprofessional adoption.

The 2006 NPSG of standardizing patient handover communications has led to

many studies and initiatives attempting to structure transfer of care verbiage and content. Patterson and Wears (2010) measured the intention of handover improvement initiatives by reviewing handover literature and identified seven conceptual framings. First and the most frequently cited concept is transfer of data. This first concept includes the processing of information through noisy networks is often met with a call for handover standardization. Measures of success include comparing handover information to essential elements deemed as the "gold standard." An elaboration on this concept includes determining what elements are most critical and altering handovers to include this information first.

The second concept identified in the literature is the stereotypical narrative. This is the handover that calls attention to the deviations from normal. An intervention example of the narrative includes the list of daily goals for all members of the interdisciplinary teams with quality measures focusing on the report of relevant patient findings.

Resilience is the third concept. Much like the static sequential with verification checklist, it facilitates confirmation of the patient's care plan and expectations. The quality of this handover concept is verified by the presence of accurate diagnosis and the avoidance of preventable adverse events.

The fourth concept is accountability including the transfer of responsibility. An example for this concept is the creation of a protocol where specific tasks are assigned to team members. Measure effectiveness occurs when reviewing task fulfillment, tasks remaining to be completed by the end of shift, and number of patients who have been inadvertently overlooked.

Social interaction is often underreported and an under recognized factor in handover. Patterson and Wears found this to be the fifth concept of handover literature. The struggle to develop a shared meaning is often met with initiatives to have interdisciplinary team rounding. Success of this initiative is seen when a team climate is established and new knowledge is generated.

Closely associated with social interaction is the sixth concept of distributed cognition. Patient care often requires multiple providers who share information and patient care responsibility. Provider coordination is essential and therefore many organizations implement techniques to track information. Quality measurement is the reduction of errors and less time wasted in getting to the correct specialist or therapy.

Last is the idea of cultural norms. Organizational expectations as well as social behaviors can enhance or stifle patient handovers. Unspoken but demonstrated poor work behaviors persist is undermining teamwork initiatives. Success and quality measurement are difficult to assess in this last concept however organizations attempting to improve cultural norms often support initiatives such as interdisciplinary handover trainings and education.

Patterson and Wears (2010) have illustrated patient handover has seven influential concepts that require healthcare provider attention. Although handover improvement projects should encompass these seven concepts, patient information, specifically content, processing, and transmission dominate handover literature. The authors suggest there is a lack of true understanding on the main purpose of handover. They suggest handover element identification is incorrectly being given priority over other equally important handover considerations; insisting element identification may not be possible

or wanted.

The 2007 WHO Safe Surgery Saves Lives program sought to reduce surgical complications by promoting safe and consistent surgical care worldwide (World Health Organization, 2008). The influential work of Haynes et al. (2009) was the creation of a 19-item surgical safety checklist based on the 2008 WHO guidelines for improving surgical patient safety that can inform the work of EMS to ED handover. A pre and post intervention prospective study was undertaken at eight hospitals in eight countries (Canada, India, Jordan, New Zealand, Philippines, Tanzania, England, and United States). The study intervention included the implementation of the 19-item WHO safe-surgery checklist. Once the checklist use began at each facility, data collectors followed non-cardiac surgical patients for 30 days or until discharge.

Interestingly there was a lack of surgical safety policies in all eight hospitals prior to checklist implementation. For instance none of the eight participating hospitals had a standard plan for intravenous access for surgical cases where high blood loss could occur. Furthermore, only two of the eight hospitals performed oral confirmation of the patient's identity and surgical site in the operating suite.

Complication data were collected on 3,733 pre-intervention patients and 3,955 post-intervention patients. Complications were those defined by the American College of Surgeons' (ACS) National Surgical Quality Improvement Program. They include a large variety of complications such as acute renal failure, deep-vein thrombosis, ventilator use for greater than 48 hours, pneumonia, and infections. Along with the ACS complications physician reviewers used the Clavien-Dindo Classification to determine complications listed as "other" should be included in the study.

The investigators reported postsurgical complications were reduced by an average of 36%. After implementation of the surgical safety checklist, the collective complication rate for all hospitals fell from 11.0% to 7.0% ($p < 0.001$). The death rate fell from 1.5% to 0.8% ($p = 0.003$). Hospitals in high-income countries saw a reduction in complication rates from 10.3% to 7.1% ($p < 0.001$) whereas low-income sites demonstrated a larger complication reduction going from 11.7% to 6.8% ($p < 0.001$). The post-surgical death rate in high-income countries did not show a statistically significant reduction with checklist implementation (0.9% to 0.6%, $p = 0.18$) however low income country hospitals post-surgical death rate went from 2.1% to 1.0% ($p = 0.006$).

The dramatic results found in the 2009 Haynes et al. study influenced adoption of the WHO surgical safety checklist across the globe. Although there is evidence to support handover checklist creation, it should be acknowledged that checklist implementation has not been met with unanimous enthusiasm (Pickering et al., 2013). In addition subsequent surgical checklist studies have not reproduced Haynes et al.'s notable findings (van Klei et al., 2012).

Researchers, Urbach, Govindarajan, Saskin, Wilton, and Baxter (2014) evaluated surgical outcomes since mandatory checklist implementation. Their review included all surgical procedures performed at 101 of 133 total surgical hospitals in Ontario, Canada. These hospitals were required to implement some type of surgical safety checklist as well as report compliance to the Ontario Ministry of Health and Long-Term Care. All facilities had chosen to implement the Canadian Patient Safety Institute checklist, the WHO checklist, or their own unique surgical safety checklist. Urbach et al. reviewed surgical complication rates, hospital length of stay, 30-day readmissions, and ED visits within 30

days of discharge. In addition, the authors stratified the patients by resource utilization bands, age, sex, urban or rural, household income averages based on address to measure socioeconomic status.

The authors reviewed over 200,000 surgical procedures. Implementation of surgical safety checklist occurred at varying times among the 101 study hospitals. Surgical patient information was retrieved from each hospital three months prior and post checklist implementation. The self-reported rate of checklist compliance was 92% from April to June 2010 and greater than 98% after June 2010.

The study results for pre-checklist implementation rate of death in hospital or within 30 days of discharge was 0.71% and 0.65% afterwards ($p = 0.07$). Review of ED visits within 30 days of discharge found 10.44% before the checklist and 10.55% post checklist initiation ($p = 0.37$). The surgical complication rate measured from time of surgery to 30 days post-operative saw a slight reduction from 3.86% to 3.82% ($p = 0.53$). There was a significant reduction in unplanned return to the operating suite with checklist implementation (1.94% to 1.78%, $p = 0.001$). Interestingly there was an increase in deep venous thrombosis rates (0.03% to 0.07%, $p < 0.001$) and ventilator days (0.08% to 0.12%, $p = 0.007$). The authors did not provide information about interventions that could have impacted these scores.

Urbach et al. (2014) acknowledges there are known issues with checklist implementation for this study. First, checklist application varied with a noticeable lack of systematic team training in all facilities. It was also possible unknown interventions or initiatives could have influenced patient surgical outcomes. Lastly, there were some improvements seen after checklist implementation however the authors suggest these

improvements occurred at the same rate as chance. Although the results of mandatory surgical checklist implementation did not demonstrate significant patient safety improvements, checklists have improved the culture of safety in operating suites globally; that culture of safety is missing in the prehospital care environment. This study garnered interprofessional handover expectations to improve the safe transition of patients from EMS to ED care.

In contrast to the many proponents of checklist implementation (Bosk, Dixon-Woods, Goeschel, & Pronovost, 2009) argue checklists alone will not improve handover. While checklists improve clarity about necessary tasks it fails to address the sociocultural impacting handover. Healthcare providers are reluctant to abdicate their expertise to a simple instrument. These same providers claim handover instruments impede rapid decisions and actions.

Structuring handover communication has a spectrum of consequences. The central motive behind structural attempts is the belief verbal handover will become organized and valid (Patterson, 2008). However there is no guarantee an enforced handover structure will meet the needs of the providers or result in a safe patient transfer.

Verbal handover is susceptible to interruptions and misunderstandings. Structured handover checklists can fail to accommodate for these issues. In situations when enormous amounts of information are being transferred Patterson proposes critical patient information be delivered first to avoid later interruptions.

(Iedema et al., 2012) sought to determine if there were undefined, preexisting EMS to ED handover structure on which a protocol could be established. The investigators video recorded 73 EMS handovers. An analysis of each handover exhibited

a preexisting implied structure resembling 'IMIS' (identification of the patient, mechanism or medical complaint, injuries or information relevant to illness, and vital signs). A focus group of emergency physicians, emergency nurses, and paramedics developed a new handover by expanding the implicit format by adding treatment, allergies, medications, background history, and other social information (IMIST-AMBO).

The next study phase included educating non-participant paramedics and ED medical staff about the new IMIST-AMBO handover structure. Sixty-three post-education EMS handovers were again videotaped and analyzed for elements, structure, length, repetition, and receiving questions.

EMS presented patient identification in 100% of the pre and post-intervention handovers. The patient's reason for their ED visit was communicated 63% of the pre-intervention handovers and 98% in the post-intervention phase. Communication of vital signs increased from 36% in the initial handovers to 65% in the second round. In addition fewer questions were raised (33%) following the IMIST-AMBO training versus (67%) before the intervention.

After implantation of the new handover structure, triage nurses completed 416 questionnaires about their satisfaction with paramedic handovers. However it must be noted the nurses were unable to distinguish pre and post-intervention educated paramedic handovers. The survey respondents advised there was slightly greater satisfaction with paramedic handovers.

This last study demonstrates how a structured EMS to ED format has multiple benefits. The IMIST-AMBO format offered specific prompts for EMS patient handovers. However this research used interprofessional emergency provider judgment and

experience applied to multiple acuity patients to identify essential handover elements. Application of these results can facilitate an effective EMS patient handover while meeting ED clinician information expectations.

Twenty nurses at a large veteran's administration medical center participated in a qualitative study to describe written and audio-recorded nursing handovers (Welsh et al., 2010). Interviews occurred either individually or in pairs. Subsequent analysis of the content revealed six barriers to end-of-shift patient handovers. First, 80% of the nurses reported too little information was given at the end-of-shift report. Missing data elements required the on-coming nurse to spend valuable time searching the medical record or reworking the problem. Fifty percent of nurses reported there were times when too much information caused a barrier to handover. Specifically, this was associated with audio taped handover reports. Inconsistent quality was reported by 50% of participants. The nursing participants asserted handover quality was a reflection of the reporting nurse's abilities.

Thirty-five percent of the participant nurses also described their preference to ask questions. Although there were 30-minutes of shift overlap, nurses were frustrated they did not have time to ask follow-up questions. The fifth barrier, reported by 35% of the nurses related to the audio equipment used to pre-record handover for the oncoming shift. Twenty percent of participants cited interruptions prevented effective handovers.

This study's participants brought forward recommendations for improved handover. Termed facilitators by Welsh et al. (2010), there were repeated mentions of pertinent content inclusion in handover with the definition of pertinent content varying across departments. Additional facilitators included space for notes on written handovers,

face-to-face interactions, and a checklist to guide report. A smaller portion of nurse participants (25%) felt there was value in structuring handover into a checklist format. While communication method and structures are important to the process, the focus of this proposed study is handover content. The next section focuses on studies related to the value and delivery of handover content.

Content

Handover simulations and real-time observations have demonstrated there is a lack of structure and standardization (Di Delupis et al., 2014a). Handover elements can vary depending on the patient population, time allotment, and presence of the patient (Johnson, Jefferies, and Nicholls, 2012). The creation of a "gold standard" in EMS element handover is complicated by inconsistent treatments and the degradation of information.

Elements.

Paramedics (n=42), emergency nurses (n=21), and physicians (n=17) were queried about essential EMS to ED handover elements (Jenkin et al., 2007). Generalizations more than specific elements were identified. However the elements included were: reason for ED presentation, issues needing rapid attention, therapy received since onset of symptoms, and relevant past medical history. Interestingly the least essential elements identified were patient's name, time of event onset, time of medication therapy, allergies, and prehospital suspected injuries.

Delupis et al. (2014a) in a study of prehospital handover simulation and identification of handover key elements in Italy highlight many of the handover struggles facing interprofessional emergency care providers. The authors developed 12 pediatric

critical care patient scenarios requiring handover from pre-hospital to ED staff. The participants were 35 pre-hospital and ED physicians, 6 nurses, 12 rescuers, and 6 actors portraying parents of the pediatric simulation mannequin. All scenarios and subsequent debriefings were videotaped and transcribed. The study was completed in phases. In the first phase the 35 participants performed the 12 preliminary handover simulations. The next two phases were delivery of a classroom communication lecture followed by micro-simulations on personal computers. The last phase was additional simulations using the high-fidelity pediatric mannequin.

Included in this study was the development of essential prehospital to hospital handover information. Twenty-three triage nurses were surveyed for information they felt was necessary during the handover process. Five categories with 11 elements of handover information were agreed upon by 100% of the nurses surveyed. The categories and information elements were: Patient identification including patient name, date of birth, and address. The chief complaint including time of onset of symptoms, where patient was found, and conditions where patient was found. The patient's clinical condition as described by presence, type, time of onset of pain, and body temperature (if patients were warm to touch or diaphoretic). A report of medications however nurses preferred pill bottles brought with patient over a list of medications. Lastly, nurses wanted family information including telephone numbers and addresses for family members/neighbors.

Seventy-eight percent of the nurses did not feel rescuers should report prehospital vital signs. The nurses considered the patient population transported by rescuers to be low acuity. Furthermore nurses verbalized their belief that rescuers were unable to obtain accurate vital signs and therefore triage nurses should gather this information upon

patient arrival to the ED.

Using a consensus method, a focus group of four emergency physicians, four emergency nurses, and four rescuers developed the final list of key handover elements using the triage nurse list for guidance. This group applied a handover assessment tool for use by the additional four emergency physician rater's evaluation of the 12 pediatric handover scenarios. The ISBAR (identification, situation, background, assessment and recommendation) handover tool contained the following elements:

Identification
Pre-hospital provider
Hospital provider assuming responsibility for care
Patient name
Patient age

Situation
Overall assessment of patient's condition since arrival on the scene
Emergency call reported chief complaint
Patient's chief complaint as elicited by rescuer

Background
Patient's past medical history
Patient's home medications
Patient's allergies

Assessment
Summary of primary assessment (ABCDE)
Treatments/intervention initiated by pre-hospital team
Pre-hospital vital signs (any)
Heart rate , blood pressure, capillary refill, respiratory rate, oxygen saturations, temperature, blood glucose

Requirements, recommendations and acceptance
Request and recommendations regarding further workup or treatment
Acceptance of transfer of care performed

Ultimately there was no significant change in the handover information given after participants received the communication lecture. However there was statistically

significant progress following high-fidelity simulation. For example, heart rate was reported in 12% of patients during baseline simulation, 31% ($p = 1$) after the communication lecture, and 83% ($p < 0.0001$) following the high-fidelity simulation and debriefings. The authors suggest prehospital care patient handover would improve with implementation of communication education, handover tool, and high-fidelity simulation training.

Determining handover elements is challenging when patient chief complaints vary widely. The recording and transcribing of 195 patient handovers in a variety of clinical settings resulted in a nursing handover elemental data set. (Johnson et al., 2012) determined the frequency of element occurrence during handover recordings to define the minimum data elements necessary for the creation of an electronic record of the verbal handover. While many of the defined nursing elements were not pertinent to prehospital care, the authors identify elements that should be incorporated into EMS to ED handover such as demographics, clinical history, resuscitation status, and outcomes of care delivered.

As previously mentioned handover elements necessary for one patient population may not be applicable to another. Therefore handover research will often focus on one subsection of the patient population. Davis, Graygo, Augenstein, and Schulman (2013) used a focus group of prehospital care providers and attending physicians to generate information necessary to care for an injured patient. The subsequent survey was then administered to the American Association for the Surgery for Trauma (AAST) members. One hundred and one members responded and 40% agreed and 41% strongly agreed the EMS information regarding injury specifics were helpful in optimizing trauma patient

care. The opinions generated from this survey also suggest the creation of standard EMS handover elements along with the elimination of low-value handover information would improve attention to crucial data elements.

A minimum data set of trauma patient care elements could expedite EMS to ED handover in the time sensitive patient population (Evans et al., 2010). A qualitative study consisting of twenty-seven interviews with paramedics, nurses, and physicians explored thoughts on how trauma patient care information elements should be transmitted, implementation of the MIST (mechanism of injury or illness, injuries, signs/symptoms/monitoring, and treatment) handover structure, along with additional EMS handover content requirements.

In relation to a handover structure, 20% of the participating paramedics and 53% of the participating trauma nurses and physicians were aware of the MIST handover format. Study participants identified additional patient elements that should be added to the standard MIST handover structure. These elements were: entrapment time, oxygen saturations, body temperature, Glasgow Coma Scale components, pupil size, immobilization, critical episodes during EMS care, "significant" medications, allergies, and past medical history.

Evans et al. (2010) also highlighted experienced trauma team members' perceptions of an effective handover. A successful EMS handover described a confident paramedic that can deliver key information elements succinctly while eliminating irrelevant data. The group recommended trauma team receipt of the handover would improve by avoiding interruptions, noise, inattention, and dismissive attitudes.

The transfer of patient responsibility between emergency physicians is fraught

with quality issues as is the EMS to ED handover. A total of 914 emergency physician handovers were observed with a researcher tracking the presence of 22 handover elements generated from the medical literature and emergency physician focus group. Ye, Taylor, Knott, Dent, and MacBean's (2007) study also assessed the relationship between the number of elements present in handover and the receiving physician's perception of handover quality measured on a one to five Likert scale. One hundred and nine (15.4%) of the observed handovers were missing required information. The median quality handover score was 3.0 and there was no relationship between the volume of elements communicated and the perceived quality of the handover ($r = -0.01$, $p + 0.86$). Quality scores were higher (median 4.0) when required elements were present in patient handover ($p < 0.001$).

This study's results can be extrapolated to the EMS to ED patient handover. Ye et al. found items most emergency physicians inadequately handed over included communications made (52.0%), management plan (38.0%), and disposition plan (38.0%). EMS handover typically contains information similar to this study's inadequately reported elements. For example similar items found in EMS handover and were inadequately handed over in this study included examination findings (28.0%), demographics (22.0%), past history (16.0%), and care received (12.0%). It is possible the Delphi expert panel in this EMS to ED handover will likely identify comparable key elements.

Klim et al. (2013) began a project to address ED nursing handover apprehensions about protracted handovers that were often interrupted, contained irrelevant information, and did not happen at the patient bedside. The investigators used a mixed method

technique of surveys and nominal group technique (NGT) interviews of ED nurses at a metropolitan teaching hospital where the ED volume was estimated to be 63,500 patients per year. The goal of the study was to discover the feasibility and current perceptions about standardizing ED nursing handover as well as to determine essential handover content for ED nursing change of shift handover.

A total of 63 or 47.9% of the ED nursing staff participated in the study survey. Of the participants, 91% were female and 57% were less than 30 years old. The median years of licensure was five; the median years of ED work experience was four. Most of the respondents, 87.9% preferred to receive report on only the patients they were to care for versus report on the entire department. In addition 98.5% preferred to receive report from the nurse caring for their patient the preceding shift versus receiving report from the charge nurse. Sixty-two percent of the nurses preferred to receive report in front of the patient; forty one percent felt the patient was allowed to participate in handover. Current handover perceptions included 97% of respondents felt they receive adequate information during handover. By contrast, 51% stated important vital sign information and 35% stated medication information was excluded.

During the NGT interviews 41 participants were asked, "What are the five most important pieces of information you require during handover?" A total of 194 responses were received. The responses were coded and five main categories emerged: patient details, presenting problems, the plan, treatment given, and nursing observations. Patient details, the most important element per 64 responses, included items such as name, age, allergies, and social history. The next most important element category was presenting problems. These were the reason for the patient's ED visit, past medical history, and

current medication. Twenty-five respondents felt the plan of care was the next most valuable set of elements. The plan of care consisted of the diagnosis, pending tests, resuscitation requirements, and diet orders. Next was the treatment received, specifically what treatment has been given and what is outstanding. Finally was nursing observations, which included vital signs and testing results.

The 41 NGT participants were asked, "What are the five most important characteristics of a good handover?" Of the 205 responses, 83 related to a structured handover using standard approach, in an appropriate environment, and using current documentation. Interestingly 20% of the survey responses reported their last handover was in an unorganized fashion. The second most frequent response (45 of 205 responses) involved the need for information about the treatments given, results, and pending plan or further treatments needed. Next was the need for handover in an appropriate environment (28 of 205 responses). Interviewees stated they preferred a quiet, distraction free environment and preferably at the patient's bedside was the most opportune place for patient handover. Lastly there were 23 responses about the importance of professional and respectful behavior during handover.

Ultimately ED nurses want to participate in a structured patient handover at the bedside that covers essential content. Klim et al. (2013) developed an ED specific handover framework based on (Thompson et al., 2011)'s ISBAR acronym handover tool from the information garnered from the survey and NGT interviews. Figure 2 is the author's ED modified handover framework tool.

I	Identification and alerts
S	Situation/Presenting Problem
B	Background
A	Assessment and progress

N	Nursing care needs
Plan	What is the plan? Outstanding issues?
Check	Check mediation chart, vital signs, fluid balance, etc.
Act	Alerting nurse in charge/medical officer based on vital sign parameters or clinical deterioration

Figure 2 ED Structured Nursing Handover. Adapted from "Developing a framework for nursing handover in the emergency department: an individualised and systematic approach," by S. Klim, AM. Kelly, D. Kerr, S. Wood, & T. McCann, 2013, *Journal of Clinical Nursing, 22,* 15/16, p. 2233-2243.

Few studies have sought to define emergency nurses and physician expectations of prehospital care handover elements. Benner et al. (2008) administered an Internet survey to 209 ED staff to determine the 15 necessary elements found in seven chief complaints frequently seen in the ED patient population. They subsequently created a data form with these elements and observed 296 EMS patient handovers.

Benner et al.'s (2008) study occurred in an academic medical center ED receiving both basic life support (EMT level provider) and advance life support (paramedic level provider) patients. These varying EMS provider handovers communicated a total of 1947 out of 4425 (44%) of the necessary data elements identified by the surveyed ED staff. The low data element yield is attributed to several issues. First is the prehospital care provider educational difference. EMT providers do not have the education and experience to assess and then communicate certain pieces of patient information the ED staff felt was necessary for handover. Moreover, the study design required evaluation of the EMS handover of 15 patient elements regardless of the chief complaint. For example, elements such as patient entrapped and extrication time were required elements for non-traumatic chief complaints such as chest pain.

Similar to the Ye et al. (2007) study, Benner et al. (2008) assessed receiving physician satisfaction with "quality and quantity" of handover information. Despite

handover of only 44% of the identified 15 essential elements per patient observation, there was a 51% physician satisfaction rate. The authors recommend subsequent studies establish physician expectations and plans for prehospital information.

Inter-organizational handovers between providers with varying backgrounds, terminology, and culture present unique challenges (Hilligoss, 2011). Sujan et al. (2013) examined the content and verbal methods England's National Health Service (NHS) paramedics used to give patient handover at three socioeconomically diverse hospital EDs. The researchers also reviewed telephone reports from ED physicians to acute medicine physicians or senior nurses.

The team audio recorded 270 handovers with 203 recordings eligible for review. Audio recordings were available for 34 resuscitation area patients, 79 major area patients, and 90 physician referrals to in-patient destinations. Paramedic handover content concentrated on previous and current patient presentation information in 78-80% for resuscitation patients. Similarly 74% of major area patient handovers also addressed the patient's current presentation. Interestingly 11-15% of paramedic remarks were interpreted as a means to create a professional or courteous connection with receiving staff whereas a larger percentage (16-18%) of in-patient referral's had similar remarks.

Resuscitation and major area patient's handovers were one-directional and descriptive. Following resuscitation handover, 12-14% of receiving staff communication sought additional clinical information necessary for patient care; 5-6% of major area subsequent communication sought information geared towards mandatory ED documentation elements. Referral physician communications were less descriptive (45%-50% versus 61%-66% of paramedic handovers) and more collaborative in nature. ED and

in-patient providers were noted to lead the conversation or request to handover by asking for the precise reason for admission followed by a discussion on immediate patient care actions.

While the median age for paramedic patient presentation was 60 to 75 years, 2-5% of handover content addressed social and psychological circumstances. Merely 1.5-2.8% of the in-patient handover reviewed this highly relevant information in the patient population. The researchers found three pieces of handover content that launched social and psychological discussions. These were EMS reported request for service was initiated by the patient's family member or caregiver, the patient's current presentation was related to their social situation, or the referral or request for an elderly in-patient admission is unclear.

This study illustrates EMS handover provides insightful and useful information related to subsequent care needs. While there is a need for standardization to improve receipt of information, collaborative conversations are necessary to identify critical elements influencing patient's immediate and future care decisions.

Degradation.

Patients transitioning from prehospital care providers to ED staff are likely to experience handover information degradation. The possibility exists for their prehospital care details to deteriorate or degrade. Additionally care providers may not remember or retain details transferred by EMS. (Nagpal, Vats, Ahmed, Vincent, & Moorthy, 2010) found handover degradation occurs as patients proceed through each phase of care. An analysis of 100 patient records found 26% of EMS and ED written documentation contained discrepancies defined as either omissions or incorrect information transfer

(Murray, Crouch, & Ainsworth-Smith, 2012). The discrepant topics varied widely and included high-risk issues such as medications, allergies, and pertinent medical history.

Zhang, Sarcevic, and Burd (2013) completed semi-structured interviews with 16 ED trauma team members to determine information needs along with challenges in retaining EMS patient handover content. The interviews revealed team members wanted the following information to prepare for patient arrival and care: the patient's mechanism of injury, physical findings, demographics, treatments provided, scene photographs if taken, and injuries. The trauma team also identified information challenges such as discrepancies between the EMS pre-arrival and bedside reports, late team members who miss the initial bedside report, and the lack of report to ancillary staff.

In addition Zhang et al.'s research included recordings of 68 EMS pre-arrival reports ranging in length from 30 seconds to 4 minutes. Although there was no pre-study education among EMS providers in how to deliver a pre-arrival EMS patient report, the authors found pre-arrival information typically included one or more of 23 elements and often followed the De-MIST (Demographics, Mechanism, Injuries, Signs, Treatments administered) structure. The most commonly EMS reported pre-arrival elements included EMS unit, patient age, patient gender, and patient's vital signs.

Traditional EMS handover consists of a verbal handover to a nurse or physician followed by a written patient care report that is left for inclusion in the hospital medical record. Information degradation occurs when the receiving ED staff fails to document the information received during EMS verbal handover. The other potential for loss is when the EMS written report contains information but is not communicated to the receiving staff verbally. Evans et al. (2010) reviewed 25 EMS trauma patient records to determine

the volume of handover data that was not or incorrectly documented. The authors found 75% of pre-arrival handover data was noted on the trauma team notification sheet. Only 7% of this data was related to prehospital treatment delivered. Injuries were most likely to be documented (86%) whereas treatment was least likely at 44%.

EMS verbal bedside handover increased the volume of handover elements from 228 elements to 498 elements ($p < 0.001$). Evans et al.'s study found 67% of this EMS bedside handover is transferred to the patient's hospital chart. Receiving staff documented 100% of demographic information however they were found to be less likely to write down EMS report of patient signs and symptoms (50%), injuries sustained (59%), and mechanism of injury (63.5%). Of concern, a discrepancy was found where paramedics documented only 79% of the bedside handover data elements in the EMS written patient care report. This lack of continuity in report is a significant safety concern.

Paramedic written documentation occurs in a variety of stages. EMS patient care notes are taken on gloves or scrap paper during care delivery. In addition, there is a known time delay between EMS handover and written documentation where details can be lost. Evans et al.'s results support the need to better understand the information needs and expectations of all emergency care providers.

Carter et al.'s (2009) study of 96 EMS trauma patient handovers illustrated significant information degradation. A review of 16 key information elements was identified for the trauma patient population. In a comparison between EMS transmittal and emergency department receipt of these predetermined 16 elements, the data show a mean of 4.9 elements were transmitted. Of the data elements transmitted, 72.9% were received as evidenced by documentation in the patient's record. Interestingly certain

elements were found to be more likely to be transmitted than others. For instance mechanism of injury, age, and site of injury were more frequently transmitted and received than any other of the 16 elements. End tidal carbon dioxide levels, volume of blood loss, and oxygen saturation levels were less likely to be transmitted during trauma patient handover. Furthermore handover of prehospital hypotension, Glasgow Coma Scale (GCS), and heart rate were less likely to be received.

The handover method used (verbal versus written) impacts the amount of patient-related information degradation. To determine the amount of information loss that can occur, Bhabra, Mackeith, Monteiro, and Potheir (2007) developed four scenarios with 20 patient-related elements for handover. Each simulated patient was handed over five times to different ENT physicians. Each scenario handover occurred in one of three formats: verbal only, verbal with recipient taking notes, and a printed sheet detailing handover elements with a verbal handover as well.

The verbal only handover resulted in retention of 33% of the elements after the first handover and retention of 2.5% after all five rounds. While verbal handover, with note taking had a retention rate of 92% after the first handover and 85.5% of information retention after the five rounds. The best results for handover retention were seen with printed handover sheets given with an associated verbal report. This method had an impressive 100% retention rate of the elements after round one with a 98.75% retention after all five handovers.

EM physician needs and expectations were surveyed; most EM physicians prefer prehospital handover to be verbal as well as include a copy of the written EMS patient care report (Knutsen & Fredriksen, 2013). For this study, the EMS pre-arrival radio

report, EMS written patient care report, and the ED records were compared for the presence of eight elements to determine information loss. The researchers determined eight elements to be most important for care management. These elements were respiratory rate, oxygen saturation, Glasgow Coma Scale, mechanism of injury, oxygen therapy provided, fluid therapy given, medications provided, and immobilization. The analysis of the pre-arrival radio report documentation found limited information is communicated. This initial EMS contact frequently included mechanism of injury, medications given, and oxygen therapy initiated; however intravenous fluid or immobilization was included less than one-third of the 500 cases analyzed. The review of the admission note included only 30% of the eight researcher-identified care elements for safe, effective patient management. This demonstrates the dangerous disruption of communication between prehospital care and subsequent in-patient management.

As previously mentioned, paramedics typically provide a verbal bedside handover report followed by a written patient care report. With competing factors vying for attention, Scott et al. (2003) measured the amount of recall ED physicians have of a paramedic's verbal bedside handover. ED physicians were interviewed after 43 paramedic verbal trauma reports and asked to recall details of the handover. Physicians correctly recalled EMS handover 36% of the time and incorrectly 4%. The physicians could not remember details of the handover 47% of the time. Lastly 12% of the recall was irrelevant information that was not communicated by EMS. Midway through Scott et al.'s study, paramedics received education to improve handover communication skills. Prior to this education, ED physicians correctly recalled an average of 33% of paramedic communications whereas post intervention physician recall increased slightly to 37% ($p =$

0.16).

EMS information degradation results in a decrease in physician awareness of prehospital care interventions. Waldron and Sixsmith (2014) performed a two-phase observational study at a Level I Trauma Center ED. Advanced life support paramedics were observed rather than EMTs since basic life support staff performs few patient interventions. In phase one, paramedics gave handover of 163 patients to the triage nurse and left a written patient care report. In the second phase a research assistant listened and recorded 116 EMS verbal handovers. The research assistant then delivered the patient to the physician and gave a verbal report based on listening to the earlier handover.

Physicians were subsequently surveyed about the prehospital care interventions performed. During phase one, physicians could correctly recall 16% of prehospital procedures and 77% of prehospital medications. During phase two, recall of prehospital procedures and medications increased to 45% and 83% respectively. This study illustrates significant information loss occurs with EMS handover as well as demonstrates physician recall improves when a verbal handover occurs.

Stiell et al. (2003) determined the pervasiveness of omissions in ED handover information; there were 1 or more gaps in information in 1/3 of the patient cases reviewed. In addition patients with information gaps were more likely to have a 1.2 hour longer ED length of stay. The researcher's analysis of 1002 ED visits in a teaching hospital with 55,000 ED visits/year determined most information gaps are associated with the geriatric patient population, presence of chronic illnesses, higher triage levels, EMS patient arrival, and a history of admission to the hospital in the last 6 months. The limitation in this study is the possibility of minimizing the true extensiveness of

information gaps. For instance EM physicians were interviewed for patient arrivals on weekdays 08:00 to 20:00. Information gaps are more likely after hours when family, medical records, or outside hospital records are unavailable. Ultimately the information from this study supports the need to investigate interprofessional expectations of EMS to ED handovers content to reduce information loss.

Talbot and Bleetman (2007) designed a prospective study at two EDs in the United Kingdom to evaluate the impact of incorporating a structured handover on the retention of EMS to ED information. Ten EMS handovers were observed and recorded in each ED. The receiving ED staff member was questioned to establish the accuracy and amount of information retained following each handover. The volume of packets of information in each handover was counted. The second phase of the study had 10 EMS crews give report using the DeMIST handover format at one of the EDs. The average of information retained and correctly recalled in the first phase at both EDs was 56.6%. After the initiation of a structured handover the ED staff accuracy and retention recall decreased to 49.2%. Although it is a small study, it was the first EMS related study to suggest structuring EMS handovers may not improve information retention.

Summary

This literature review has addressed the emergency care environment, safety implications, handover barriers, communication methods, structure, content elements and degradation issues. As a result a gap in knowledge has been identified. The literature highlights EMS to ED handover lacks a consistent approach, content, structure along with the many reasons why this problem exists. Chapter 3 will address a study methodology to discern appropriate content for effective EMS to ED handover.

Chapter Three: Methodology

Chapter 3 discusses the purpose statement, research questions, Delphi research methodology, and data acquisition. The outcome of collection of core versus provider specific information lends itself nicely to the use of the Delphi method as a first step in developing a handover tool. Included in this chapter is a discussion regarding the benefits and criticisms of the Delphi method as well as the rationale for its selection. The ultimate distillation of the data provides expert opinion on what core and specific handover elements are expected during EMS to ED patient handover.

Purpose

The purpose of this study is to determine interprofessional expectations of EMS to ED handover content. The current gold standard of handover content is the 2009 NHTSA's National Emergency Medical Services Education Standards. This standard outlines eleven components to be given during verbal EMS to ED patient handover. At the conclusion of this study, expert opinion will delineate core versus provider specific handover elements and their applicability to patient acuity.

Research Questions

The objective for this dissertation was to determine interprofessional expectations of essential handover content necessary for an EMS to ED patient handover. The following research questions form the basis of this research:

1. What are the core and provider specific elements necessary for an EMS to ED patient handover?

2. What are the core and specific handover elements as applied to each of the five levels of acuity?

Protection of Human Subjects

This study was submitted and approval received from the Institutional Review Board of Medical University of South Carolina. Participant consent was obtained when the expert panelist logged into the survey application RedCAP.

Electronic surveys are widely acknowledged as a quick and acceptable method for data acquisition. However there is a balance between the convenience of electronic surveys and participant protection. The volunteer Delphi panelists were assured their participation was completely voluntary and all responses are confidential. Individual panelists were blinded to other participant responses; group emails were also blinded to maintain panelist anonymity.

Design and Methodology

The complex problem of EMS to ED patient handover interprofessional expectations has yet to be studied. There are three research methods considered for this research. They include Nominal Group Technique (NGT), Interacting Group Method (IGM) and the Delphi method (Clayton, 1997).

NGT design consists of an impartial group meeting where members generate potential ideas or solutions individually; following this the group receives these ideas as a whole for ranking (Clayton, 1997). There are two major reasons the NGT method is not acceptable for this research study. First, the ideal size for a NGT group is nine panelists

(Horton, 1980). The desired 45-member EMS to ED handover panel requires a method capable of accommodating its size.

NGT's additional limiting factor is the need for participant presence at the time of idea generation (McMurray, 1994). The EMS to ED handover expert panelists live and work throughout the United States. The logistic and fiscal difficulties of face-to-face meetings prevent use of the NGT.

IGM is a focus group or brainstorming session where members volunteer information with the intention of solving a problem. The session concludes once the group generates an acceptable number of potential solutions or reaches the pre-determined time parameter (Clayton, 1997). IGM generates ideas whereas the EMS to ED handover panelists will communicate, with the Delphi method, a definitive expert opinion of interprofessional expectations. In addition IGM as with NGT is not a reasonable option because of the geographical distribution of panelists.

Delphi Research Method

The Delphi method is best for identifying current practice and what "could or should be" (L. E. Miller, 2006). Linstone and Turoff (2002) identify several factors making Delphi research a good fit. These areas include:

- There is a need for subjective information rather than traditional analytical statistics;
- There is a complex issue requiring diverse opinions however there is substandard communication among these participant groups;
- Face-to-face meetings are not possible due to cost or geographical locations;
- There is no significant body of literature;
- Contention or position variance exists between group members requiring anonymity to

ensure honest participation.

The original mission of the Delphi method was the creation of a group communication framework (Dalkey & Helmer, 1963). The method includes the use of iterative series of questionnaires to structure group interactions and information acquisition. Final distillation of the Delphi method results in subject matter experts generating well-founded opinions (Hsu & Sandford, 2007). Day and Bobeva (2005) suggest the method is particularly applicable to complex issues unquantifiable by traditional statistics. This study applies the Delphi method to address the complex problem of patient handover.

RAND Corporation employees named this research process the Delphi method for the oracle in Greek myths (Turoff & Hiltz, 1996). In Homeric poems the prophetic oracle of Delphi offers guidance to the pilgrims with information garnered from an ensemble of advisors (Fontenrose, 1959). Original RAND Delphi researchers, Norman Dalkey and Olaf Helmet's first contemporary use of the Delphi method began in the 1950s (Dalkey & Helmer, 1963). Using an iterative series of questions, known as rounds, the group determined which United States strategic targets were the most vulnerable to Soviet attack (Linstone & Turoff, 2002). This initial research was based on Dalkey's supposition that knowledge is on a continuum. At one end of the continuum is knowledge where the other end is conjecture. The area along the continuum represents individual viewpoints requiring expert opinion endorsement prior to implementation (Dalkey, 1968).

Panel Selection

This research used the Delphi method for structuring expert opinion communication. A purposive sampling of emergency medicine experts will be members

of this study's Delphi panel. An initial sample of 15 each of paramedics, emergency nurses, and EM physicians for a total of 45 participants was used in this study. This diverse Delphi panel of medical professionals identified interprofessional expectations of EMS to ED verbal handover content.

The Delphi method hinges on the selection and perspective of subject matter experts. The definition of expert remains elusive. Historically possession of a credential or qualification equated individuals as experts. The typical description of expert is someone who has knowledge about the subject under review (Clayton, 1997). Keeney, Hasson, and McKenna (2006) acquiesce there is no one rule for determining the qualification and number of experts to include in a Delphi study. Similarly Baker, Lovell, and Harris (2006) analysis of expert selection readily admits there is difficulty in determining panelist's knowledge base and expertise; ultimately their work advises against using organization association or number of years of work as expert criteria. One method of member selection is having panelists self-rate their expertise (Mullen, 2003; Rowe & Wright, 1999). Criticisms of the self-rating approach include concerns with method variations to assess one's own experience level and discrepancies over accuracy of expert versus non-expert results (Rowe & Wright, 1999). Duncan, Nicol, and Ager (2006) supports using published authors as a criteria for knowledge expertise. Powell suggests considering factors such as clinical practice, attitude assessment, and quality of the expert's employer (Powell, 2003).

In his highly critical analysis of the Delphi technique, Sackman (1974) asserts the use of expert forecasting is highly inaccurate. The review found Delphi panelists are highly susceptible to the opinion of others; after receiving first round feedback the

panelist's subsequent round results show remarkable consistency thereby vitiating the idea they are reaching actual consensus. Additional criticism of the expert selection includes the potential bias of panelists. Panelists who have an agenda or specific interest in the subject may influence outcomes (Fischer, 1978). Careful expert selection is necessary in order to prevent such influences. Mitigation of this bias should occur by encouraging snowball sampling by giving panelists the option of recommending others (to the researcher) who may be interested in participating in the study.

Regardless of the difficulty in categorizing someone's knowledge or experience, Delphi results hinge upon the diversity of viewpoints of its expert panel. For this study, the expert panel criteria are as follows:

- Having professional credential for a minimum of 2 years
- Currently working in an emergency medicine patient care setting
- Has experience giving or receiving EMS to ED patient care handoff report
- Currently practicing as an EM physician, ED nurse, or paramedic.

Electronic Survey

The EMS to ED handover expectation Delphi used REDCap software survey system for data collection. The software program is a secure, web-based application that works to capture research survey study data. REDCap manages vital research software components such as security, user authentication, real-time data verification, and export functions (Harris et al., 2009). REDCap was best for this research because of its customizability, secure environment, export capability, and most importantly ease of use by Delphi panelists.

Variables and Measures

The research variables in the study are elements that are eligible for communication during an EMS to ED handover. The first round of Delphi studies typically begins with an open-ended questionnaire. However this research begins with a list of potential EMS assessment findings and treatment drawn from NHTSA National EMS Education Standards (NHTSA, 2009), CDC Guidelines for Field Triage of Injured Patients (McCoy, Chakravarthy, & Lotfipour, 2013), and North Carolina Performance Improvement Center's handover template (see Appendix A). Subsequent rounds followed a modified Delphi approach.

Pilot Testing

The survey instrument was sent two medical professionals who have experience with EMS to ED handover. The real world testing of the instrument allowed for external evaluation of the instrument design (Jairath & Weinstein, 1994). This pilot testing detected issues with survey design, content, and software implementation. These issues were resolved to ensure readability, usability, and content validity. Feedback collected resulted in survey modification that improved clarity. Initial patient scenarios were inclusive of every detail of the pre-hospital patient encounter. It was determined to ascertain necessary handover information it would require drastically reducing the content of each patient scenario. Lastly, pilot testing also informed the time to complete the entire survey.

Instrumentation and Procedure

Delphi panelists received a survey invite that included the REDCap website Uniform Resource Locator (URL) they could access 24 hours a day. Each Delphi panelist

began the survey after logging in to the RedCap website and answering affirmatively to the first item, the consent to participate. The survey included five EMS brief patient scenarios; Each of the five case scenarios was designed to represent one of the five levels of patient acuity based on the ESI Triage Tool (Gilboy, Tanabe, Travers, & Rosenau, 2012) Participants read each patient description then specify the level of importance of each given element for safe EMS handover. The response options on the four-point Likert-scale range were coded as follows 0 = Not Important, 1 = Somewhat Important, 2 = Important, 3 = Essential. The handover list consists of 67 medical and trauma handover elements. However some elements may not be applicable to every case study. However all elements were available regardless of the scenario.

Delphi Research

The initial phase of typical Delphi research begins with the first in an iterative series of interviews, surveys, or questionnaires to elicit information from a group of subject matter experts. In lieu of this typical first round, a literature review and this researcher's experience contributed to a list of content elements (known hereafter as the element list) available for communication during an EMS to ED patient care handover.

Delphi Rounds

The Delphi panelist reviewed a patient description then selected the importance of each element's inclusion in the EMS to ED verbal handover for that particular patient. This exercise was repeated for each of the five case studies. At the conclusion of the scenarios panelists were given the ability to make comments on elements and suggest additional elements for EMS verbal handover. The second round follows the organization of the first round (Rowe & Wright, 1999). After review of the first round results, the

handover list was decreased to 51 elements. The Delphi experts were asked to re-read the newly ordered patient scenarios and again to rate the importance of each element to EMS to ED patient handover.

Reliability and Validity

Assessing reliability in Delphi studies come with a set of discrete challenges. First the Delphi approach consists of a variety of methods. Critics cite issues such as expertise criteria, panel size, question clarity, result sharing techniques, and analysis methods produce questionable results (Kastein, Jacobs, van der Hell, Luttik, & Touw-Otten, 1993). The reliability assessment of most Delphi research is accomplished by comparing two or more same subject Delphi studies. This technique is not applicable for this study as it is the first of its kind. Instead Lincoln and Guba (1985) advocate application of truthfulness, consistency, and confirm ability.

The Delphi method has undergone much criticism in terms of validity. Murphy et al. (1998) suggest there are five potential methods for establishing content validity. This study validates the emergency participant expert panel findings by initiating a comparison of the Delphi results with the current standard, findings of other similar studies, and response similarity between panelists.

participants were asked to rate the importance of each of the 67 elements on the given scenario using the four-point Likert scale. The final item of the Delphi Round I instrument included an open text box to allow participants to suggest additional elements. REDcap allowed for the programming of automatic reminders to be sent to non-responders. Twenty-three responses were received with 21 participants completing the survey. All data submitted was included in the analysis.

Round I results were analyzed by using descriptive statistics to measure central tendency (mean, standard deviation, and median) for each of the 67 rated elements. The means of the individual elements ranged from 0.43 to 2.87 on the four point Likert scale. The results of the descriptive statistical measures for each element aggregated for all participants are listed in Table 3. Each profession's Round I responses for elements necessary for EMS to ED handover are included in Table 4.

Table 3 Round I, All Participants, All ESI Scenario Ratings

Elements in Survey Order	Median	% Rated Important or Essential	Mean
Patient's name	2	81.48%	2.10
Age	2	84.26%	2.22
Date of Birth	2	52.78%	1.58
Gender	2	65.42%	1.81
Location of Belongings	1	14.95%	0.78
Insurance Information	0	10.28%	0.43
Weight	1	46.30%	1.48
Primary Care Physician	1	21.30%	0.81
EMS Agency/Transport Method	2	69.44%	1.94
Geographic Location of Incident	1	32.71%	1.07
Details of Incident/Accident	3	90.74%	2.41
Decontamination Required	3	78.70%	2.20
Photographs of Scene	0	11.11%	0.55
Number of Total Patients	2	70.37%	1.94
Total Transport Time	2	67.59%	1.85
Chief Complaint	3	98.15%	2.87
History of Present Illness	3	99.07%	2.84
Associated Symptoms	3	95.37%	2.69

Table 3 Round I, All Participants, All ESI Scenario Ratings (continued)

Elements in Survey Order	Median	% Rated Important or Essential	Mean
Current Medications	2	87.04%	2.35
Allergies	3	89.81%	2.42
Past Medical History	2	86.11%	2.29
Pertinent System Findings	3	95.37%	2.67
Time of Injury/Illness	3	94.44%	2.68
Mechanism of Injury	3	99.07%	2.80
Acute or Chronic Nature of Illness	2	85.19%	2.26
Site of Physical Injuries	3	97.17%	2.67
Baseline Vital Signs	3	97.22%	2.71
Last Set of Vital Signs	3	91.59%	2.54
Mental Status	3	97.22%	2.83
Glasgow Coma Scale	3	71.30%	2.17
Airway Patency	3	84.26%	2.48
Pupil Exam	2.5	73.15%	2.09
Chest Abnormalities	2	71.30%	2.01
Abdominal/Pelvic Abnormalities	2	62.96%	1.89
Last Oral Intake	1	39.81%	1.42
Combativeness	3	84.26%	2.37
Skin Exam	2	54.63%	1.57
Pain Assessment	2	72.22%	2.00
Suspected Type of Shock	2	68.22%	1.88
Psychiatric History	1	43.52%	1.36
Suspected Fractures	2	69.44%	1.94
Airway Intervention	3	80.56%	2.42
Oxygen Saturation	2	81.31%	2.22
12 Lead EKG Findings	2	60.75%	1.69
CPR Performed	3	66.36%	1.98
Duration of CPR	3	64.49%	1.95
Defibrillation Attempts	3	66.36%	1.97
Vascular Access	2	80.37%	2.22
Volume & Type of IV Fluid	3	80.37%	2.25
Tourniquet Placed	2	66.36%	1.92
Patient Initiated Treatment	2	73.83%	2.07
Time Placed on Long Spine Board	1	42.06%	1.25
EMS Medications & Dosages	3	97.20%	2.76
Glucose Level	2	79.44%	2.21
Notification of Other Physicians	2	52.34%	1.54
Patient Response to Treatments	3	92.52%	2.62
Nature of/Person Who Called 911	1	23.58%	0.86
Patient Reported Drug Use	2	74.53%	1.89

Table 3 Round I, All Participants, All ESI Scenario Ratings (continued)

Elements in Survey Order	Median	% Rated Important or Essential	Mean
EMS Suspicions of Drug Use	2	63.21%	1.75
EMS Suspicions of Narcotic Seeking	1	36.45%	1.20
EMS Suspicions of Suicide Attempt	3	77.57%	2.27
EMS Suspicions of Abuse	2	79.25%	2.20
Police Involvement	2	57.94%	1.70
Presence of News Media On Scene	0	14.15%	0.65
Family Dynamics, Presence	1	49.06%	1.51
Location of Outside Medical Records	1	22.43%	0.84
Location of EMS Documentation	2	66.98%	1.75

Table 4 Round I, Participant Grouped, All ESI Scenario Ratings

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Patient's name	77.42%	2.23	72.73%	1.77	87.27%	2.16
Age	87.10%	2.29	59.09%	1.68	92.73%	2.40
Date of Birth	45.16%	1.58	54.55%	1.45	56.36%	1.64
Gender	61.29%	1.87	38.10%	0.95	78.18%	2.11
Location of Belongings	9.68%	0.58	19.05%	0.76	16.36%	0.89
Insurance Information	0.00%	0.10	13.64%	0.45	14.81%	0.61
Weight	45.16%	1.39	59.09%	1.73	41.82%	1.44
Primary Care Physician	0.00%	0.32	36.36%	1.14	27.27%	0.96
EMS Agency/Transport Method	74.19%	2.03	54.55%	1.59	72.73%	2.04
Geographic Location of Incident	12.90%	0.68	31.82%	0.95	44.44%	1.33
Details of Incident/Accident	93.55%	2.26	86.36%	2.23	90.91%	2.56
Decontamination Required	100.00%	2.81	81.82%	2.14	65.45%	1.89
Photographs of Scene	3.23%	0.45	13.64%	0.45	14.55%	0.64
Number of Total Patients	87.10%	2.35	40.91%	1.18	72.73%	2.02
Total Transport Time	74.19%	1.97	59.09%	1.68	67.27%	1.85
Chief Complaint	96.77%	2.84	100.00%	2.95	98.18%	2.85
History of Present Illness	96.77%	2.71	100.00%	2.95	100.00%	2.87
Associated Symptoms	93.55%	2.58	100.00%	2.82	94.55%	2.71
Current Medications	96.77%	2.58	81.82%	2.32	83.64%	2.24

Table 4 Round I, Participant Grouped, All ESI Scenario Ratings (continued)

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Allergies	100.00%	2.71	100.00%	2.45	80.00%	2.24
Past Medical History	90.32%	2.45	86.36%	2.27	83.64%	2.20
Pertinent System Findings	87.10%	2.45	95.45%	2.73	100.00%	2.76
Time of Injury/Illness	93.55%	2.58	100.00%	2.86	92.73%	2.65
Mechanism of Injury	100.00%	2.81	100.00%	2.91	98.18%	2.75
Acute or Chronic Nature of Illness	83.87%	2.10	95.45%	2.55	81.82%	2.24
Site of Physical Injuries	100.00%	2.67	100.00%	2.67	94.55%	2.67
Baseline Vital Signs	93.55%	2.68	100.00%	2.68	98.18%	2.75
Last Set of Vital Signs	93.33%	2.70	100.00%	2.73	87.27%	2.38
Mental Status	96.77%	2.84	100.00%	2.95	96.36%	2.78
Glasgow Coma Scale	80.65%	2.26	81.82%	2.36	61.82%	2.04
Airway Patency	87.10%	2.55	81.82%	2.45	83.64%	2.45
Pupil Exam	67.74%	1.87	81.82%	2.32	72.73%	2.13
Chest Abnormalities	80.65%	2.19	72.73%	2.18	65.45%	1.84
Abdominal/Pelvic Abnormalities	80.65%	2.19	68.18%	2.14	50.91%	1.62
Last Oral Intake	48.39%	1.45	50.00%	1.64	30.91%	1.31
Combativeness	93.55%	2.45	77.27%	2.23	81.82%	2.38
Skin Exam	67.74%	1.77	50.00%	1.27	49.09%	1.58
Pain Assessment	70.97%	1.90	59.09%	1.59	78.18%	2.22

Table 4 Round I, Participant Grouped, All ESI Scenario Ratings (continued)

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Suspected Type of Shock	77.42%	2.06	54.55%	1.55	68.52%	1.91
Psychiatric History	54.84%	1.48	40.91%	1.36	38.18%	1.29
Suspected Fractures	64.52%	1.87	77.27%	1.91	69.09%	1.98
Airway Intervention	90.32%	2.61	80.95%	2.62	76.36%	2.24
Oxygen Saturation	87.10%	2.45	85.71%	2.33	76.36%	2.05
12 Lead EKG Findings	61.29%	1.52	80.95%	2.24	52.73%	1.58
CPR Performed	74.19%	2.23	61.90%	1.95	63.64%	1.85
Duration of CPR	74.19%	2.23	61.90%	1.95	60.00%	1.80
Defibrillation Attempts	74.19%	2.19	61.90%	1.95	63.64%	1.85
Vascular Access	83.87%	2.32	76.19%	2.33	80.00%	2.13
Volume & Type of IV Fluid	83.87%	2.29	76.19%	2.38	80.00%	2.18
Tourniquet Placed	80.65%	2.26	61.90%	1.90	60.00%	1.73
Patient Initiated Treatment	61.29%	1.81	90.48%	2.62	74.55%	2.00
Time Placed on Long Spine Board	54.84%	1.71	42.86%	1.10	34.55%	1.05
EMS Medications & Dosages	100.00%	2.84	100.00%	2.76	94.55%	2.71
Glucose Level	74.19%	2.23	90.48%	2.43	78.18%	2.11
Notification of Other Physicians	58.06%	1.74	52.38%	1.52	49.09%	1.44
Patient Response to Treatments	89.66%	2.52	100.00%	2.62	94.55%	2.67

Table 4 Round I, Participant Grouped, All ESI Scenario Ratings (continued)

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Nature of/Person Who Called 911	12.90%	0.61	38.10%	0.90	24.07%	0.98
Patient Reported Drug Use	66.67%	1.67	90.48%	1.95	72.73%	1.98
EMS Suspicions of Drug Use	54.84%	1.55	61.90%	1.52	68.52%	1.96
EMS Suspicions of Narcotic Seeking	29.03%	0.94	42.86%	1.14	38.18%	1.36
EMS Suspicions of Suicide Attempt	87.10%	2.45	76.19%	2.10	72.73%	2.24
EMS Suspicions of Abuse	83.33%	2.47	76.19%	2.00	78.18%	2.13
Police Involvement	70.97%	1.77	52.38%	1.57	52.73%	1.71
Presence of News Media On Scene	16.67%	0.73	23.81%	0.90	9.09%	0.51
Family Dynamics, Presence	56.67%	1.77	47.62%	1.48	45.45%	1.38
Location of Outside Medical Records	9.68%	0.55	38.10%	1.24	23.64%	0.85
Location of EMS Documentation	58.06%	1.55	76.19%	1.76	68.52%	1.87

The Round II survey instrument was based on the all participants' scores in all of the ESI scenarios. This Round II survey was developed by eliminating any element with a median score of less than 2.0 and less than 75% of participants rating the element 2 (important) or 3 (essential information). A median score of greater than 2.0 and 75% of participants rating the element important or essential indicates the importance of the information in EMS to ED patient handover (Green, 1981). Therefore an element was retained for the next Delphi round if it received a median score of 2.0 or greater and 75% of participants rated the element 2 (important) or 3 (essential information) on any scenario. Any element that did not meet these criteria was judged to be non-essential.

Round I resulted in the elimination of 17 elements and the addition of one element to the survey. Specifically five demographic, two environment of care, two clinical assessment, two EMS interventions, and six additional elements were eliminated. One element (patient known to EMS) was added to the Round II survey based on panelist recommendations. The 51 of 67 (76%) of the retained elements had mean ratings between 1.86 and 2.96.

Round II

The Round II survey tool consisted of 51 elements (see Appendix D). The electronic survey invitation was sent to the remaining 44 member participants. Twenty-three respondents ranked the importance of the 51-handover elements for each ESI scenario. Descriptive statistics were again used to determine the group ratings of all the elements for all of the scenarios as presented in Table 5. The mean element rating for all scenarios for all professions was 0.96-2.82. Table 6 is the result of the participants' element ratings for all ESI scenarios.

Table 5 Round II, All Participants, All ESI Scenarios Ratings

Elements in Survey Order	Median	% Rated Important or Essential	Mean
Patient's name	2	67.83%	1.89
Age	2	79.13%	2.09
Gender	1	47.83%	1.45
EMS Agency Identification/Transport Method	2	54.87%	1.62
Details of Incident/Accident	3	97.39%	2.64
Decontamination Required	2	71.30%	1.92
Number of Total Patients	2	60.87%	1.67
Total Transport Time	2	66.96%	1.89
Chief Complaint	3	98.26%	2.82
History of Present Illness	3	92.17%	2.59
Associated Symptoms	3	92.17%	2.56
Current Medications	2	80.87%	2.17
Allergies	3	88.70%	2.39
Past Medical History	2	80.87%	2.11
Pertinent System Findings	3	94.78%	2.61
Time of Injury/Illness	3	95.61%	2.63
Mechanism of Injury	3	92.17%	2.63
Acute/Chronic Nature of Illness	2	70.18%	2.03
Site of Physical Injuries	3	92.11%	2.62
Baseline Vital Signs	3	88.60%	2.46
Last Set of Vital Signs	3	91.23%	2.52
Mental Status	3	87.83%	2.51
Glasgow Coma Scale	2	65.79%	1.96
Airway Patency	3	73.04%	2.16
Pupil Exam	2	63.16%	1.89
Chest Abnormalities	2	60.53%	1.72
Abdominal/Pelvic Abnormalities	2	57.39%	1.66
Combativeness	2	78.26%	2.13
Skin Exam	2	66.96%	1.79
Pain Assessment	2	72.81%	1.95
Suspected Type of Shock	2	62.61%	1.84
Suspected Fractures	2	74.56%	2.05
Airway Intervention	3	67.83%	2.08
Oxygen Saturation	2	62.61%	1.85
12 Lead EKG Findings	2	52.17%	1.48
CPR Performed	2	54.78%	1.61
Duration of CPR	2	55.26%	1.61
Defibrillation Attempts	2	53.91%	1.59
Vascular Access	2	70.43%	1.99
Volume & Type of IV Fluid	2	73.04%	2.06
Tourniquet Placed	1	49.12%	1.40
Patient Initiated Treatment	2	77.19%	2.07
EMS Medications & Dosages	3	93.86%	2.61
Glucose Level	2	65.79%	1.92
Patient Response to Treatments	3	92.98%	2.59

Table 5 Round II, All Participants, All ESI Scenarios Ratings

Elements in Survey Order	Median	% Rated Important or Essential	Mean
Patient Reported Drug Use	2	66.96%	1.89
EMS Suspicions of Suicide Attempt	2	76.52%	2.14
EMS Suspicions of Abuse	2	68.70%	2.00
Police Involvement	2	60.53%	1.82
Physical Location of EMS Documentation	2	58.41%	1.60
Patient Known to EMS	1	24.56%	0.96

Table 6 Round II, Participant Grouped Responses, All ESI Scenario Ratings

	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Patient's name	66.67%	1.83	72.50%	1.90	64.44%	1.91
Age	80.00%	2.13	67.50%	1.85	88.89%	2.27
Gender	46.67%	1.57	55.00%	1.48	42.22%	1.36
EMS Agency Identification/Transport Method	60.00%	1.77	50.00%	1.45	55.81%	1.67
Details of Incident/Accident	90.00%	2.50	100.00%	2.50	100.00%	2.87
Decontamination Required	80.00%	2.20	65.00%	1.73	71.11%	1.91
Number of Total Patients	80.00%	2.10	52.50%	1.40	55.56%	1.62
Total Transport Time	66.67%	1.87	62.50%	1.63	71.11%	2.13
Chief Complaint	96.67%	2.70	97.50%	2.73	100.00%	2.98
History of Present Illness	83.33%	2.57	97.50%	2.50	93.33%	2.69
Associated Symptoms	86.67%	2.43	92.50%	2.53	95.56%	2.67
Current Medications	86.67%	2.27	75.00%	2.18	82.22%	2.09
Allergies	96.67%	2.77	97.50%	2.43	75.56%	2.11
Past Medical History	83.33%	2.20	75.00%	2.10	84.44%	2.07
Pertinent System Findings	80.00%	2.27	100.00%	2.75	100.00%	2.71
Time of Injury/Illness	93.33%	2.50	95.00%	2.63	97.73%	2.73
Mechanism of Injury	96.67%	2.63	85.00%	2.53	95.56%	2.73
Acute/Chronic Nature of Illness	63.33%	1.90	69.23%	2.08	75.56%	2.07

Table 6 Round II, Participant Grouped Responses, All ESI Scenario Ratings (continued)

	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Site of Physical Injuries	93.33%	2.57	85.00%	2.53	97.73%	2.75
Baseline Vital Signs	89.66%	2.55	87.50%	2.48	88.89%	2.40
Last Set of Vital Signs	90.00%	2.43	92.50%	2.63	90.91%	2.48
Mental Status	86.67%	2.40	90.00%	2.63	86.67%	2.49
Glasgow Coma Scale	46.67%	1.60	82.50%	2.23	63.64%	1.95
Airway Patency	76.67%	2.33	77.50%	2.18	66.67%	2.02
Pupil Exam	53.33%	1.73	74.36%	2.08	60.00%	1.82
Chest Abnormalities	73.33%	2.13	72.50%	1.85	40.91%	1.32
Abdominal/Pelvic Abnormalities	73.33%	2.10	72.50%	1.88	33.33%	1.18
Combativeness	76.67%	2.20	82.50%	2.18	75.56%	2.04
Skin Exam	66.67%	1.87	70.00%	1.75	64.44%	1.78
Pain Assessment	56.67%	1.70	84.62%	2.13	73.33%	1.96
Suspected Type of Shock	53.33%	1.80	65.00%	1.80	66.67%	1.91
Suspected Fractures	65.52%	2.00	77.50%	2.10	77.78%	2.04
Airway Intervention	73.33%	2.27	72.50%	2.18	60.00%	1.87
Oxygen Saturation	73.33%	2.17	75.00%	2.10	44.44%	1.42
12 Lead EKG Findings	43.33%	1.37	72.50%	1.85	40.00%	1.22
CPR Performed	70.00%	2.10	57.50%	1.68	42.22%	1.22
Duration of CPR	72.41%	2.17	57.50%	1.65	42.22%	1.22
Defibrillation Attempts	66.67%	2.03	57.50%	1.68	42.22%	1.22

Table 6 Round II, Participant Grouped Responses, All ESI Scenario Ratings (continued)

	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Vascular Access	70.00%	2.07	77.50%	2.13	64.44%	1.82
Volume & Type of IV Fluid	83.33%	2.33	80.00%	2.15	60.00%	1.80
Tourniquet Placed	46.67%	1.53	56.41%	1.59	44.44%	1.16
Patient Initiated Treatment	90.00%	2.37	82.05%	2.21	64.44%	1.76
EMS Medications & Dosages	100.00%	2.80	94.87%	2.62	88.89%	2.47
Glucose Level	70.00%	1.97	74.36%	2.08	55.56%	1.76
Patient Response to Treatments	93.33%	2.63	97.44%	2.56	88.89%	2.58
Patient Reported Drug Use	53.33%	1.70	72.50%	2.00	71.11%	1.91
EMS Suspicions of Suicide Attempt	96.67%	2.73	70.00%	1.98	68.89%	1.89
EMS Suspicions of Abuse	93.33%	2.47	57.50%	1.78	62.22%	1.89
Police Involvement	83.33%	2.27	57.50%	1.83	47.73%	1.52
Physical Location of EMS Documentation	66.67%	1.83	53.85%	1.44	56.82%	1.59
Patient Known to EMS	23.33%	1.10	15.38%	0.82	33.33%	0.98

Table 7 displays the percent of respondents who found the elements important or essential along with the mean element rating for the ESI Level One scenario. The mean element ratings for all participants ranged from 0.78-3.00. All participant groups achieved unanimous consensus, scoring a 75% or higher rating of important or essential on 28 of the 51 elements. These elements were details of incident, decontamination required, number of total patients, total transport time, chief complaint, history of present illness, associated symptoms, pertinent system findings, time of injury/illness, mechanism of injury, site of physical injuries, baseline vital signs, last set of vital signs, mental status, Glasgow Coma Scale, airway patency, pupil exam, combativeness, skin exam, suspected type of shock, airway intervention, vascular access, volume/type of IV fluid, patient initiated treatment, EMS medications/dosages, patient response to treatments, EMS suspicions of abuse, and police involvement. Table 8 is the grouped participant responses for the ESI Level One scenario.

Table 7 Round II, All Participants, ESI Level One Scenario

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.78
Time of Injury/Illness	100.00%	2.91
Mechanism of Injury	100.00%	2.91
Site of Physical Injuries	100.00%	2.96
Last Set of Vital Signs	100.00%	2.87
Mental Status	100.00%	2.96
Airway Patency	100.00%	3.00
Combativeness	100.00%	2.78
Airway Intervention	100.00%	3.00
Vascular Access	100.00%	2.70
Volume & Type of IV Fluid	100.00%	2.74
EMS Medications & Dosages	100.00%	2.78
Patient Response to Treatments	100.00%	2.91
Total Transport Time	95.65%	2.70
Chief Complaint	95.65%	2.78
Pertinent System Findings	95.65%	2.78
Baseline Vital Signs	95.65%	2.74
History of Present Illness	91.30%	2.57
Associated Symptoms	91.30%	2.52

Glasgow Coma Scale	91.30%	2.70
Pupil Exam	91.30%	2.61
Police Involvement	90.91%	2.45
Decontamination Required	86.96%	2.26
Oxygen Saturation	86.96%	2.52
Number of Total Patients	82.61%	2.13
Allergies	82.61%	2.30
Skin Exam	82.61%	2.09
Suspected Type of Shock	82.61%	2.39
CPR Performed	82.61%	2.39
Duration of CPR	82.61%	2.39
EMS Suspicions of Suicide Attempt	82.61%	2.30
EMS Suspicions of Abuse	82.61%	2.22
Chest Abnormalities	78.26%	2.22
Suspected Fractures	78.26%	2.17
Defibrillation Attempts	78.26%	2.30
Patient Initiated Treatment	78.26%	2.13
Physical Location of EMS Documentation	78.26%	1.96
Age	73.91%	1.96
EMS Agency Identification/Transport Method	73.91%	2.09
Abdominal/Pelvic Abnormalities	73.91%	2.09
Current Medications	69.57%	1.91
Past Medical History	69.57%	1.87
Glucose Level	69.57%	2.13
Patient Reported Drug Use	69.57%	1.83
Acute/Chronic Nature of Illness	68.18%	1.95
12 Lead EKG Findings	65.22%	1.87
Pain Assessment	60.87%	1.70
Patient's name	52.17%	1.57
Tourniquet Placed	52.17%	1.48
Gender	43.48%	1.39
Patient Known to EMS	21.74%	0.78

Table 8 Round II, Participant Grouped, ESI Level One Scenario

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Emergency Medicine Physicians Mean	Emergency Registered Nurses % Rated Important or Essential	Emergency Registered Nurses Mean	Paramedics % Rated Important or Essential	Paramedics Mean
Patient's name	66.67%	1.83	50.00%	1.38	44.44%	1.56
Age	66.67%	1.83	75.00%	1.88	77.78%	2.11
Gender	50.00%	1.67	62.50%	1.63	22.22%	1.00
EMS Agency Identification/Transport Method	66.67%	2.17	62.50%	1.88	88.89%	2.22
Details of Incident/Accident	100.00%	2.83	100.00%	2.63	100.00%	2.89
Decontamination Required	83.33%	2.17	75.00%	2.00	100.00%	2.56
Number of Total Patients	100.00%	2.50	75.00%	2.00	77.78%	2.00
Total Transport Time	83.33%	2.67	100.00%	2.50	100.00%	2.89
Chief Complaint	100.00%	2.83	87.50%	2.50	100.00%	3.00
History of Present Illness	83.33%	2.67	87.50%	2.25	100.00%	2.78
Associated Symptoms	83.33%	2.50	87.50%	2.50	100.00%	2.56
Current Medications	83.33%	2.00	62.50%	2.00	66.67%	1.78
Allergies	100.00%	3.00	100.00%	2.38	55.56%	1.78
Past Medical History	83.33%	2.17	75.00%	2.00	55.56%	1.56
Pertinent System Findings	83.33%	2.33	100.00%	3.00	100.00%	2.89
Time of Injury/Illness	100.00%	2.83	100.00%	2.88	100.00%	3.00
Mechanism of Injury	100.00%	2.83	100.00%	2.88	100.00%	3.00
Acute/Chronic Nature of Illness	66.67%	2.00	71.43%	2.00	66.67%	1.89

Table 8 Round II, Participant Grouped, ESI Level One Scenario (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Site of Physical Injuries	100.00%	2.83	100.00%	3.00	100.00%	3.00
Baseline Vital Signs	100.00%	2.83	87.50%	2.50	100.00%	2.89
Last Set of Vital Signs	100.00%	2.83	100.00%	2.88	100.00%	2.89
Mental Status	100.00%	2.83	100.00%	3.00	100.00%	3.00
Glasgow Coma Scale	83.33%	2.67	100.00%	2.88	88.89%	2.56
Airway Patency	100.00%	3.00	100.00%	3.00	100.00%	3.00
Pupil Exam	83.33%	2.67	100.00%	2.75	88.89%	2.44
Chest Abnormalities	100.00%	2.83	87.50%	2.25	55.56%	1.78
Abdominal/Pelvic Abnormalities	100.00%	2.67	87.50%	2.25	44.44%	1.56
Combativeness	100.00%	2.83	100.00%	2.88	100.00%	2.67
Skin Exam	83.33%	2.17	87.50%	2.00	77.78%	2.11
Pain Assessment	50.00%	1.67	87.50%	2.13	44.44%	1.33
Suspected Type of Shock	83.33%	2.50	75.00%	2.25	88.89%	2.44
Suspected Fractures	66.67%	2.17	75.00%	2.13	88.89%	2.22
Airway Intervention	100.00%	3.00	100.00%	3.00	100.00%	3.00
Oxygen Saturation	100.00%	2.83	100.00%	2.75	66.67%	2.11
12 Lead EKG Findings	33.33%	1.67	100.00%	2.50	55.56%	1.44
CPR Performed	100.00%	3.00	87.50%	2.50	66.67%	1.89
Duration of CPR	100.00%	3.00	87.50%	2.50	66.67%	1.89

Table 8 Round II, Participant Grouped, ESI Level One Scenario (continued)

Elements in Survey Order	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Defibrillation Attempts	83.33%	2.67	87.50%	2.50	66.67%	1.89
Vascular Access	100.00%	2.83	100.00%	2.75	100.00%	2.56
Volume & Type of IV Fluid	100.00%	3.00	100.00%	2.75	100.00%	2.56
Tourniquet Placed	33.33%	1.33	62.50%	1.63	55.56%	1.44
Patient Initiated Treatment	83.33%	2.33	75.00%	2.13	77.78%	2.00
EMS Medications & Dosages	100.00%	3.00	100.00%	2.75	100.00%	2.67
Glucose Level	100.00%	2.67	62.50%	2.13	55.56%	1.78
Patient Response to Treatments	100.00%	2.83	100.00%	2.88	100.00%	3.00
Patient Reported Drug Use	50.00%	1.67	75.00%	1.88	77.78%	1.89
EMS Suspicions of Suicide Attempt	100.00%	2.83	87.50%	2.25	66.67%	2.00
EMS Suspicions of Abuse	100.00%	2.50	75.00%	2.00	77.78%	2.22
Police Involvement	100.00%	2.50	100.00%	2.63	75.00%	2.25
Physical Location of EMS Documentation	66.67%	2.00	87.50%	1.88	77.78%	2.00
Patient Known to EMS	33.33%	1.17	12.50%	0.75	22.22%	0.56

Table 9 displays the percent of respondents who found the elements important or essential along with the mean element rating for the ESI Level Two scenario. The mean element ratings for all participants ranged from 1.00-2.91. All participant groups achieved consensus, scoring a 75% or higher rating of important or essential on 32 of the 51 elements. These elements were details of incident, number of total patients, total transport time, chief complaint, history of present illness, associated symptoms, current medications, allergies, past medical history, pertinent system findings, time of injury/illness, mechanism of injury, site of physical injuries, baseline vital signs, last set of vital signs, mental status, Glasgow Coma Scale, airway patency, pupil exam, chest abnormalities, abdominal/pelvic abnormalities, combativeness, skin exam, airway intervention, 12-lead EKG findings, vascular access, volume/type of IV fluid, patient initiated treatment, glucose level, EMS medications/dosages, patient response to treatments, and EMS suspicions of suicide attempt. Table 10 is the grouped participant responses for the ESI Level Two scenario.

Table 9 Round II, All Participants, ESI Level Two Scenario

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.74
Total Transport Time	100.00%	2.43
Time of Injury/Illness	100.00%	2.74
Last Set of Vital Signs	100.00%	2.65
Mental Status	100.00%	2.91
Airway Patency	100.00%	2.87
EMS Medications & Dosages	100.00%	2.70
Glucose Level	100.00%	2.87
Patient Response to Treatments	100.00%	2.91
Chief Complaint	95.65%	2.83
Associated Symptoms	95.65%	2.65
Pertinent System Findings	95.65%	2.74
Mechanism of Injury	95.65%	2.83
Site of Physical Injuries	95.65%	2.74
Chest Abnormalities	95.65%	2.48

Abdominal/Pelvic Abnormalities	95.65%	2.48
Combativeness	95.65%	2.48
Airway Intervention	95.65%	2.87
History of Present Illness	91.30%	2.65
Allergies	91.30%	2.43
Baseline Vital Signs	91.30%	2.57
Volume & Type of IV Fluid	91.30%	2.43
Pupil Exam	90.91%	2.55
Glasgow Coma Scale	86.96%	2.57
Oxygen Saturation	86.96%	2.57
12 Lead EKG Findings	86.96%	2.17
Current Medications	82.61%	2.30
Past Medical History	82.61%	2.22
Skin Exam	82.61%	2.04
Suspected Fractures	82.61%	2.30
Vascular Access	82.61%	2.35
Patient Initiated Treatment	82.61%	2.30
EMS Suspicions of Suicide Attempt	82.61%	2.26
Age	78.26%	2.09
Decontamination Required	78.26%	2.09
Number of Total Patients	78.26%	2.00
Suspected Type of Shock	78.26%	2.30
Patient Reported Drug Use	78.26%	2.17
Acute/Chronic Nature of Illness	73.91%	2.17
EMS Suspicions of Abuse	73.91%	2.13
EMS Agency Identification/Transport Method	68.18%	1.82
Physical Location of EMS Documentation	68.18%	1.82
Pain Assessment	65.22%	1.83
CPR Performed	65.22%	1.91
Duration of CPR	65.22%	1.91
Defibrillation Attempts	65.22%	1.91
Police Involvement	65.22%	1.96
Patient's name	60.87%	1.70
Gender	56.52%	1.57
Tourniquet Placed	56.52%	1.61
Patient Known to EMS	30.43%	1.00

Table 10 Round II, Participant Grouped, ESI Level Two Scenario Ratings

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Patient's name	50.00%	1.50	75.00%	2.13	55.56%	1.44
Age	66.67%	2.00	75.00%	2.00	88.89%	2.22
Gender	50.00%	1.83	62.50%	1.63	55.56%	1.33
EMS Agency Identification/Transport Method	83.33%	2.00	62.50%	1.75	62.50%	1.75
Details of Incident/Accident	100.00%	2.83	100.00%	2.38	100.00%	3.00
Decontamination Required	83.33%	2.50	62.50%	1.63	88.89%	2.22
Number of Total Patients	83.33%	2.17	75.00%	1.75	77.78%	2.11
Total Transport Time	100.00%	2.33	100.00%	2.13	100.00%	2.78
Chief Complaint	83.33%	2.67	100.00%	2.88	100.00%	2.89
History of Present Illness	83.33%	2.67	100.00%	2.63	88.89%	2.67
Associated Symptoms	100.00%	2.50	87.50%	2.50	100.00%	2.89
Current Medications	100.00%	2.67	75.00%	2.38	77.78%	2.00
Allergies	100.00%	3.00	100.00%	2.50	77.78%	2.00
Past Medical History	83.33%	2.33	75.00%	2.25	88.89%	2.11
Pertinent System Findings	83.33%	2.33	100.00%	2.75	100.00%	3.00
Time of Injury/Illness	100.00%	2.67	100.00%	2.63	100.00%	2.89
Mechanism of Injury	100.00%	2.83	87.50%	2.63	100.00%	3.00
Acute/Chronic Nature of Illness	66.67%	2.00	62.50%	2.13	88.89%	2.33

Table 10 Round II, Participant Grouped, ESI Level Two Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Site of Physical Injuries	100.00%	2.67	87.50%	2.63	100.00%	2.89
Baseline Vital Signs	100.00%	2.67	87.50%	2.50	88.89%	2.56
Last Set of Vital Signs	100.00%	2.50	100.00%	2.75	100.00%	2.67
Mental Status	100.00%	2.83	100.00%	2.88	100.00%	3.00
Glasgow Coma Scale	83.33%	2.50	100.00%	2.75	77.78%	2.44
Airway Patency	100.00%	3.00	100.00%	3.00	100.00%	2.67
Pupil Exam	83.33%	2.33	100.00%	2.71	88.89%	2.56
Chest Abnormalities	100.00%	2.67	100.00%	2.50	88.89%	2.33
Abdominal/Pelvic Abnormalities	100.00%	2.67	100.00%	2.50	88.89%	2.33
Combativeness	83.33%	2.50	100.00%	2.50	100.00%	2.44
Skin Exam	83.33%	2.17	75.00%	1.88	88.89%	2.11
Pain Assessment	50.00%	1.67	75.00%	2.00	66.67%	1.78
Suspected Type of Shock	66.67%	2.17	75.00%	2.13	88.89%	2.56
Suspected Fractures	66.67%	2.17	75.00%	2.25	100.00%	2.44
Airway Intervention	100.00%	3.00	100.00%	3.00	88.89%	2.67
Oxygen Saturation	100.00%	3.00	100.00%	2.88	66.67%	2.00
12 Lead EKG Findings	83.33%	2.00	100.00%	2.38	77.78%	2.11
CPR Performed	83.33%	2.50	50.00%	1.63	66.67%	1.78
Duration of CPR	83.33%	2.50	50.00%	1.63	66.67%	1.78
Defibrillation Attempts	83.33%	2.50	50.00%	1.63	66.67%	1.78

Table 10 Round II, Participant Grouped, ESI Level Two Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Vascular Access	83.33%	2.50	87.50%	2.50	77.78%	2.11
Volume & Type of IV Fluid	100.00%	2.67	100.00%	2.50	77.78%	2.22
Tourniquet Placed	66.67%	2.00	50.00%	1.50	55.56%	1.44
Patient Initiated Treatment	100.00%	2.67	75.00%	2.13	77.78%	2.22
EMS Medications & Dosages	100.00%	2.83	100.00%	2.63	100.00%	2.67
Glucose Level	100.00%	3.00	100.00%	2.88	100.00%	2.78
Patient Response to Treatments	100.00%	3.00	100.00%	2.75	100.00%	3.00
Patient Reported Drug Use	66.67%	2.00	87.50%	2.38	77.78%	2.11
EMS Suspicions of Suicide Attempt	100.00%	2.67	75.00%	2.13	77.78%	2.11
EMS Suspicions of Abuse	100.00%	2.50	62.50%	2.00	66.67%	2.00
Police Involvement	83.33%	2.33	62.50%	1.88	55.56%	1.78
Physical Location of EMS Documentation	83.33%	2.00	50.00%	1.50	75.00%	2.00
Patient Known to EMS	33.33%	1.17	25.00%	0.75	33.33%	1.11

Table 11 displays the percent of respondents who found the elements important or essential along with the mean element rating for the ESI Level Three scenario. The mean element ratings for all participants ranged from 1.00-2.83. Participant groups achieved unanimous consensus, scoring a 75% or higher rating of important or essential on 14 of the 51 elements. These elements were age, chief complaint, history of present illness, associated symptoms, current medications, allergies, past medical history, time of injury/illness, baseline vital signs, last set of vital signs, mental status, combativeness, EMS medication/dosages, and patient response to treatments. Table 12 is the grouped participant responses for the ESI Level Three scenario.

Table 11 Round II, All Participants, ESI Level Three Scenario

Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.83
Last Set of Vital Signs	100.00%	2.77
Mental Status	100.00%	2.83
History of Present Illness	95.65%	2.70
Associated Symptoms	95.65%	2.70
Current Medications	95.65%	2.43
Baseline Vital Signs	95.65%	2.65
Time of Injury/Illness	95.45%	2.68
Details of Incident/Accident	91.30%	2.52
Allergies	91.30%	2.52
Past Medical History	91.30%	2.39
Pertinent System Findings	91.30%	2.57
EMS Medications & Dosages	91.30%	2.65
Age	86.96%	2.39
Pupil Exam	86.96%	2.43
Patient Response to Treatments	86.96%	2.52
Pain Assessment	86.36%	2.18
Combativeness	82.61%	2.26
Patient Initiated Treatment	82.61%	2.13
Acute/Chronic Nature of Illness	78.26%	2.30
Glasgow Coma Scale	78.26%	2.09
Volume & Type of IV Fluid	78.26%	2.09
Patient's name	73.91%	2.04

Total Transport Time	73.91%	1.96
Patient Reported Drug Use	73.91%	2.13
Site of Physical Injuries	72.73%	2.00
EMS Agency Identification/Transport Method	69.57%	1.87
Mechanism of Injury	69.57%	2.00
Vascular Access	69.57%	1.91
Glucose Level	69.57%	1.91
Airway Patency	65.22%	1.91
Oxygen Saturation	65.22%	1.78
EMS Suspicions of Suicide Attempt	65.22%	1.91
Suspected Type of Shock	60.87%	1.65
Gender	56.52%	1.78
Airway Intervention	56.52%	1.78
12 Lead EKG Findings	52.17%	1.48
EMS Suspicions of Abuse	52.17%	1.70
Physical Location of EMS Documentation	50.00%	1.55
Decontamination Required	47.83%	1.43
Number of Total Patients	43.48%	1.30
Chest Abnormalities	43.48%	1.30
Abdominal/Pelvic Abnormalities	43.48%	1.30
Skin Exam	43.48%	1.26
CPR Performed	43.48%	1.30
Duration of CPR	43.48%	1.30
Defibrillation Attempts	43.48%	1.30
Suspected Fractures	40.91%	1.09
Tourniquet Placed	34.78%	1.00
Police Involvement	34.78%	1.26
Patient Known to EMS	26.09%	1.13

Table 12 Round II, Participant Grouped, ESI Level Three Scenario Ratings

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Patient's name	66.67%	1.83	87.50%	2.13	66.67%	2.11
Age	83.33%	2.33	75.00%	2.00	100.00%	2.78
Gender	50.00%	1.83	50.00%	1.50	66.67%	2.00
EMS Agency Identification/Transport Method	66.67%	1.83	50.00%	1.50	88.89%	2.22
Details of Incident/Accident	66.67%	2.17	100.00%	2.50	100.00%	2.78
Decontamination Required	66.67%	2.00	50.00%	1.25	33.33%	1.22
Number of Total Patients	50.00%	1.67	37.50%	1.00	44.44%	1.33
Total Transport Time	50.00%	1.50	75.00%	1.75	88.89%	2.44
Chief Complaint	100.00%	2.67	100.00%	2.75	100.00%	3.00
History of Present Illness	83.33%	2.50	100.00%	2.63	100.00%	2.89
Associated Symptoms	83.33%	2.50	100.00%	2.63	100.00%	2.89
Current Medications	100.00%	2.50	87.50%	2.25	100.00%	2.56
Allergies	100.00%	3.00	100.00%	2.38	77.78%	2.33
Past Medical History	83.33%	2.33	87.50%	2.25	100.00%	2.56
Pertinent System Findings	66.67%	2.17	100.00%	2.63	100.00%	2.78
Time of Injury/Illness	83.33%	2.33	100.00%	2.63	100.00%	3.00
Mechanism of Injury	100.00%	2.33	37.50%	1.38	77.78%	2.33
Acute/Chronic Nature of Illness	50.00%	1.83	75.00%	2.38	100.00%	2.56

Table 12 Round II, Participant Grouped, ESI Level Three Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Site of Physical Injuries	83.33%	2.17	50.00%	1.50	87.50%	2.38
Baseline Vital Signs	100.00%	2.83	100.00%	2.75	88.89%	2.44
Last Set of Vital Signs	100.00%	2.67	100.00%	2.88	100.00%	2.75
Mental Status	100.00%	2.67	100.00%	3.00	100.00%	2.78
Glasgow Coma Scale	33.33%	1.17	100.00%	2.63	88.89%	2.22
Airway Patency	83.33%	2.33	75.00%	1.88	44.44%	1.67
Pupil Exam	66.67%	1.83	100.00%	2.75	88.89%	2.56
Chest Abnormalities	66.67%	2.00	62.50%	1.63	11.11%	0.56
Abdominal/Pelvic Abnormalities	66.67%	2.00	62.50%	1.63	11.11%	0.56
Combativeness	83.33%	2.33	75.00%	2.13	88.89%	2.33
Skin Exam	33.33%	1.17	37.50%	1.13	55.56%	1.44
Pain Assessment	66.67%	1.67	85.71%	2.29	100.00%	2.44
Suspected Type of Shock	50.00%	1.67	75.00%	1.88	55.56%	1.44
Suspected Fractures	40.00%	1.20	50.00%	1.25	33.33%	0.89
Airway Intervention	66.67%	2.17	62.50%	1.88	44.44%	1.44
Oxygen Saturation	83.33%	2.33	75.00%	2.00	44.44%	1.22
12 Lead EKG Findings	50.00%	1.33	62.50%	1.75	44.44%	1.33
CPR Performed	66.67%	2.00	50.00%	1.38	22.22%	0.78
Duration of CPR	66.67%	2.00	50.00%	1.38	22.22%	0.78
Defibrillation Attempts	66.67%	2.00	50.00%	1.38	22.22%	0.78

Table 12 Round II, Participant Grouped, ESI Level Three Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Vascular Access	66.67%	1.83	87.50%	2.25	55.56%	1.67
Volume & Type of IV Fluid	100.00%	2.50	87.50%	2.13	55.56%	1.78
Tourniquet Placed	33.33%	1.17	50.00%	1.38	22.22%	0.56
Patient Initiated Treatment	100.00%	2.50	100.00%	2.63	55.56%	1.44
EMS Medications & Dosages	100.00%	2.83	100.00%	2.75	77.78%	2.44
Glucose Level	50.00%	1.50	87.50%	2.25	66.67%	1.89
Patient Response to Treatments	83.33%	2.50	100.00%	2.63	77.78%	2.44
Patient Reported Drug Use	50.00%	1.83	87.50%	2.13	77.78%	2.33
EMS Suspicions of Suicide Attempt	83.33%	2.50	50.00%	1.63	66.67%	1.78
EMS Suspicions of Abuse	83.33%	2.33	37.50%	1.38	44.44%	1.56
Police Involvement	66.67%	1.83	25.00%	1.13	22.22%	1.00
Physical Location of EMS Documentation	50.00%	1.67	57.14%	1.71	44.44%	1.33
Patient Known to EMS	16.67%	1.00	25.00%	1.38	33.33%	1.00

Table 13 displays the percent of respondents who found the elements important or essential along with the mean element rating for the ESI Level Four scenario. The mean element ratings for all participants ranged from 0.96-2.87. All participant groups achieved consensus, scoring a 75% or higher rating of important or essential on 14 of the 51 elements. These elements were details of the incident, decontamination required, chief complaint, history of present illness, associated symptoms, current medications, allergies, pertinent system findings, time of injury/illness, mechanism of injury, site of physical injuries, suspected fractures, EMS medications/dosages, and patient response to treatments. Table 14 is the grouped participant responses for the ESI Level Four scenario.

Table 13 Round II, All Participants, ESI Level Four Scenario

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.52
Chief Complaint	100.00%	2.87
Pertinent System Findings	95.65%	2.52
Mechanism of Injury	95.65%	2.65
Site of Physical Injuries	95.65%	2.65
Suspected Fractures	95.65%	2.52
Patient Response to Treatments	95.45%	2.36
History of Present Illness	91.30%	2.48
Associated Symptoms	91.30%	2.48
Allergies	91.30%	2.35
EMS Medications & Dosages	90.91%	2.50
Time of Injury/Illness	86.96%	2.26
Decontamination Required	82.61%	2.04
Current Medications	82.61%	2.17
Past Medical History	78.26%	2.04
Baseline Vital Signs	78.26%	2.17
Last Set of Vital Signs	78.26%	2.13
Pain Assessment	78.26%	1.96
EMS Suspicions of Suicide Attempt	78.26%	2.17
Patient Initiated Treatment	77.27%	1.95
Patient's name	73.91%	2.09
Age	73.91%	1.87
Mental Status	73.91%	2.09

EMS Suspicions of Abuse	73.91%	2.13
Combativeness	69.57%	1.83
Acute/Chronic Nature of Illness	60.87%	1.78
Skin Exam	60.87%	1.78
Patient Reported Drug Use	60.87%	1.70
Police Involvement	60.87%	1.78
Number of Total Patients	52.17%	1.43
Vascular Access	52.17%	1.48
Tourniquet Placed	50.00%	1.41
Glucose Level	50.00%	1.45
Airway Patency	47.83%	1.52
Physical Location of EMS Documentation	47.83%	1.43
Duration of CPR	45.45%	1.32
Suspected Type of Shock	43.48%	1.48
Airway Intervention	43.48%	1.43
CPR Performed	43.48%	1.30
Defibrillation Attempts	43.48%	1.30
Volume & Type of IV Fluid	43.48%	1.48
Chest Abnormalities	39.13%	1.35
Gender	34.78%	1.17
Glasgow Coma Scale	34.78%	1.26
Oxygen Saturation	34.78%	1.17
EMS Agency Identification/Transport Method	30.43%	1.09
Abdominal/Pelvic Abnormalities	30.43%	1.26
Patient Known to EMS	27.27%	1.09
Total Transport Time	26.09%	1.00
12 Lead EKG Findings	26.09%	0.96
Pupil Exam	21.74%	0.96

Table 14 Round II, Participant Grouped, ESI Level Four Scenario Ratings

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Patient's name	83.33%	2.17	62.50%	1.88	77.78%	2.22
Age	100.00%	2.33	50.00%	1.63	77.78%	1.78
Gender	33.33%	1.00	50.00%	1.38	22.22%	1.11
EMS Agency Identification/Transport Method	33.33%	1.17	37.50%	1.00	22.22%	1.11
Details of Incident/Accident	100.00%	2.17	100.00%	2.38	100.00%	2.89
Decontamination Required	100.00%	2.33	75.00%	2.13	77.78%	1.78
Number of Total Patients	100.00%	2.17	25.00%	1.00	44.44%	1.33
Total Transport Time	33.33%	1.17	12.50%	0.63	33.33%	1.22
Chief Complaint	100.00%	2.67	100.00%	2.88	100.00%	3.00
History of Present Illness	83.33%	2.50	100.00%	2.63	88.89%	2.33
Associated Symptoms	83.33%	2.33	100.00%	2.63	88.89%	2.44
Current Medications	83.33%	2.17	87.50%	2.38	77.78%	2.00
Allergies	83.33%	2.17	100.00%	2.63	88.89%	2.22
Past Medical History	83.33%	2.00	62.50%	2.00	88.89%	2.11
Pertinent System Findings	83.33%	2.33	100.00%	2.88	100.00%	2.33
Time of Injury/Illness	83.33%	2.17	87.50%	2.50	88.89%	2.11
Mechanism of Injury	83.33%	2.50	100.00%	3.00	100.00%	2.44
Acute/Chronic Nature of Illness	66.67%	1.83	62.50%	1.88	55.56%	1.67
Site of Physical Injuries	83.33%	2.33	100.00%	3.00	100.00%	2.56
Baseline Vital Signs	66.67%	2.17	87.50%	2.50	77.78%	1.89
Last Set of Vital Signs	66.67%	2.00	87.50%	2.38	77.78%	2.00

Table 14 Round II, Participant Grouped, ESI Level Four Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Mental Status	50.00%	1.67	87.50%	2.50	77.78%	2.00
Glasgow Coma Scale	16.67%	1.00	50.00%	1.38	33.33%	1.33
Airway Patency	33.33%	1.33	50.00%	1.38	55.56%	1.78
Pupil Exam	16.67%	1.00	25.00%	0.88	22.22%	1.00
Chest Abnormalities	33.33%	1.33	50.00%	1.38	33.33%	1.33
Abdominal/Pelvic Abnormalities	33.33%	1.33	50.00%	1.50	11.11%	1.00
Combativeness	66.67%	1.83	75.00%	1.75	66.67%	1.89
Skin Exam	66.67%	2.00	75.00%	1.88	44.44%	1.56
Pain Assessment	66.67%	1.83	87.50%	2.00	77.78%	2.00
Suspected Type of Shock	33.33%	1.33	50.00%	1.50	44.44%	1.56
Suspected Fractures	83.33%	2.33	100.00%	2.63	100.00%	2.56
Airway Intervention	50.00%	1.67	50.00%	1.50	33.33%	1.22
Oxygen Saturation	33.33%	1.17	50.00%	1.38	22.22%	1.00
12 Lead EKG Findings	16.67%	0.83	50.00%	1.38	11.11%	0.67
CPR Performed	50.00%	1.50	50.00%	1.50	33.33%	1.00
Duration of CPR	60.00%	1.80	50.00%	1.38	33.33%	1.00
Defibrillation Attempts	50.00%	1.50	50.00%	1.50	33.33%	1.00
Vascular Access	50.00%	1.50	50.00%	1.38	55.56%	1.56
Volume & Type of IV Fluid	50.00%	1.50	50.00%	1.63	33.33%	1.33
Tourniquet Placed	50.00%	1.50	57.14%	1.71	44.44%	1.11
Patient Initiated Treatment	83.33%	2.17	85.71%	2.14	66.67%	1.67
EMS Medications & Dosages	100.00%	2.67	85.71%	2.43	88.89%	2.44

Table 14 Round II, Participant Grouped, ESI Level Four Scenario Ratings (continued)

Elements in Survey Order	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Glucose Level	50.00%	1.33	71.43%	1.71	33.33%	1.33
Patient Response to Treatments	100.00%	2.50	100.00%	2.29	88.89%	2.33
Patient Reported Drug Use	50.00%	1.50	75.00%	2.00	55.56%	1.56
EMS Suspicions of Suicide Attempt	100.00%	3.00	62.50%	1.88	77.78%	1.89
EMS Suspicions of Abuse	100.00%	2.83	62.50%	1.88	66.67%	1.89
Police Involvement	83.33%	2.33	50.00%	1.75	55.56%	1.44
Physical Location of EMS Documentation	50.00%	1.67	37.50%	1.13	55.56%	1.56
Patient Known to EMS	16.67%	1.17	14.29%	0.71	44.44%	1.33

Table 15 displays the percent of respondents who found the elements important or essential along with the mean element rating for the ESI Level Five scenario. The mean element ratings for all participants ranged from 0.78-2.78. All participant groups achieved unanimous consensus, scoring a 75% or higher rating of important or essential on 14 of the 51 elements. These elements were details of incident, chief complaint, history of present illness, associated symptoms, allergies, past medical history, pertinent system findings, time of injury/illness, mechanism of injury, site of physical injuries, baseline vital signs, last set of vital signs, EMS medications/dosages, and patient response to treatment. Table 16 is the grouped participant responses for the ESI Level Five scenario.

Table 15 Round II, All Participants, ESI Level Four Scenario

Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.78
Mechanism of Injury	100.00%	2.78
Details of Incident/Accident	95.65%	2.65
Pertinent System Findings	95.65%	2.43
Time of Injury/Illness	95.65%	2.57
Site of Physical Injuries	95.65%	2.74
History of Present Illness	91.30%	2.57
Associated Symptoms	86.96%	2.43
Allergies	86.96%	2.35
EMS Medications & Dosages	86.96%	2.39
Age	82.61%	2.13
Past Medical History	82.61%	2.04
Patient Response to Treatments	82.61%	2.22
Baseline Vital Signs	81.82%	2.18
Patient's name	78.26%	2.04
Last Set of Vital Signs	78.26%	2.17
Current Medications	73.91%	2.00
Pain Assessment	73.91%	2.09
Suspected Fractures	73.91%	2.13
EMS Suspicions of Suicide Attempt	73.91%	2.04
Acute/Chronic Nature of Illness	69.57%	1.91
Mental Status	65.22%	1.78
Skin Exam	65.22%	1.78
Patient Initiated Treatment	65.22%	1.83
Decontamination Required	60.87%	1.78

EMS Suspicions of Abuse	60.87%	1.83
Airway Patency	52.17%	1.48
Volume & Type of IV Fluid	52.17%	1.57
Tourniquet Placed	52.17%	1.52
Patient Reported Drug Use	52.17%	1.61
Police Involvement	52.17%	1.70
Gender	47.83%	1.35
Number of Total Patients	47.83%	1.48
Suspected Type of Shock	47.83%	1.39
Vascular Access	47.83%	1.52
Physical Location of EMS Documentation	47.83%	1.26
Chest Abnormalities	45.45%	1.23
Abdominal/Pelvic Abnormalities	43.48%	1.17
Combativeness	43.48%	1.30
Airway Intervention	43.48%	1.30
Total Transport Time	39.13%	1.35
Oxygen Saturation	39.13%	1.22
CPR Performed	39.13%	1.13
Duration of CPR	39.13%	1.13
Defibrillation Attempts	39.13%	1.13
Glucose Level	39.13%	1.22
Glasgow Coma Scale	36.36%	1.14
EMS Agency Identification/Transport Method	31.82%	1.23
12 Lead EKG Findings	30.43%	0.91
Pupil Exam	26.09%	0.91
Patient Known to EMS	17.39%	0.78

Table 16 Round II, Participant Grouped, ESI Level Five Scenario

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Patient's name	66.67%	1.83	87.50%	2.00	77.78%	2.22
Age	83.33%	2.17	62.50%	1.75	100.00%	2.44
Gender	50.00%	1.50	50.00%	1.25	44.44%	1.33
EMS Agency Identification/Transport Method	50.00%	1.67	37.50%	1.13	12.50%	1.00
Details of Incident/Accident	83.33%	2.50	100.00%	2.63	100.00%	2.78
Decontamination Required	66.67%	2.00	62.50%	1.63	55.56%	1.78
Number of Total Patients	66.67%	2.00	50.00%	1.25	33.33%	1.33
Total Transport Time	66.67%	1.67	25.00%	1.13	33.33%	1.33
Chief Complaint	100.00%	2.67	100.00%	2.63	100.00%	3.00
History of Present Illness	83.33%	2.50	100.00%	2.38	88.89%	2.78
Associated Symptoms	83.33%	2.33	87.50%	2.38	88.89%	2.56
Current Medications	66.67%	2.00	62.50%	1.88	88.89%	2.11
Allergies	100.00%	2.67	87.50%	2.25	77.78%	2.22
Past Medical History	83.33%	2.17	75.00%	2.00	88.89%	2.00
Pertinent System Findings	83.33%	2.17	100.00%	2.50	100.00%	2.56
Time of Injury/Illness	100.00%	2.50	87.50%	2.50	100.00%	2.67
Mechanism of Injury	100.00%	2.67	100.00%	2.75	100.00%	2.89
Acute/Chronic Nature of Illness	66.67%	1.83	75.00%	2.00	66.67%	1.89
Site of Physical Injuries	100.00%	2.83	87.50%	2.50	100.00%	2.89
Baseline Vital Signs	80.00%	2.20	75.00%	2.13	88.89%	2.22
Last Set of Vital Signs	83.33%	2.17	75.00%	2.25	77.78%	2.11

Table 16 Round II, Participant Grouped, ESI Level Five Scenario (continued)

Elements in Survey Order	Emergency Medicine Physicians % Rated Important or Essential	Mean	Emergency Registered Nurses % Rated Important or Essential	Mean	Paramedics % Rated Important or Essential	Mean
Mental Status	83.33%	2.00	62.50%	1.75	55.56%	1.67
Glasgow Coma Scale	16.67%	0.67	62.50%	1.50	25.00%	1.13
Airway Patency	66.67%	2.00	62.50%	1.63	33.33%	1.00
Pupil Exam	16.67%	0.83	50.00%	1.38	11.11%	0.56
Chest Abnormalities	66.67%	1.83	62.50%	1.50	12.50%	0.50
Abdominal/Pelvic Abnormalities	66.67%	1.83	62.50%	1.50	11.11%	0.44
Combativeness	50.00%	1.50	62.50%	1.63	22.22%	0.89
Skin Exam	66.67%	1.83	75.00%	1.88	55.56%	1.67
Pain Assessment	50.00%	1.67	87.50%	2.25	77.78%	2.22
Suspected Type of Shock	33.33%	1.33	50.00%	1.25	55.56%	1.56
Suspected Fractures	66.67%	2.00	87.50%	2.25	66.67%	2.11
Airway Intervention	50.00%	1.50	50.00%	1.50	33.33%	1.00
Oxygen Saturation	50.00%	1.50	50.00%	1.50	22.22%	0.78
12 Lead EKG Findings	33.33%	1.00	50.00%	1.25	11.11%	0.56
CPR Performed	50.00%	1.50	50.00%	1.38	22.22%	0.67
Duration of CPR	50.00%	1.50	50.00%	1.38	22.22%	0.67
Defibrillation Attempts	50.00%	1.50	50.00%	1.38	22.22%	0.67
Vascular Access	50.00%	1.67	62.50%	1.75	33.33%	1.22
Volume & Type of IV Fluid	66.67%	2.00	62.50%	1.75	33.33%	1.11
Tourniquet Placed	50.00%	1.67	62.50%	1.75	44.44%	1.22
Patient Initiated Treatment	83.33%	2.17	75.00%	2.00	44.44%	1.44
EMS Medications & Dosages	100.00%	2.67	87.50%	2.50	77.78%	2.11

Table 16 Round II, Participant Grouped, ESI Level Five Scenario (continued)

Elements in Survey Order	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics	
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Glucose Level	50.00%	1.33	50.00%	1.38	22.22%	1.00
Patient Response to Treatments	83.33%	2.33	87.50%	2.25	77.78%	2.11
Patient Reported Drug Use	50.00%	1.50	37.50%	1.63	66.67%	1.67
EMS Suspicions of Suicide Attempt	100.00%	2.67	75.00%	2.00	55.56%	1.67
EMS Suspicions of Abuse	83.33%	2.17	50.00%	1.63	55.56%	1.78
Police Involvement	83.33%	2.33	50.00%	1.75	33.33%	1.22
Physical Location of EMS Documentation	83.33%	1.83	37.50%	1.00	33.33%	1.11
Patient Known to EMS	16.67%	1.00	0.00%	0.50	33.33%	0.89

Results by Research Question

Research question 1 asked: What are the core and provider specific elements necessary for an EMS to ED patient handover? A consensus handover list was obtained by using a 75% score ranking of important or essential on each element. Ultimately there were 20 core universal elements were deemed as necessary for EMS to ED patient handover for all acuity level patients (Table 17).

Table 17 EMS to ED Universal Handover Elements for All ESI Levels

Elements	% Rated Important or Essential	Mean
Chief Complaint	98.26%	2.82
Details of Incident/Accident	97.39%	2.64
Time of Injury/Illness	95.61%	2.63
Pertinent System Findings	94.78%	2.61
EMS Medications & Dosages	93.86%	2.61
Patient Response to Treatments	92.98%	2.59
History of Present Illness	92.17%	2.59
Associated Symptoms	92.17%	2.56
Mechanism of Injury	92.17%	2.63
Site of Physical Injuries	92.11%	2.62
Last Set of Vital Signs	91.23%	2.52
Allergies	88.70%	2.39
Baseline Vital Signs	88.60%	2.46
Mental Status	87.83%	2.51
Current Medications	80.87%	2.17
Past Medical History	80.87%	2.11
Age	79.13%	2.09
Combativeness	78.26%	2.13
Patient Initiated Treatment	77.19%	2.07
EMS Suspicions of Suicide Attempt	76.52%	2.14

The provider specific handover expectations were determined by using a two-step process. First provider group element consensus was established using a consensus rating of 75% of important or essential on the aggregated scenario elements. Second the provider group consensus was determined when 100% consensus (following the greater

than 75% rule) was achieved across the three professions. There was a consensus of 17 elements by the three provider groups. The elements were details of incident, chief complaint, history of present illness, associated symptoms, current medications, allergies, past medical history, pertinent system findings, time of injury/illness, mechanism of injury, site of physical injuries, baseline vital signs, last set of vital signs, mental status, combativeness, EMS medications/dosages, and patient response to treatments. Table 18 displays the provider consensus of elements for all ESI scenarios.

Table 18 Round II, Provider Consensus of Handover Elements, All Scenarios

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics		
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	Consensus of Profession Ratings
Details of Incident/Accident	90.00%	2.50	100.00%	2.50	100.00%	2.87	100%
Chief Complaint	96.67%	2.70	97.50%	2.73	100.00%	2.98	100%
History of Present Illness	83.33%	2.57	97.50%	2.50	93.33%	2.69	100%
Associated Symptoms	86.67%	2.43	92.50%	2.53	95.56%	2.67	100%
Current Medications	86.67%	2.27	75.00%	2.18	82.22%	2.09	100%
Allergies	96.67%	2.77	97.50%	2.43	75.56%	2.11	100%
Past Medical History	83.33%	2.20	75.00%	2.10	84.44%	2.07	100%
Pertinent System Findings	80.00%	2.27	100.00%	2.75	100.00%	2.71	100%
Time of Injury/Illness	93.33%	2.50	95.00%	2.63	97.73%	2.73	100%
Mechanism of Injury	96.67%	2.63	85.00%	2.53	95.56%	2.73	100%
Site of Physical Injuries	93.33%	2.57	85.00%	2.53	97.73%	2.75	100%
Baseline Vital Signs	89.66%	2.55	87.50%	2.48	88.89%	2.40	100%
Last Set of Vital Signs	90.00%	2.43	92.50%	2.63	90.91%	2.48	100%
Mental Status	86.67%	2.40	90.00%	2.63	86.67%	2.49	100%
Combativeness	76.67%	2.20	82.50%	2.18	75.56%	2.04	100%
EMS Medications & Dosages	100.00%	2.80	94.87%	2.62	88.89%	2.47	100%
Patient Response to Treatments	93.33%	2.63	97.44%	2.56	88.89%	2.58	100%
Age	80.00%	2.13	67.50%	1.85	88.89%	2.27	67%
Airway Patency	76.67%	2.33	77.50%	2.18	66.67%	2.02	67%
Suspected Fractures	65.52%	2.00	77.50%	2.10	77.78%	2.04	67%

Table 18 Round II, Provider Consensus of Handover Elements, All Scenarios (continued)

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics		
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	Consensus of Profession Ratings
Volume & Type of IV Fluid	83.33%	2.33	80.00%	2.15	60.00%	1.80	67%
Patient Initiated Treatment	90.00%	2.37	82.05%	2.21	64.44%	1.76	67%
Decontamination Required	80.00%	2.20	65.00%	1.73	71.11%	1.91	33%
Number of Total Patients	80.00%	2.10	52.50%	1.40	55.56%	1.62	33%
Acute/Chronic Nature of Illness	63.33%	1.90	69.23%	2.08	75.56%	2.07	33%
Glasgow Coma Scale	46.67%	1.60	82.50%	2.23	63.64%	1.95	33%
Pain Assessment	56.67%	1.70	84.62%	2.13	73.33%	1.96	33%
Oxygen Saturation	73.33%	2.17	75.00%	2.10	44.44%	1.42	33%
Vascular Access	70.00%	2.07	77.50%	2.13	64.44%	1.82	33%
EMS Suspicions of Suicide Attempt	96.67%	2.73	70.00%	1.98	68.89%	1.89	33%
EMS Suspicions of Abuse	93.33%	2.47	57.50%	1.78	62.22%	1.89	33%
Police Involvement	83.33%	2.27	57.50%	1.83	47.73%	1.52	33%
Patient's name	66.67%	1.83	72.50%	1.90	64.44%	1.91	0%
Gender	46.67%	1.57	55.00%	1.48	42.22%	1.36	0%
EMS Agency Identification/Transport Method	60.00%	1.77	50.00%	1.45	55.81%	1.67	0%
Total Transport Time	66.67%	1.87	62.50%	1.63	71.11%	2.13	0%
Pupil Exam	53.33%	1.73	74.36%	2.08	60.00%	1.82	0%
Chest Abnormalities	73.33%	2.13	72.50%	1.85	40.91%	1.32	0%
Abdominal/Pelvic Abnormalities	73.33%	2.10	72.50%	1.88	33.33%	1.18	0%

Table 18 Round II, Provider Consensus of Handover Elements, All Scenarios (continued)

Elements	Emergency Medicine Physicians		Emergency Registered Nurses		Paramedics		
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	Consensus of Profession Ratings
Skin Exam	66.67%	1.87	70.00%	1.75	64.44%	1.78	0%
Suspected Type of Shock	53.33%	1.80	65.00%	1.80	66.67%	1.91	0%
Airway Intervention	73.33%	2.27	72.50%	2.18	60.00%	1.87	0%
12 Lead EKG Findings	43.33%	1.37	72.50%	1.85	40.00%	1.22	0%
CPR Performed	70.00%	2.10	57.50%	1.68	42.22%	1.22	0%
Duration of CPR	72.41%	2.17	57.50%	1.65	42.22%	1.22	0%
Defibrillation Attempts	66.67%	2.03	57.50%	1.68	42.22%	1.22	0%
Tourniquet Placed	46.67%	1.53	56.41%	1.59	44.44%	1.16	0%
Glucose Level	70.00%	1.97	74.36%	2.08	55.56%	1.76	0%
Patient Reported Drug Use	53.33%	1.70	72.50%	2.00	71.11%	1.91	0%
Physical Location of EMS Documentation	66.67%	1.83	53.85%	1.44	56.82%	1.59	0%
Patient Known to EMS	23.33%	1.10	15.38%	0.82	33.33%	0.98	0%

The emergency medicine physicians reached consensus on 26 elements necessary for EMS to ED handover (Table 19). This was determined by using a cumulative emergency medicine physician group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 19 Round II, Emergency Medicine Physician Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
EMS Medications & Dosages	100.00%	2.80
Chief Complaint	96.67%	2.70
Allergies	96.67%	2.77
Mechanism of Injury	96.67%	2.63
EMS Suspicions of Suicide Attempt	96.67%	2.73
Time of Injury/Illness	93.33%	2.50
Site of Physical Injuries	93.33%	2.57
Patient Response to Treatments	93.33%	2.63
EMS Suspicions of Abuse	93.33%	2.47
Details of Incident/Accident	90.00%	2.50
Last Set of Vital Signs	90.00%	2.43
Patient Initiated Treatment	90.00%	2.37
Baseline Vital Signs	89.66%	2.55
Associated Symptoms	86.67%	2.43
Current Medications	86.67%	2.27
Mental Status	86.67%	2.40
History of Present Illness	83.33%	2.57
Past Medical History	83.33%	2.20
Volume & Type of IV Fluid	83.33%	2.33
Police Involvement	83.33%	2.27
Age	80.00%	2.13
Decontamination Required	80.00%	2.20
Number of Total Patients	80.00%	2.10
Pertinent System Findings	80.00%	2.27
Airway Patency	76.67%	2.33
Combativeness	76.67%	2.20

The emergency registered nurses reached consensus on 25 elements necessary for EMS to ED handover (Table 20). This was determined by using an emergency registered

nurse group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 20 Round II, Emergency Registered Nurse Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.50
Pertinent System Findings	100.00%	2.75
Chief Complaint	97.50%	2.73
History of Present Illness	97.50%	2.50
Allergies	97.50%	2.43
Patient Response to Treatments	97.44%	2.56
Time of Injury/Illness	95.00%	2.63
EMS Medications & Dosages	94.87%	2.62
Associated Symptoms	92.50%	2.53
Last Set of Vital Signs	92.50%	2.63
Mental Status	90.00%	2.63
Baseline Vital Signs	87.50%	2.48
Mechanism of Injury	85.00%	2.53
Site of Physical Injuries	85.00%	2.53
Pain Assessment	84.62%	2.13
Glasgow Coma Scale	82.50%	2.23
Combativeness	82.50%	2.18
Patient Initiated Treatment	82.05%	2.21
Volume & Type of IV Fluid	80.00%	2.15
Airway Patency	77.50%	2.18
Suspected Fractures	77.50%	2.10
Vascular Access	77.50%	2.13
Current Medications	75.00%	2.18
Past Medical History	75.00%	2.10
Oxygen Saturation	75.00%	2.10

The paramedics reached consensus on 20 elements necessary for EMS to ED handover (Table 21). The was determined by using a paramedic group score of greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 21 Round II, Paramedic Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.87
Chief Complaint	100.00%	2.98
Pertinent System Findings	100.00%	2.71
Time of Injury/Illness	97.73%	2.73
Site of Physical Injuries	97.73%	2.75
Associated Symptoms	95.56%	2.67
Mechanism of Injury	95.56%	2.73
History of Present Illness	93.33%	2.69
Last Set of Vital Signs	90.91%	2.48
Age	88.89%	2.27
Baseline Vital Signs	88.89%	2.40
EMS Medications & Dosages	88.89%	2.47
Patient Response to Treatments	88.89%	2.58
Mental Status	86.67%	2.49
Past Medical History	84.44%	2.07
Current Medications	82.22%	2.09
Suspected Fractures	77.78%	2.04
Allergies	75.56%	2.11
Acute/Chronic Nature of Illness	75.56%	2.07
Combativeness	75.56%	2.04

The second research question asked what are the core and specific handover elements for each of the five ESI acuity levels? The grouped participant determined element scores for all ESI levels are presented in Table 22. The core elements for the ESI scenarios were determined in a two-step process. First ESI element consensus was based on a participant group rating of 75% of important or essential for each element in each scenario. Second the core elements for all ESI levels were based on the element reaching an 80% consensus (using the greater than 75% rule) across all five scenarios. Table 23 displays the consensus of elements across all ESI level scenarios.

Table 22 Round II, All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78

Table 23 Round II, Consensus of All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65	100%
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78	100%
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57	100%
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43	100%
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35	100%
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43	100%
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18	100%
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17	100%
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39	100%
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22	100%
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00	80%
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04	80%
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57	80%
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78	80%
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74	80%
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83	80%
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13	60%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78	60%
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78	60%
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14	60%
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91	60%
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30	60%
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13	60%
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57	60%
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04	60%
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48	40%
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35	40%
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48	40%
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23	40%
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78	40%
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09	40%
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39	40%
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30	40%
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22	40%
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52	40%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04	20%
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91	20%
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17	20%
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91	20%
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13	20%
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22	20%
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61	20%
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83	20%
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70	20%
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26	20%
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35	0%
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23	0%
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52	0%
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78	0%

Consensus was achieved on 16 handover elements across all ESI acuity scenarios. These elements were details of incident, chief complaint, history of present illness, associated symptoms, allergies, pertinent system findings, baseline vital signs, last set of vital signs, EMS medications/dosages, patient response to treatments, current medications, past medical history, time of injury/illness, mechanism of injury, site of physical injuries, and patient initiated treatment.

Individual ESI scenario element rankings differed in terms of content and volume necessary for handover. Consensus was achieved on 37 Level One scenario elements, 38 Level Two elements, 22 Level Three elements, 20 Level Four elements, and 16 Level Five elements. The top rated elements achieving a consensus score of 75% important or essential rankings are presented in Table 24.

Table 24 Round II, Top Elements for All ESI Scenarios

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.78	Details of Incident/Accident	100.00%	2.74
Time of Injury/Illness	100.00%	2.91	Total Transport Time	100.00%	2.43
Mechanism of Injury	100.00%	2.91	Time of Injury/Illness	100.00%	2.74
Site of Physical Injuries	100.00%	2.96	Last Set of Vital Signs	100.00%	2.65
Last Set of Vital Signs	100.00%	2.87	Mental Status	100.00%	2.91
Mental Status	100.00%	2.96	Airway Patency	100.00%	2.87
Airway Patency	100.00%	3.00	EMS Medications & Dosages	100.00%	2.70
Combativeness	100.00%	2.78	Glucose Level	100.00%	2.87
Airway Intervention	100.00%	3.00	Patient Response to Treatments	100.00%	2.91
Vascular Access	100.00%	2.70	Chief Complaint	95.65%	2.83
Volume & Type of IV Fluid	100.00%	2.74	Associated Symptoms	95.65%	2.65
EMS Medications & Dosages	100.00%	2.78	Pertinent System Findings	95.65%	2.74
Patient Response to Treatments	100.00%	2.91	Mechanism of Injury	95.65%	2.83
Total Transport Time	95.65%	2.70	Site of Physical Injuries	95.65%	2.74
Chief Complaint	95.65%	2.78	Chest Abnormalities	95.65%	2.48
Pertinent System Findings	95.65%	2.78	Abdominal/Pelvic Abnormalities	95.65%	2.48
Baseline Vital Signs	95.65%	2.74	Combativeness	95.65%	2.48
History of Present Illness	91.30%	2.57	Airway Intervention	95.65%	2.87
Associated Symptoms	91.30%	2.52	History of Present Illness	91.30%	2.65
Glasgow Coma Scale	91.30%	2.70	Allergies	91.30%	2.43
Pupil Exam	91.30%	2.61	Baseline Vital Signs	91.30%	2.57
Police Involvement	90.91%	2.45	Volume & Type of IV Fluid	91.30%	2.43
Decontamination Required	86.96%	2.26	Pupil Exam	90.91%	2.55
Oxygen Saturation	86.96%	2.52	Glasgow Coma Scale	86.96%	2.57

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Number of Total Patients	82.61%	2.13	Oxygen Saturation	86.96%	2.57
Allergies	82.61%	2.30	12 Lead EKG Findings	86.96%	2.17
Skin Exam	82.61%	2.09	Current Medications	82.61%	2.30
Suspected Type of Shock	82.61%	2.39	Past Medical History	82.61%	2.22
CPR Performed	82.61%	2.39	Skin Exam	82.61%	2.04
Duration of CPR	82.61%	2.39	Suspected Fractures	82.61%	2.30
EMS Suspicions of Suicide Attempt	82.61%	2.30	Vascular Access	82.61%	2.35
EMS Suspicions of Abuse	82.61%	2.22	Patient Initiated Treatment	82.61%	2.30
Chest Abnormalities	78.26%	2.22	EMS Suspicions of Suicide Attempt	82.61%	2.26
Suspected Fractures	78.26%	2.17	Age	78.26%	2.09
Defibrillation Attempts	78.26%	2.30	Decontamination Required	78.26%	2.09
Patient Initiated Treatment	78.26%	2.13	Number of Total Patients	78.26%	2.00
Physical Location of EMS Documentation	78.26%	1.96	Suspected Type of Shock	78.26%	2.30
			Patient Reported Drug Use	78.26%	2.17

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.83	Details of Incident/Accident	100.00%	2.52
Last Set of Vital Signs	100.00%	2.77	Chief Complaint	100.00%	2.87
Mental Status	100.00%	2.83	Pertinent System Findings	95.65%	2.52
History of Present Illness	95.65%	2.70	Mechanism of Injury	95.65%	2.65
Associated Symptoms	95.65%	2.70	Site of Physical Injuries	95.65%	2.65

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Current Medications	95.65%	2.43	Suspected Fractures	95.65%	2.52
Baseline Vital Signs	95.65%	2.65	Patient Response to Treatments	95.45%	2.36
Time of Injury/Illness	95.45%	2.68	History of Present Illness	91.30%	2.48
Details of Incident/Accident	91.30%	2.52	Associated Symptoms	91.30%	2.48
Allergies	91.30%	2.52	Allergies	91.30%	2.35
Past Medical History	91.30%	2.39	EMS Medications & Dosages	90.91%	2.50
Pertinent System Findings	91.30%	2.57	Time of Injury/Illness	86.96%	2.26
EMS Medications & Dosages	91.30%	2.65	Decontamination Required	82.61%	2.04
Age	86.96%	2.39	Current Medications	82.61%	2.17
Pupil Exam	86.96%	2.43	Past Medical History	78.26%	2.04
Patient Response to Treatments	86.96%	2.52	Baseline Vital Signs	78.26%	2.17
Pain Assessment	86.36%	2.18	Last Set of Vital Signs	78.26%	2.13
Combativeness	82.61%	2.26	Pain Assessment	78.26%	1.96
Patient Initiated Treatment	82.61%	2.13	EMS Suspicions of Suicide Attempt	78.26%	2.17
Acute/Chronic Nature of Illness	78.26%	2.30	Patient Initiated Treatment	77.27%	1.95
Glasgow Coma Scale	78.26%	2.09			
Volume & Type of IV Fluid	78.26%	2.09			

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Five Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.78
Mechanism of Injury	100.00%	2.78
Site of Physical Injuries	95.65%	2.74
History of Present Illness	91.30%	2.57
Associated Symptoms	86.96%	2.43
Allergies	86.96%	2.35
EMS Medications & Dosages	86.96%	2.39
Age	82.61%	2.13
Past Medical History	82.61%	2.04
Patient Response to Treatments	82.61%	2.22
Baseline Vital Signs	81.82%	2.18
Patient's name	78.26%	2.04
Last Set of Vital Signs	78.26%	2.17

Inferential statistics were performed on the Round I and II results. A one-way analysis of variance (ANOVA) was performed on the three professional group responses, the retained and eliminated element items from Round I, and the ESI scenario scoring. Using an alpha level of 0.05 for all statistical testing, a one-way between participants ANOVA was performed to compare the difference between professional roles on the ranking of handover element importance in all ESI scenarios. In the Round I and Round II surveys there was not a significant effect of profession on the handover content expectation group means (Round I $p = 0.91$, Round II $p = 0.44$). After the conclusion of Round I, an ANOVA was calculated demonstrating there was not significance between the mean group scores of professional role rankings on eliminated handover elements ($p = 0.84$) or retained handover elements ($p = 0.41$). These results suggest it is possible to achieve an EMS to ED handover content tool to meet all interprofessional expectations.

A one way ANOVA of ESI scenario element rating group means showed the ESI acuity level was significant for the element importance rating ($p < 0.001$). Given the statistically significant ANOVA, Tukey honestly significant difference (HSD) testing using a 95% significance was performed on all possible pairwise comparisons of means for post hoc analysis (Table 25). The only ESI scenario with significantly different professional group means ($p < 0.05$) was the emergency medicine physician and paramedic ranking of ESI Level Five scenario.

Table 25 Tukey HSD for Interprofessional ESI Element Ratings

Scenario	Group Mean Difference	95% Confidence Intervals	*p* value
ESI Level One Scenario			
MD vs. RN	-0.12	-0.36 to 0.13	p=0.50
MD vs. EMS	-0.23	-0.47 to 0.02	p=0.07
RN vs. EMS	-0.11	-0.36 to 0.13	p=0.52

ESI Level Two Scenario			
MD vs. RN	-0.16	-0.37 to 0.06	p=0.20
MD vs. EMS	-0.13	-0.35 to 0.08	p=0.28
RN vs. EMS	0.02	-0.20 to 0.23	p=0.98
ESI Level Three Scenario			
MD vs. RN	-0.06	-0.34 to 0.22	p=0.88
MD vs. EMS	-0.14	-0.42 to 0.14	p=0.48
RN vs. EMS	-0.08	-0.36 to 0.20	p=0.78
ESI Level Four Scenario			
MD vs. RN	0.03	-0.24 to 0.29	p=0.97
MD vs. EMS	-0.13	-0.39 to 0.14	p=0.50
RN vs. EMS	-0.15	-0.42 to 0.11	p=0.36
ESI Level Five Scenario			
MD vs. RN	-0.11	-0.39 to 0.16	p=0.60
MD vs. EMS	-0.29	-0.56 to -0.01	p=0.04
RN vs. EMS	-0.17	-0.45 to 0.10	p=0.29

Credibility, Validity, and Reliability of Findings

Expert opinion consensus regarding EMS to ED handover elements was obtained following two rounds of surveys. The credibility and reliability of these findings were generated by the selection of key participants involved in this critical phase of patient care. Content validity was established for this study by the use of 23 participants with subject matter knowledge regarding EMS to ED handover (Goodman, 1987). Submitting the aggregate results obtained in Round I scenarios to the panelists during Round II ensured construct validity (Okoli & Pawlowski, 2004).

Summary

The selection of the Delphi methodology was based on the need to gather expert opinion of emergency medicine professionals located across a geographical region. This chapter offers the data collected and analysis of two rounds of Delphi study. Using a 75%

participant consensus score, developed among the entire expert panel, 20 elements were generated. These elements had mean scores ranging from 2.07-2.82. Expert opinion among each profession identified a differing number and type of elements. The emergency physician identified 26 elements, the emergency nurses identified 25 elements, and paramedics identified 20 elements. The ESI scenarios also resulted in a varying number and types of elements based on the acuity level of the patient. ESI Level Two patients requiring the most at 38 elements with ESI Level Five requiring only 16 core elements for EMS to ED patient handover. Ultimately 16 core elements were ranked important or essential to all ESI acuity levels.

The emergency medicine physicians reached consensus on 26 elements necessary for EMS to ED handover (Table 19). This was determined by using a cumulative emergency medicine physician group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 19 Round II, Emergency Medicine Physician Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
EMS Medications & Dosages	100.00%	2.80
Chief Complaint	96.67%	2.70
Allergies	96.67%	2.77
Mechanism of Injury	96.67%	2.63
EMS Suspicions of Suicide Attempt	96.67%	2.73
Time of Injury/Illness	93.33%	2.50
Site of Physical Injuries	93.33%	2.57
Patient Response to Treatments	93.33%	2.63
EMS Suspicions of Abuse	93.33%	2.47
Details of Incident/Accident	90.00%	2.50
Last Set of Vital Signs	90.00%	2.43
Patient Initiated Treatment	90.00%	2.37
Baseline Vital Signs	89.66%	2.55
Associated Symptoms	86.67%	2.43
Current Medications	86.67%	2.27
Mental Status	86.67%	2.40
History of Present Illness	83.33%	2.57
Past Medical History	83.33%	2.20
Volume & Type of IV Fluid	83.33%	2.33
Police Involvement	83.33%	2.27
Age	80.00%	2.13
Decontamination Required	80.00%	2.20
Number of Total Patients	80.00%	2.10
Pertinent System Findings	80.00%	2.27
Airway Patency	76.67%	2.33
Combativeness	76.67%	2.20

The emergency registered nurses reached consensus on 25 elements necessary for EMS to ED handover (Table 20). This was determined by using an emergency registered

nurse group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 20 Round II, Emergency Registered Nurse Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.50
Pertinent System Findings	100.00%	2.75
Chief Complaint	97.50%	2.73
History of Present Illness	97.50%	2.50
Allergies	97.50%	2.43
Patient Response to Treatments	97.44%	2.56
Time of Injury/Illness	95.00%	2.63
EMS Medications & Dosages	94.87%	2.62
Associated Symptoms	92.50%	2.53
Last Set of Vital Signs	92.50%	2.63
Mental Status	90.00%	2.63
Baseline Vital Signs	87.50%	2.48
Mechanism of Injury	85.00%	2.53
Site of Physical Injuries	85.00%	2.53
Pain Assessment	84.62%	2.13
Glasgow Coma Scale	82.50%	2.23
Combativeness	82.50%	2.18
Patient Initiated Treatment	82.05%	2.21
Volume & Type of IV Fluid	80.00%	2.15
Airway Patency	77.50%	2.18
Suspected Fractures	77.50%	2.10
Vascular Access	77.50%	2.13
Current Medications	75.00%	2.18
Past Medical History	75.00%	2.10
Oxygen Saturation	75.00%	2.10

The paramedics reached consensus on 20 elements necessary for EMS to ED handover (Table 21). The was determined by using a paramedic group score of greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 21 Round II, Paramedic Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.87
Chief Complaint	100.00%	2.98
Pertinent System Findings	100.00%	2.71
Time of Injury/Illness	97.73%	2.73
Site of Physical Injuries	97.73%	2.75
Associated Symptoms	95.56%	2.67
Mechanism of Injury	95.56%	2.73
History of Present Illness	93.33%	2.69
Last Set of Vital Signs	90.91%	2.48
Age	88.89%	2.27
Baseline Vital Signs	88.89%	2.40
EMS Medications & Dosages	88.89%	2.47
Patient Response to Treatments	88.89%	2.58
Mental Status	86.67%	2.49
Past Medical History	84.44%	2.07
Current Medications	82.22%	2.09
Suspected Fractures	77.78%	2.04
Allergies	75.56%	2.11
Acute/Chronic Nature of Illness	75.56%	2.07
Combativeness	75.56%	2.04

The second research question asked what are the core and specific handover elements for each of the five ESI acuity levels? The grouped participant determined element scores for all ESI levels are presented in Table 22. The core elements for the ESI scenarios were determined in a two-step process. First ESI element consensus was based on a participant group rating of 75% of important or essential for each element in each scenario. Second the core elements for all ESI levels were based on the element reaching an 80% consensus (using the greater than 75% rule) across all five scenarios. Table 23 displays the consensus of elements across all ESI level scenarios.

Table 22 Round II, All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78

Table 23 Round II, Consensus of All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65	100%
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78	100%
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57	100%
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43	100%
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35	100%
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43	100%
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18	100%
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17	100%
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39	100%
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22	100%
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00	80%
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04	80%
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57	80%
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78	80%
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74	80%
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83	80%
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13	60%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78	60%
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78	60%
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14	60%
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91	60%
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30	60%
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13	60%
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57	60%
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04	60%
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48	40%
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35	40%
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48	40%
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23	40%
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78	40%
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09	40%
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39	40%
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30	40%
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22	40%
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52	40%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04	20%
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91	20%
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17	20%
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91	20%
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13	20%
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22	20%
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61	20%
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83	20%
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70	20%
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26	20%
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35	0%
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23	0%
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52	0%
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78	0%

Consensus was achieved on 16 handover elements across all ESI acuity scenarios. These elements were details of incident, chief complaint, history of present illness, associated symptoms, allergies, pertinent system findings, baseline vital signs, last set of vital signs, EMS medications/dosages, patient response to treatments, current medications, past medical history, time of injury/illness, mechanism of injury, site of physical injuries, and patient initiated treatment.

Individual ESI scenario element rankings differed in terms of content and volume necessary for handover. Consensus was achieved on 37 Level One scenario elements, 38 Level Two elements, 22 Level Three elements, 20 Level Four elements, and 16 Level Five elements. The top rated elements achieving a consensus score of 75% important or essential rankings are presented in Table 24.

Table 24 Round II, Top Elements for All ESI Scenarios

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.78	Details of Incident/Accident	100.00%	2.74
Time of Injury/Illness	100.00%	2.91	Total Transport Time	100.00%	2.43
Mechanism of Injury	100.00%	2.91	Time of Injury/Illness	100.00%	2.74
Site of Physical Injuries	100.00%	2.96	Last Set of Vital Signs	100.00%	2.65
Last Set of Vital Signs	100.00%	2.87	Mental Status	100.00%	2.91
Mental Status	100.00%	2.96	Airway Patency	100.00%	2.87
Airway Patency	100.00%	3.00	EMS Medications & Dosages	100.00%	2.70
Combativeness	100.00%	2.78	Glucose Level	100.00%	2.87
Airway Intervention	100.00%	3.00	Patient Response to Treatments	100.00%	2.91
Vascular Access	100.00%	2.70	Chief Complaint	95.65%	2.83
Volume & Type of IV Fluid	100.00%	2.74	Associated Symptoms	95.65%	2.65
EMS Medications & Dosages	100.00%	2.78	Pertinent System Findings	95.65%	2.74
Patient Response to Treatments	100.00%	2.91	Mechanism of Injury	95.65%	2.83
Total Transport Time	95.65%	2.70	Site of Physical Injuries	95.65%	2.74
Chief Complaint	95.65%	2.78	Chest Abnormalities	95.65%	2.48
Pertinent System Findings	95.65%	2.78	Abdominal/Pelvic Abnormalities	95.65%	2.48
Baseline Vital Signs	95.65%	2.74	Combativeness	95.65%	2.48
History of Present Illness	91.30%	2.57	Airway Intervention	95.65%	2.87
Associated Symptoms	91.30%	2.52	History of Present Illness	91.30%	2.65
Glasgow Coma Scale	91.30%	2.70	Allergies	91.30%	2.43
Pupil Exam	91.30%	2.61	Baseline Vital Signs	91.30%	2.57
Police Involvement	90.91%	2.45	Volume & Type of IV Fluid	91.30%	2.43
Decontamination Required	86.96%	2.26	Pupil Exam	90.91%	2.55
Oxygen Saturation	86.96%	2.52	Glasgow Coma Scale	86.96%	2.57

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Number of Total Patients	82.61%	2.13	Oxygen Saturation	86.96%	2.57
Allergies	82.61%	2.30	12 Lead EKG Findings	86.96%	2.17
Skin Exam	82.61%	2.09	Current Medications	82.61%	2.30
Suspected Type of Shock	82.61%	2.39	Past Medical History	82.61%	2.22
CPR Performed	82.61%	2.39	Skin Exam	82.61%	2.04
Duration of CPR	82.61%	2.39	Suspected Fractures	82.61%	2.30
EMS Suspicions of Suicide Attempt	82.61%	2.30	Vascular Access	82.61%	2.35
EMS Suspicions of Abuse	82.61%	2.22	Patient Initiated Treatment	82.61%	2.30
Chest Abnormalities	78.26%	2.22	EMS Suspicions of Suicide Attempt	82.61%	2.26
Suspected Fractures	78.26%	2.17	Age	78.26%	2.09
Defibrillation Attempts	78.26%	2.30	Decontamination Required	78.26%	2.09
Patient Initiated Treatment	78.26%	2.13	Number of Total Patients	78.26%	2.00
Physical Location of EMS Documentation	78.26%	1.96	Suspected Type of Shock	78.26%	2.30
			Patient Reported Drug Use	78.26%	2.17

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.83	Details of Incident/Accident	100.00%	2.52
Last Set of Vital Signs	100.00%	2.77	Chief Complaint	100.00%	2.87
Mental Status	100.00%	2.83	Pertinent System Findings	95.65%	2.52
History of Present Illness	95.65%	2.70	Mechanism of Injury	95.65%	2.65
Associated Symptoms	95.65%	2.70	Site of Physical Injuries	95.65%	2.65

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Current Medications	95.65%	2.43	Suspected Fractures	95.65%	2.52
Baseline Vital Signs	95.65%	2.65	Patient Response to Treatments	95.45%	2.36
Time of Injury/Illness	95.45%	2.68	History of Present Illness	91.30%	2.48
Details of Incident/Accident	91.30%	2.52	Associated Symptoms	91.30%	2.48
Allergies	91.30%	2.52	Allergies	91.30%	2.35
Past Medical History	91.30%	2.39	EMS Medications & Dosages	90.91%	2.50
Pertinent System Findings	91.30%	2.57	Time of Injury/Illness	86.96%	2.26
EMS Medications & Dosages	91.30%	2.65	Decontamination Required	82.61%	2.04
Age	86.96%	2.39	Current Medications	82.61%	2.17
Pupil Exam	86.96%	2.43	Past Medical History	78.26%	2.04
Patient Response to Treatments	86.96%	2.52	Baseline Vital Signs	78.26%	2.17
Pain Assessment	86.36%	2.18	Last Set of Vital Signs	78.26%	2.13
Combativeness	82.61%	2.26	Pain Assessment	78.26%	1.96
Patient Initiated Treatment	82.61%	2.13	EMS Suspicions of Suicide Attempt	78.26%	2.17
Acute/Chronic Nature of Illness	78.26%	2.30	Patient Initiated Treatment	77.27%	1.95
Glasgow Coma Scale	78.26%	2.09			
Volume & Type of IV Fluid	78.26%	2.09			

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Five Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.78
Mechanism of Injury	100.00%	2.78
Site of Physical Injuries	95.65%	2.74
History of Present Illness	91.30%	2.57
Associated Symptoms	86.96%	2.43
Allergies	86.96%	2.35
EMS Medications & Dosages	86.96%	2.39
Age	82.61%	2.13
Past Medical History	82.61%	2.04
Patient Response to Treatments	82.61%	2.22
Baseline Vital Signs	81.82%	2.18
Patient's name	78.26%	2.04
Last Set of Vital Signs	78.26%	2.17

Inferential statistics were performed on the Round I and II results. A one-way analysis of variance (ANOVA) was performed on the three professional group responses, the retained and eliminated element items from Round I, and the ESI scenario scoring. Using an alpha level of 0.05 for all statistical testing, a one-way between participants ANOVA was performed to compare the difference between professional roles on the ranking of handover element importance in all ESI scenarios. In the Round I and Round II surveys there was not a significant effect of profession on the handover content expectation group means (Round I $p = 0.91$, Round II $p = 0.44$). After the conclusion of Round I, an ANOVA was calculated demonstrating there was not significance between the mean group scores of professional role rankings on eliminated handover elements ($p = 0.84$) or retained handover elements ($p = 0.41$). These results suggest it is possible to achieve an EMS to ED handover content tool to meet all interprofessional expectations.

A one way ANOVA of ESI scenario element rating group means showed the ESI acuity level was significant for the element importance rating ($p < 0.001$). Given the statistically significant ANOVA, Tukey honestly significant difference (HSD) testing using a 95% significance was performed on all possible pairwise comparisons of means for post hoc analysis (Table 25). The only ESI scenario with significantly different professional group means ($p < 0.05$) was the emergency medicine physician and paramedic ranking of ESI Level Five scenario.

Table 25 Tukey HSD for Interprofessional ESI Element Ratings

Scenario	Group Mean Difference	95% Confidence Intervals	*p* value
ESI Level One Scenario			
MD vs. RN	-0.12	-0.36 to 0.13	p=0.50
MD vs. EMS	-0.23	-0.47 to 0.02	p=0.07
RN vs. EMS	-0.11	-0.36 to 0.13	p=0.52

ESI Level Two Scenario			
MD vs. RN	-0.16	-0.37 to 0.06	p=0.20
MD vs. EMS	-0.13	-0.35 to 0.08	p=0.28
RN vs. EMS	0.02	-0.20 to 0.23	p=0.98
ESI Level Three Scenario			
MD vs. RN	-0.06	-0.34 to 0.22	p=0.88
MD vs. EMS	-0.14	-0.42 to 0.14	p=0.48
RN vs. EMS	-0.08	-0.36 to 0.20	p=0.78
ESI Level Four Scenario			
MD vs. RN	0.03	-0.24 to 0.29	p=0.97
MD vs. EMS	-0.13	-0.39 to 0.14	p=0.50
RN vs. EMS	-0.15	-0.42 to 0.11	p=0.36
ESI Level Five Scenario			
MD vs. RN	-0.11	-0.39 to 0.16	p=0.60
MD vs. EMS	-0.29	-0.56 to -0.01	p=0.04
RN vs. EMS	-0.17	-0.45 to 0.10	p=0.29

Credibility, Validity, and Reliability of Findings

Expert opinion consensus regarding EMS to ED handover elements was obtained following two rounds of surveys. The credibility and reliability of these findings were generated by the selection of key participants involved in this critical phase of patient care. Content validity was established for this study by the use of 23 participants with subject matter knowledge regarding EMS to ED handover (Goodman, 1987). Submitting the aggregate results obtained in Round I scenarios to the panelists during Round II ensured construct validity (Okoli & Pawlowski, 2004).

Summary

The selection of the Delphi methodology was based on the need to gather expert opinion of emergency medicine professionals located across a geographical region. This chapter offers the data collected and analysis of two rounds of Delphi study. Using a 75%

participant consensus score, developed among the entire expert panel, 20 elements were generated. These elements had mean scores ranging from 2.07-2.82. Expert opinion among each profession identified a differing number and type of elements. The emergency physician identified 26 elements, the emergency nurses identified 25 elements, and paramedics identified 20 elements. The ESI scenarios also resulted in a varying number and types of elements based on the acuity level of the patient. ESI Level Two patients requiring the most at 38 elements with ESI Level Five requiring only 16 core elements for EMS to ED patient handover. Ultimately 16 core elements were ranked important or essential to all ESI acuity levels.

Chapter Five: Results, Conclusions, and Recommendations

The purpose of this study was to determine the interprofessional expectations of EMS to ED handover content. The study surveyed emergency medical care experts with experience in giving or receiving prehospital care handover. Two Delphi survey rounds were completed by 23 of 44 invited expert panelists. Chapter five discusses the study findings, implications, limitations, and recommendations for future research.

Summary of Findings

This discussion reflects the results for each research question.

Research Question #1. What are the core and provider specific elements necessary for an EMS to ED patient handover?

Results. A consensus of 20 handover elements for all ESI acuity levels was determined using all participant ratings on all ESI scenarios. The universal 20 elements are: chief complaint, details of incident/accident, pertinent system findings, time of illness/injury, EMS medications/dosages, history of present illness, associated symptoms, mechanism of injury, patient response to treatments, site of physical injuries, last set of vital signs, allergies, baseline vital signs, mental status/ associated changes, current medications, past medical history, age, combativeness, patient initiated treatment, and EMS suspicions of self-harm/suicide attempt (Table 17).

The results of the interprofessional ratings identified consensus on 17 handover elements. These 17 handover elements are included in the universal list. The three elements that did not obtain consensus in the interprofessional rating analysis were age,

patient initiated treatment and EMS suspicions of self-harm/suicide attempt, which are all important concepts. The EM physicians deemed 26 elements as necessary for EMS to ED patient handover, emergency registered nurses ranked 25 elements as necessary whereas paramedics ranked 20 elements as important or essential for all scenarios.

Emergency medicine physicians were the only profession who achieved group consensus regarding decontamination requirements, EMS suspicions of domestic violence or self-harm, total number of patients, and police involvement on scene as key EMS handover elements. Emergency registered nurses identified four unique elements as necessary for handover. These were Glasgow Coma Scale, oxygen saturation levels, pain assessment, and vascular access. Paramedics identified one element, the acute or chronic nature of the illness as necessary for handover whereas the other two groups did not reach consensus on the importance of this item. The complete lists of consensus elements are presented in Tables 19, 20, and 21 in Chapter Four.

Inferential statistics verified the emergency care Delphi participants did not demonstrate a statistically significant difference in their group mean responses to the handover elements. Furthermore elements identified for inclusion and exclusion for the Round II survey had comparable mean group responses. This indicates the possibility exists for the development of a prehospital handover element checklist to meet the needs of all emergency care providers involved in the transfer of prehospital to ED patient care. Thus, a recommendation to use 20 common elements generated from the initial analysis is warranted and discussed later in this chapter.

Research Question #2. What are the core and specific handover elements when applied to each of the five levels of acuity?

Results. The analysis of all ESI acuity ratings yielded 16 elements necessary for EMS to ED patient handover across all acuity levels. These ESI handover elements differ slightly from the universal and interprofessional lists previously discussed. The ESI acuity elements were chief complaint, baseline vital signs, last set of vital signs, history of present illness, details of incident/accident, mechanism of injury, time of injury/illness, associated symptoms, patient initiated treatment, EMS medications/dosages, patient response to treatments, pertinent system findings, site of physical injuries, past medical history, allergies, and current medications. The element difference between the ESI acuity element list and the interprofessional list is the addition of patient initiated treatment and the deletion of mental status/associated changes and combativeness.

The number of elements in each ESI scenario meeting the 75% consensus threshold varied based on acuity level. The participants ranked 37 elements in the ESI Level One scenario as necessary for handover with 38 elements for Level Two, 22 elements for Level Three, 20 elements for Level Four, and 16 elements for Level Five. In addition some elements were only pertinent to select ESI acuity levels. For instance, cardiopulmonary resuscitation (CPR), defibrillation, and duration of CPR were deemed necessary for the ESI Level One scenario. EMS suspicion of abuse, physical location of EMS documentation, and police involvement were also rated as important or essential for only the Level One scenario. The ESI Level Two scenario also had unique element consensus. The panelists deemed abdominal/pelvic abnormalities, 12-lead electrocardiogram results, patient reported drug use, and blood glucose level was necessary for EMS handover of the Level Two scenario. The acute or chronic nature of the illness was distinct to the ESI Level Three scenario with patient name distinct to the

Level Five scenario. The ESI Level Four scenario shared all handover elements with at least one other ESI level scenario.

The completion of an ANOVA analysis on the Delphi participant rankings of ESI scenario elements detected a small difference between the acuity level group means. However, after ad hoc testing, only the emergency medicine physician and paramedic group means of the ESI Level Five scenario had a statistical difference ($p = 0.04$). This data demonstrates each group of emergency care providers involved with prehospital patient handover has similar content expectations for each acuity level patient. Participants identified that Level One and Two ESI scenario patients required a larger volume of patient information or element transfer, 37 and 38 respectively versus the 16 elements necessary for ESI Level Five. From these findings, one could infer that greater acuity patients require a more comprehensive or detailed handover due to the increased number of elements necessary for the safe transition of care.

Implications

The complexity of EMS to ED patient handover is subject to environmental factors, safety implications, workplace barriers, communication issues, and content considerations. Although prehospital and ED care providers have differing environmental practice areas, their patient handover content expectations are similar. The use of any of these consensus handover checklists has the potential to diminish unsafe practices while reducing the medical-legal risk of incomplete handover.

An additional literature search was performed at the conclusion of this study to determine if further research has been published regarding EMS to ED patient handover. There continues to be a paucity of literature regarding prehospital care handover.

Previous research suggests dissatisfaction with the communication of prehospital patient information in terms of method, structure, and content. This study identified content expectations across interdisciplinary roles as well as patient acuity levels. The use of this information can be applied to the development of an EMS to ED handover checklist to ensure necessary patient information is consistently communicated.

The current NHTSA National EMS Education Standards for prehospital care handover includes 12 handover elements. However, this standard is not supported by the real world expectations of the Delphi emergency care expert panel in this study. Table 26 outlines the discrepancy between the 2009 NHTSA handover content standards and the interprofessional content expectations elements revealed in this study.

Table 26 NHTSA 2009 Handover Guidelines versus Delphi Study Findings

NHTSA 2009 Handover Guidelines	Delphi Study Results Interprofessional & Acuity Scenarios (Universal)	Interprofessional Consensus	ESI Acuity Consensus
Chief complaint	Chief complaint	Chief complaint	Chief complaint
Patient's age and sex	Age		
Baseline vital signs	Baseline vital signs	Baseline vital signs	Baseline vital signs
	Last set of vital signs	Last set of vital signs	Last set of vital signs
Brief and pertinent history of the present illness	History of present illness	History of present illness	History of present illness
	Details of incident/accident	Details of incident/accident	Details of incident/accident
	Mechanism of injury	Mechanism of injury	Mechanism of injury
	Time of injury/illness	Time of injury/illness	Time of injury/illness
	Associated symptoms	Associated symptoms	Associated symptoms
Mental status	Mental status & associated changes	Mental status & associated changes	
	Combativeness	Combativeness	
Emergency medical care given	Patient initiated treatment		Patient initiated treatment
Response to emergency medical care	EMS medications & dosages	EMS medications & dosages	EMS medications & dosages
	Patient response to treatments	Patient response to treatments	Patient response to treatments

Table 26 NHTSA 2009 Handover Guidelines versus Delphi Study Findings (continued)

NHTSA 2009 Handover Guidelines	Delphi Study Results Interprofessional & Acuity Scenarios (Universal)	Interprofessional Consensus	ESI Acuity Consensus
Pertinent findings of the physical exam	Pertinent system findings	Pertinent system findings	Pertinent system findings
Current patient condition	Site of physical injuries	Site of physical injuries	Site of physical injuries
Major past illnesses	Past medical history	Past medical history	Past medical history
	Allergies	Allergies	Allergies
	Current medications	Current medications	Current medications
	EMS suspicions of suicide attempt		
Unit identification and level of provider			
Estimated time of arrival			

The emergency medicine physicians reached consensus on 26 elements necessary for EMS to ED handover (Table 19). This was determined by using a cumulative emergency medicine physician group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 19 Round II, Emergency Medicine Physician Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
EMS Medications & Dosages	100.00%	2.80
Chief Complaint	96.67%	2.70
Allergies	96.67%	2.77
Mechanism of Injury	96.67%	2.63
EMS Suspicions of Suicide Attempt	96.67%	2.73
Time of Injury/Illness	93.33%	2.50
Site of Physical Injuries	93.33%	2.57
Patient Response to Treatments	93.33%	2.63
EMS Suspicions of Abuse	93.33%	2.47
Details of Incident/Accident	90.00%	2.50
Last Set of Vital Signs	90.00%	2.43
Patient Initiated Treatment	90.00%	2.37
Baseline Vital Signs	89.66%	2.55
Associated Symptoms	86.67%	2.43
Current Medications	86.67%	2.27
Mental Status	86.67%	2.40
History of Present Illness	83.33%	2.57
Past Medical History	83.33%	2.20
Volume & Type of IV Fluid	83.33%	2.33
Police Involvement	83.33%	2.27
Age	80.00%	2.13
Decontamination Required	80.00%	2.20
Number of Total Patients	80.00%	2.10
Pertinent System Findings	80.00%	2.27
Airway Patency	76.67%	2.33
Combativeness	76.67%	2.20

The emergency registered nurses reached consensus on 25 elements necessary for EMS to ED handover (Table 20). This was determined by using an emergency registered

nurse group score greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 20 Round II, Emergency Registered Nurse Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.50
Pertinent System Findings	100.00%	2.75
Chief Complaint	97.50%	2.73
History of Present Illness	97.50%	2.50
Allergies	97.50%	2.43
Patient Response to Treatments	97.44%	2.56
Time of Injury/Illness	95.00%	2.63
EMS Medications & Dosages	94.87%	2.62
Associated Symptoms	92.50%	2.53
Last Set of Vital Signs	92.50%	2.63
Mental Status	90.00%	2.63
Baseline Vital Signs	87.50%	2.48
Mechanism of Injury	85.00%	2.53
Site of Physical Injuries	85.00%	2.53
Pain Assessment	84.62%	2.13
Glasgow Coma Scale	82.50%	2.23
Combativeness	82.50%	2.18
Patient Initiated Treatment	82.05%	2.21
Volume & Type of IV Fluid	80.00%	2.15
Airway Patency	77.50%	2.18
Suspected Fractures	77.50%	2.10
Vascular Access	77.50%	2.13
Current Medications	75.00%	2.18
Past Medical History	75.00%	2.10
Oxygen Saturation	75.00%	2.10

The paramedics reached consensus on 20 elements necessary for EMS to ED handover (Table 21). The was determined by using a paramedic group score of greater than 75% ranking of either important or essential for each element in all ESI scenarios.

Table 21 Round II, Paramedic Consensus of Handover Elements, All Scenarios

Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.87
Chief Complaint	100.00%	2.98
Pertinent System Findings	100.00%	2.71
Time of Injury/Illness	97.73%	2.73
Site of Physical Injuries	97.73%	2.75
Associated Symptoms	95.56%	2.67
Mechanism of Injury	95.56%	2.73
History of Present Illness	93.33%	2.69
Last Set of Vital Signs	90.91%	2.48
Age	88.89%	2.27
Baseline Vital Signs	88.89%	2.40
EMS Medications & Dosages	88.89%	2.47
Patient Response to Treatments	88.89%	2.58
Mental Status	86.67%	2.49
Past Medical History	84.44%	2.07
Current Medications	82.22%	2.09
Suspected Fractures	77.78%	2.04
Allergies	75.56%	2.11
Acute/Chronic Nature of Illness	75.56%	2.07
Combativeness	75.56%	2.04

The second research question asked what are the core and specific handover elements for each of the five ESI acuity levels? The grouped participant determined element scores for all ESI levels are presented in Table 22. The core elements for the ESI scenarios were determined in a two-step process. First ESI element consensus was based on a participant group rating of 75% of important or essential for each element in each scenario. Second the core elements for all ESI levels were based on the element reaching an 80% consensus (using the greater than 75% rule) across all five scenarios. Table 23 displays the consensus of elements across all ESI level scenarios.

Table 22 Round II, All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13

Table 22 Round II, All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5	
	% Rated Important or Essential	Mean	% Rate Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78

Table 23 Round II, Consensus of All ESI Scenario Ratings

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Details of Incident/Accident	100.00%	2.78	100.00%	2.74	91.30%	2.52	100.00%	2.52	95.65%	2.65	100%
Chief Complaint	95.65%	2.78	95.65%	2.83	100.00%	2.83	100.00%	2.87	100.00%	2.78	100%
History of Present Illness	91.30%	2.57	91.30%	2.65	95.65%	2.70	91.30%	2.48	91.30%	2.57	100%
Associated Symptoms	91.30%	2.52	95.65%	2.65	95.65%	2.70	91.30%	2.48	86.96%	2.43	100%
Allergies	82.61%	2.30	91.30%	2.43	91.30%	2.52	91.30%	2.35	86.96%	2.35	100%
Pertinent System Findings	95.65%	2.78	95.65%	2.74	91.30%	2.57	95.65%	2.52	95.65%	2.43	100%
Baseline Vital Signs	95.65%	2.74	91.30%	2.57	95.65%	2.65	78.26%	2.17	81.82%	2.18	100%
Last Set of Vital Signs	100.00%	2.87	100.00%	2.65	100.00%	2.77	78.26%	2.13	78.26%	2.17	100%
EMS Medications & Dosages	100.00%	2.78	100.00%	2.70	91.30%	2.65	90.91%	2.50	86.96%	2.39	100%
Patient Response to Treatments	100.00%	2.91	100.00%	2.91	86.96%	2.52	95.45%	2.36	82.61%	2.22	100%
Current Medications	69.57%	1.91	82.61%	2.30	95.65%	2.43	82.61%	2.17	73.91%	2.00	80%
Past Medical History	69.57%	1.87	82.61%	2.22	91.30%	2.39	78.26%	2.04	82.61%	2.04	80%
Time of Injury/Illness	100.00%	2.91	100.00%	2.74	95.45%	2.68	86.96%	2.26	95.65%	2.57	80%
Mechanism of Injury	100.00%	2.91	95.65%	2.83	69.57%	2.00	95.65%	2.65	100.00%	2.78	80%
Site of Physical Injuries	100.00%	2.96	95.65%	2.74	72.73%	2.00	95.65%	2.65	95.65%	2.74	80%
Patient Initiated Treatment	78.26%	2.13	82.61%	2.30	82.61%	2.13	77.27%	1.95	65.22%	1.83	80%
Age	73.91%	1.96	78.26%	2.09	86.96%	2.39	73.91%	1.87	82.61%	2.13	60%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Decontamination Required	86.96%	2.26	78.26%	2.09	47.83%	1.43	82.61%	2.04	60.87%	1.78	60%
Mental Status	100.00%	2.96	100.00%	2.91	100.00%	2.83	73.91%	2.09	65.22%	1.78	60%
Glasgow Coma Scale	91.30%	2.70	86.96%	2.57	78.26%	2.09	34.78%	1.26	36.36%	1.14	60%
Pupil Exam	91.30%	2.61	90.91%	2.55	86.96%	2.43	21.74%	0.96	26.09%	0.91	60%
Combativeness	100.00%	2.78	95.65%	2.48	82.61%	2.26	69.57%	1.83	43.48%	1.30	60%
Suspected Fractures	78.26%	2.17	82.61%	2.30	40.91%	1.09	95.65%	2.52	73.91%	2.13	60%
Volume & Type of IV Fluid	100.00%	2.74	91.30%	2.43	78.26%	2.09	43.48%	1.48	52.17%	1.57	60%
EMS Suspicions of Suicide Attempt	82.61%	2.30	82.61%	2.26	65.22%	1.91	78.26%	2.17	73.91%	2.04	60%
Number of Total Patients	82.61%	2.13	78.26%	2.00	43.48%	1.30	52.17%	1.43	47.83%	1.48	40%
Total Transport Time	95.65%	2.70	100.00%	2.43	73.91%	1.96	26.09%	1.00	39.13%	1.35	40%
Airway Patency	100.00%	3.00	100.00%	2.87	65.22%	1.91	47.83%	1.52	52.17%	1.48	40%
Chest Abnormalities	78.26%	2.22	95.65%	2.48	43.48%	1.30	39.13%	1.35	45.45%	1.23	40%
Skin Exam	82.61%	2.09	82.61%	2.04	43.48%	1.26	60.87%	1.78	65.22%	1.78	40%
Pain Assessment	60.87%	1.70	65.22%	1.83	86.36%	2.18	78.26%	1.96	73.91%	2.09	40%
Suspected Type of Shock	82.61%	2.39	78.26%	2.30	60.87%	1.65	43.48%	1.48	47.83%	1.39	40%
Airway Intervention	100.00%	3.00	95.65%	2.87	56.52%	1.78	43.48%	1.43	43.48%	1.30	40%
Oxygen Saturation	86.96%	2.52	86.96%	2.57	65.22%	1.78	34.78%	1.17	39.13%	1.22	40%
Vascular Access	100.00%	2.70	82.61%	2.35	69.57%	1.91	52.17%	1.48	47.83%	1.52	40%

Table 23 Round II, Consensus of All ESI Scenario Ratings (continued)

Elements in Survey Order	ESI 1		ESI 2		ESI 3		ESI 4		ESI 5		Consensus of ESI Ratings
	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	% Rated Important or Essential	Mean	
Patient's name	52.17%	1.57	60.87%	1.70	73.91%	2.04	73.91%	2.09	78.26%	2.04	20%
Acute/Chronic Nature of Illness	68.18%	1.95	73.91%	2.17	78.26%	2.30	60.87%	1.78	69.57%	1.91	20%
Abdominal/Pelvic Abnormalities	73.91%	2.09	95.65%	2.48	43.48%	1.30	30.43%	1.26	43.48%	1.17	20%
12 Lead EKG Findings	65.22%	1.87	86.96%	2.17	52.17%	1.48	26.09%	0.96	30.43%	0.91	20%
CPR Performed	82.61%	2.39	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Duration of CPR	82.61%	2.39	65.22%	1.91	43.48%	1.30	45.45%	1.32	39.13%	1.13	20%
Defibrillation Attempts	78.26%	2.30	65.22%	1.91	43.48%	1.30	43.48%	1.30	39.13%	1.13	20%
Glucose Level	69.57%	2.13	100.00%	2.87	69.57%	1.91	50.00%	1.45	39.13%	1.22	20%
Patient Reported Drug Use	69.57%	1.83	78.26%	2.17	73.91%	2.13	60.87%	1.70	52.17%	1.61	20%
EMS Suspicions of Abuse	82.61%	2.22	73.91%	2.13	52.17%	1.70	73.91%	2.13	60.87%	1.83	20%
Police Involvement	90.91%	2.45	65.22%	1.96	34.78%	1.26	60.87%	1.78	52.17%	1.70	20%
Physical Location of EMS Documentation	78.26%	1.96	68.18%	1.82	50.00%	1.55	47.83%	1.43	47.83%	1.26	20%
Gender	43.48%	1.39	56.52%	1.57	56.52%	1.78	34.78%	1.17	47.83%	1.35	0%
EMS Agency Identification/Transport Method	73.91%	2.09	68.18%	1.82	69.57%	1.87	30.43%	1.09	31.82%	1.23	0%
Tourniquet Placed	52.17%	1.48	56.52%	1.61	34.78%	1.00	50.00%	1.41	52.17%	1.52	0%
Patient Known to EMS	21.74%	0.78	30.43%	1.00	26.09%	1.13	27.27%	1.09	17.39%	0.78	0%

Consensus was achieved on 16 handover elements across all ESI acuity scenarios. These elements were details of incident, chief complaint, history of present illness, associated symptoms, allergies, pertinent system findings, baseline vital signs, last set of vital signs, EMS medications/dosages, patient response to treatments, current medications, past medical history, time of injury/illness, mechanism of injury, site of physical injuries, and patient initiated treatment.

Individual ESI scenario element rankings differed in terms of content and volume necessary for handover. Consensus was achieved on 37 Level One scenario elements, 38 Level Two elements, 22 Level Three elements, 20 Level Four elements, and 16 Level Five elements. The top rated elements achieving a consensus score of 75% important or essential rankings are presented in Table 24.

Table 24 Round II, Top Elements for All ESI Scenarios

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Details of Incident/Accident	100.00%	2.78	Details of Incident/Accident	100.00%	2.74
Time of Injury/Illness	100.00%	2.91	Total Transport Time	100.00%	2.43
Mechanism of Injury	100.00%	2.91	Time of Injury/Illness	100.00%	2.74
Site of Physical Injuries	100.00%	2.96	Last Set of Vital Signs	100.00%	2.65
Last Set of Vital Signs	100.00%	2.87	Mental Status	100.00%	2.91
Mental Status	100.00%	2.96	Airway Patency	100.00%	2.87
Airway Patency	100.00%	3.00	EMS Medications & Dosages	100.00%	2.70
Combativeness	100.00%	2.78	Glucose Level	100.00%	2.87
Airway Intervention	100.00%	3.00	Patient Response to Treatments	100.00%	2.91
Vascular Access	100.00%	2.70	Chief Complaint	95.65%	2.83
Volume & Type of IV Fluid	100.00%	2.74	Associated Symptoms	95.65%	2.65
EMS Medications & Dosages	100.00%	2.78	Pertinent System Findings	95.65%	2.74
Patient Response to Treatments	100.00%	2.91	Mechanism of Injury	95.65%	2.83
Total Transport Time	95.65%	2.70	Site of Physical Injuries	95.65%	2.74
Chief Complaint	95.65%	2.78	Chest Abnormalities	95.65%	2.48
Pertinent System Findings	95.65%	2.78	Abdominal/Pelvic Abnormalities	95.65%	2.48
Baseline Vital Signs	95.65%	2.74	Combativeness	95.65%	2.48
History of Present Illness	91.30%	2.57	Airway Intervention	95.65%	2.87
Associated Symptoms	91.30%	2.52	History of Present Illness	91.30%	2.65
Glasgow Coma Scale	91.30%	2.70	Allergies	91.30%	2.43
Pupil Exam	91.30%	2.61	Baseline Vital Signs	91.30%	2.57
Police Involvement	90.91%	2.45	Volume & Type of IV Fluid	91.30%	2.43
Decontamination Required	86.96%	2.26	Pupil Exam	90.91%	2.55
Oxygen Saturation	86.96%	2.52	Glasgow Coma Scale	86.96%	2.57

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI One Elements	% Rated Important or Essential	Mean	ESI Two Elements	% Rated Important or Essential	Mean
Number of Total Patients	82.61%	2.13	Oxygen Saturation	86.96%	2.57
Allergies	82.61%	2.30	12 Lead EKG Findings	86.96%	2.17
Skin Exam	82.61%	2.09	Current Medications	82.61%	2.30
Suspected Type of Shock	82.61%	2.39	Past Medical History	82.61%	2.22
CPR Performed	82.61%	2.39	Skin Exam	82.61%	2.04
Duration of CPR	82.61%	2.39	Suspected Fractures	82.61%	2.30
EMS Suspicions of Suicide Attempt	82.61%	2.30	Vascular Access	82.61%	2.35
EMS Suspicions of Abuse	82.61%	2.22	Patient Initiated Treatment	82.61%	2.30
Chest Abnormalities	78.26%	2.22	EMS Suspicions of Suicide Attempt	82.61%	2.26
Suspected Fractures	78.26%	2.17	Age	78.26%	2.09
Defibrillation Attempts	78.26%	2.30	Decontamination Required	78.26%	2.09
Patient Initiated Treatment	78.26%	2.13	Number of Total Patients	78.26%	2.00
Physical Location of EMS Documentation	78.26%	1.96	Suspected Type of Shock	78.26%	2.30
			Patient Reported Drug Use	78.26%	2.17

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.83	Details of Incident/Accident	100.00%	2.52
Last Set of Vital Signs	100.00%	2.77	Chief Complaint	100.00%	2.87
Mental Status	100.00%	2.83	Pertinent System Findings	95.65%	2.52
History of Present Illness	95.65%	2.70	Mechanism of Injury	95.65%	2.65
Associated Symptoms	95.65%	2.70	Site of Physical Injuries	95.65%	2.65

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Three Elements	% Rated Important or Essential	Mean	ESI Four Elements	% Rated Important or Essential	Mean
Current Medications	95.65%	2.43	Suspected Fractures	95.65%	2.52
Baseline Vital Signs	95.65%	2.65	Patient Response to Treatments	95.45%	2.36
Time of Injury/Illness	95.45%	2.68	History of Present Illness	91.30%	2.48
Details of Incident/Accident	91.30%	2.52	Associated Symptoms	91.30%	2.48
Allergies	91.30%	2.52	Allergies	91.30%	2.35
Past Medical History	91.30%	2.39	EMS Medications & Dosages	90.91%	2.50
Pertinent System Findings	91.30%	2.57	Time of Injury/Illness	86.96%	2.26
EMS Medications & Dosages	91.30%	2.65	Decontamination Required	82.61%	2.04
Age	86.96%	2.39	Current Medications	82.61%	2.17
Pupil Exam	86.96%	2.43	Past Medical History	78.26%	2.04
Patient Response to Treatments	86.96%	2.52	Baseline Vital Signs	78.26%	2.17
Pain Assessment	86.36%	2.18	Last Set of Vital Signs	78.26%	2.13
Combativeness	82.61%	2.26	Pain Assessment	78.26%	1.96
Patient Initiated Treatment	82.61%	2.13	EMS Suspicions of Suicide Attempt	78.26%	2.17
Acute/Chronic Nature of Illness	78.26%	2.30	Patient Initiated Treatment	77.27%	1.95
Glasgow Coma Scale	78.26%	2.09			
Volume & Type of IV Fluid	78.26%	2.09			

Table 24 Round II, Top Elements for All ESI Scenarios (continued)

ESI Five Elements	% Rated Important or Essential	Mean
Chief Complaint	100.00%	2.78
Mechanism of Injury	100.00%	2.78
Site of Physical Injuries	95.65%	2.74
History of Present Illness	91.30%	2.57
Associated Symptoms	86.96%	2.43
Allergies	86.96%	2.35
EMS Medications & Dosages	86.96%	2.39
Age	82.61%	2.13
Past Medical History	82.61%	2.04
Patient Response to Treatments	82.61%	2.22
Baseline Vital Signs	81.82%	2.18
Patient's name	78.26%	2.04
Last Set of Vital Signs	78.26%	2.17

Inferential statistics were performed on the Round I and II results. A one-way analysis of variance (ANOVA) was performed on the three professional group responses, the retained and eliminated element items from Round I, and the ESI scenario scoring. Using an alpha level of 0.05 for all statistical testing, a one-way between participants ANOVA was performed to compare the difference between professional roles on the ranking of handover element importance in all ESI scenarios. In the Round I and Round II surveys there was not a significant effect of profession on the handover content expectation group means (Round I $p = 0.91$, Round II $p = 0.44$). After the conclusion of Round I, an ANOVA was calculated demonstrating there was not significance between the mean group scores of professional role rankings on eliminated handover elements ($p = 0.84$) or retained handover elements ($p = 0.41$). These results suggest it is possible to achieve an EMS to ED handover content tool to meet all interprofessional expectations.

A one way ANOVA of ESI scenario element rating group means showed the ESI acuity level was significant for the element importance rating ($p < 0.001$). Given the statistically significant ANOVA, Tukey honestly significant difference (HSD) testing using a 95% significance was performed on all possible pairwise comparisons of means for post hoc analysis (Table 25). The only ESI scenario with significantly different professional group means ($p < 0.05$) was the emergency medicine physician and paramedic ranking of ESI Level Five scenario.

Table 25 Tukey HSD for Interprofessional ESI Element Ratings

Scenario	Group Mean Difference	95% Confidence Intervals	*p* value
ESI Level One Scenario			
MD vs. RN	-0.12	-0.36 to 0.13	p=0.50
MD vs. EMS	-0.23	-0.47 to 0.02	p=0.07
RN vs. EMS	-0.11	-0.36 to 0.13	p=0.52

ESI Level Two Scenario			
MD vs. RN	-0.16	-0.37 to 0.06	p=0.20
MD vs. EMS	-0.13	-0.35 to 0.08	p=0.28
RN vs. EMS	0.02	-0.20 to 0.23	p=0.98
ESI Level Three Scenario			
MD vs. RN	-0.06	-0.34 to 0.22	p=0.88
MD vs. EMS	-0.14	-0.42 to 0.14	p=0.48
RN vs. EMS	-0.08	-0.36 to 0.20	p=0.78
ESI Level Four Scenario			
MD vs. RN	0.03	-0.24 to 0.29	p=0.97
MD vs. EMS	-0.13	-0.39 to 0.14	p=0.50
RN vs. EMS	-0.15	-0.42 to 0.11	p=0.36
ESI Level Five Scenario			
MD vs. RN	-0.11	-0.39 to 0.16	p=0.60
MD vs. EMS	-0.29	-0.56 to -0.01	p=0.04
RN vs. EMS	-0.17	-0.45 to 0.10	p=0.29

Credibility, Validity, and Reliability of Findings

Expert opinion consensus regarding EMS to ED handover elements was obtained following two rounds of surveys. The credibility and reliability of these findings were generated by the selection of key participants involved in this critical phase of patient care. Content validity was established for this study by the use of 23 participants with subject matter knowledge regarding EMS to ED handover (Goodman, 1987). Submitting the aggregate results obtained in Round I scenarios to the panelists during Round II ensured construct validity (Okoli & Pawlowski, 2004).

Summary

The selection of the Delphi methodology was based on the need to gather expert opinion of emergency medicine professionals located across a geographical region. This chapter offers the data collected and analysis of two rounds of Delphi study. Using a 75%

participant consensus score, developed among the entire expert panel, 20 elements were generated. These elements had mean scores ranging from 2.07-2.82. Expert opinion among each profession identified a differing number and type of elements. The emergency physician identified 26 elements, the emergency nurses identified 25 elements, and paramedics identified 20 elements. The ESI scenarios also resulted in a varying number and types of elements based on the acuity level of the patient. ESI Level Two patients requiring the most at 38 elements with ESI Level Five requiring only 16 core elements for EMS to ED patient handover. Ultimately 16 core elements were ranked important or essential to all ESI acuity levels.

Chapter Five: Results, Conclusions, and Recommendations

The purpose of this study was to determine the interprofessional expectations of EMS to ED handover content. The study surveyed emergency medical care experts with experience in giving or receiving prehospital care handover. Two Delphi survey rounds were completed by 23 of 44 invited expert panelists. Chapter five discusses the study findings, implications, limitations, and recommendations for future research.

Summary of Findings

This discussion reflects the results for each research question.

Research Question #1. What are the core and provider specific elements necessary for an EMS to ED patient handover?

Results. A consensus of 20 handover elements for all ESI acuity levels was determined using all participant ratings on all ESI scenarios. The universal 20 elements are: chief complaint, details of incident/accident, pertinent system findings, time of illness/injury, EMS medications/dosages, history of present illness, associated symptoms, mechanism of injury, patient response to treatments, site of physical injuries, last set of vital signs, allergies, baseline vital signs, mental status/ associated changes, current medications, past medical history, age, combativeness, patient initiated treatment, and EMS suspicions of self-harm/suicide attempt (Table 17).

The results of the interprofessional ratings identified consensus on 17 handover elements. These 17 handover elements are included in the universal list. The three elements that did not obtain consensus in the interprofessional rating analysis were age,

patient initiated treatment and EMS suspicions of self-harm/suicide attempt, which are all important concepts. The EM physicians deemed 26 elements as necessary for EMS to ED patient handover, emergency registered nurses ranked 25 elements as necessary whereas paramedics ranked 20 elements as important or essential for all scenarios.

Emergency medicine physicians were the only profession who achieved group consensus regarding decontamination requirements, EMS suspicions of domestic violence or self-harm, total number of patients, and police involvement on scene as key EMS handover elements. Emergency registered nurses identified four unique elements as necessary for handover. These were Glasgow Coma Scale, oxygen saturation levels, pain assessment, and vascular access. Paramedics identified one element, the acute or chronic nature of the illness as necessary for handover whereas the other two groups did not reach consensus on the importance of this item. The complete lists of consensus elements are presented in Tables 19, 20, and 21 in Chapter Four.

Inferential statistics verified the emergency care Delphi participants did not demonstrate a statistically significant difference in their group mean responses to the handover elements. Furthermore elements identified for inclusion and exclusion for the Round II survey had comparable mean group responses. This indicates the possibility exists for the development of a prehospital handover element checklist to meet the needs of all emergency care providers involved in the transfer of prehospital to ED patient care. Thus, a recommendation to use 20 common elements generated from the initial analysis is warranted and discussed later in this chapter.

Research Question #2. What are the core and specific handover elements when applied to each of the five levels of acuity?

Results. The analysis of all ESI acuity ratings yielded 16 elements necessary for EMS to ED patient handover across all acuity levels. These ESI handover elements differ slightly from the universal and interprofessional lists previously discussed. The ESI acuity elements were chief complaint, baseline vital signs, last set of vital signs, history of present illness, details of incident/accident, mechanism of injury, time of injury/illness, associated symptoms, patient initiated treatment, EMS medications/dosages, patient response to treatments, pertinent system findings, site of physical injuries, past medical history, allergies, and current medications. The element difference between the ESI acuity element list and the interprofessional list is the addition of patient initiated treatment and the deletion of mental status/associated changes and combativeness.

The number of elements in each ESI scenario meeting the 75% consensus threshold varied based on acuity level. The participants ranked 37 elements in the ESI Level One scenario as necessary for handover with 38 elements for Level Two, 22 elements for Level Three, 20 elements for Level Four, and 16 elements for Level Five. In addition some elements were only pertinent to select ESI acuity levels. For instance, cardiopulmonary resuscitation (CPR), defibrillation, and duration of CPR were deemed necessary for the ESI Level One scenario. EMS suspicion of abuse, physical location of EMS documentation, and police involvement were also rated as important or essential for only the Level One scenario. The ESI Level Two scenario also had unique element consensus. The panelists deemed abdominal/pelvic abnormalities, 12-lead electrocardiogram results, patient reported drug use, and blood glucose level was necessary for EMS handover of the Level Two scenario. The acute or chronic nature of the illness was distinct to the ESI Level Three scenario with patient name distinct to the

Level Five scenario. The ESI Level Four scenario shared all handover elements with at least one other ESI level scenario.

The completion of an ANOVA analysis on the Delphi participant rankings of ESI scenario elements detected a small difference between the acuity level group means. However, after ad hoc testing, only the emergency medicine physician and paramedic group means of the ESI Level Five scenario had a statistical difference ($p = 0.04$). This data demonstrates each group of emergency care providers involved with prehospital patient handover has similar content expectations for each acuity level patient. Participants identified that Level One and Two ESI scenario patients required a larger volume of patient information or element transfer, 37 and 38 respectively versus the 16 elements necessary for ESI Level Five. From these findings, one could infer that greater acuity patients require a more comprehensive or detailed handover due to the increased number of elements necessary for the safe transition of care.

Implications

The complexity of EMS to ED patient handover is subject to environmental factors, safety implications, workplace barriers, communication issues, and content considerations. Although prehospital and ED care providers have differing environmental practice areas, their patient handover content expectations are similar. The use of any of these consensus handover checklists has the potential to diminish unsafe practices while reducing the medical-legal risk of incomplete handover.

An additional literature search was performed at the conclusion of this study to determine if further research has been published regarding EMS to ED patient handover. There continues to be a paucity of literature regarding prehospital care handover.

Previous research suggests dissatisfaction with the communication of prehospital patient information in terms of method, structure, and content. This study identified content expectations across interdisciplinary roles as well as patient acuity levels. The use of this information can be applied to the development of an EMS to ED handover checklist to ensure necessary patient information is consistently communicated.

The current NHTSA National EMS Education Standards for prehospital care handover includes 12 handover elements. However, this standard is not supported by the real world expectations of the Delphi emergency care expert panel in this study. Table 26 outlines the discrepancy between the 2009 NHTSA handover content standards and the interprofessional content expectations elements revealed in this study.

Table 26 NHTSA 2009 Handover Guidelines versus Delphi Study Findings

NHTSA 2009 Handover Guidelines	Delphi Study Results Interprofessional & Acuity Scenarios (Universal)	Interprofessional Consensus	ESI Acuity Consensus
Chief complaint	Chief complaint	Chief complaint	Chief complaint
Patient's age and sex	Age		
Baseline vital signs	Baseline vital signs	Baseline vital signs	Baseline vital signs
	Last set of vital signs	Last set of vital signs	Last set of vital signs
Brief and pertinent history of the present illness	History of present illness	History of present illness	History of present illness
	Details of incident/accident	Details of incident/accident	Details of incident/accident
	Mechanism of injury	Mechanism of injury	Mechanism of injury
	Time of injury/illness	Time of injury/illness	Time of injury/illness
	Associated symptoms	Associated symptoms	Associated symptoms
Mental status	Mental status & associated changes	Mental status & associated changes	
	Combativeness	Combativeness	
Emergency medical care given	Patient initiated treatment		Patient initiated treatment
Response to emergency medical care	EMS medications & dosages	EMS medications & dosages	EMS medications & dosages
	Patient response to treatments	Patient response to treatments	Patient response to treatments

Table 26 NHTSA 2009 Handover Guidelines versus Delphi Study Findings (continued)

NHTSA 2009 Handover Guidelines	Delphi Study Results Interprofessional & Acuity Scenarios (Universal)	Interprofessional Consensus	ESI Acuity Consensus
Pertinent findings of the physical exam	Pertinent system findings	Pertinent system findings	Pertinent system findings
Current patient condition	Site of physical injuries	Site of physical injuries	Site of physical injuries
Major past illnesses	Past medical history	Past medical history	Past medical history
	Allergies	Allergies	Allergies
	Current medications	Current medications	Current medications
	EMS suspicions of suicide attempt		
Unit identification and level of provider			
Estimated time of arrival			

The current NHTSA EMS handover elements are vague when compared to the detailed interprofessional handover content expectations of the emergency care experts generated during this study. Conclusions could be drawn that these vague handover guidelines contribute inadequate interprofessional communication leading to the tension currently experienced by prehospital and ED personnel during patient care transition. Therefore future EMS handover education should consider the inclusion of the expectations garnered from this study.

Time, ED audience, and patient acuity will influence the decision to use the universal, interprofessional, or ESI acuity handover elements. The universal handover contains additional elements and will result in a lengthier EMS to ED handover. This would result in extended turnaround times for EMS staff and impact ambulance availability to the community.

The receiving emergency medicine physician and emergency registered nurse audience may prefer the interprofessional consensus elements. As recently as March 2015, Panchal et al. published their work to evaluate provider interpretation of EMS handover of high acuity patients. The researchers found that although information was found lacking in 1,091 observer handovers, the level of professionalism between transferring and receiving staff was the influencing factor of EMS and ED staff perception of clinical information handover adequacy. Panchal et al. recommends further studies are needed to increase the quantity of information delivered during EMS transfers. This Delphi study answers this recommendation by providing a specific list of interprofessional EMS to ED handover content elements.

Lastly, different element lists may be needed to meet the prehospital transfer requirements of all acuity patients. Future research is needed to determine if there is a need to consolidate the handover requirements of ESI Level One, Two, and Three for high acuity patients. Lesser acuity patients, those considered to be an ESI Level Four or Five may require fewer elements.

Recommendation for Practice.

Ultimately EMS systems should subscribe to one handover method and test its applicability to daily operations. This researcher recommends the universal list of 20 elements based on three factors. First, 17 of the 20 universal elements achieved 100% consensus in the interprofessional consensus. Second, the 3 additional universal elements (age, patient initiated treatment, and EMS suspicions of self-harm/suicide attempt) provide information that contributes to patient safety. Finally, the comparison with the NHTSA National EMS Education Standards and the charge from the Panchal et al. study suggests more elements are needed for an effective EMS handover. Adoption of the 20 elements is an evidence-based starting point that will lend itself to immediate implementation verbally, on paper, or electronically with little change in conventional practice.

Limitations

Limitations to this study were related to the research design. The Delphi method has been used repeatedly since the 1960's to create a group communication framework. The benefit of using a modified Delphi to access the collective wisdom of the emergency care panelists generated previously undiscovered information. However, the nature of the Delphi and its use of a relatively small sample size require the need for further testing to

determine the generalizability of the information across rural, urban, as well as international care settings.

The research called for the generation of information related to the core and specific EMS handover elements necessary for differing acuity level patients. Therefore the ESI Triage Tool was used as a guideline to design patient scenarios for the assessment of emergency medicine Delphi participant content expectations. This scenario delineation provided knowledge regarding the need or lack thereof to differentiate EMS handover based on patient acuity. However, the scenarios may have influenced the participant judgment on the importance of item inclusion in each handover.

Recommendations for Future Research

This study resulted in a handover element list that can be the foundation for an EMS to ED handover checklist instrument. The development of an EMS handover instrument has the potential to enhance the safe transfer of patient care from prehospital to ED staff. Further examination of the content garnered from this study is needed to determine element clarity along with its validity when applied to a larger sample size. Factor loading analysis should be performed to show the strength of the association of the element to each ESI level. Subsequent testing is needed to determine if paramedic personnel could use the handover checklist in daily patient care situations. In addition, international testing of the handover instrument would be helpful in identifying how this information meets the expectations and needs of global emergency medicine experts, where much of the previous research has been conducted. Lastly, the findings of this study provide an instrument for use in the practice setting, which can be tested for reliability, workflow, and satisfaction with communication.

Conclusions

The delivery of prehospital patient care is an essential component in the acutely ill or injured patient's overall health care experience. EMS to ED patient handover occurs when time is of the essence, requiring paramedics to convey pertinent information that will be received and acted upon, while allowing for expedient return to service and call availability. The identification of interprofessional content expectations is essential for the elimination of costly rework and repetition while ensuring seamless transfer of emergency care treatments and reducing the tension between disciplines based upon differing communication emphasis. It is vital that prehospital care information is accurately reported and received by all emergency care professionals tasked with the responsibility of providing exceptional patient care. A consistent, evidence-based instrument is a critical first step in improving this communication.

References

Aase, K., Soyland, E., & Hansen, B. (2011). A standardized patient handover process: perceptions and functioning. *Safety Science Monitor, 15*(2).

Anderson, J., Shroff, D., Curtis, A., Eldridge, N., Cannon, K., Karnani, R., . . . Kaboli, P. (2010). The Veterans Affairs Shift Change Physician-to-Physician Handoff Project. *Joint Commission Journal on Quality and Patient Safety, 36*(2), 62-71.

Arora, V., Johnson, J., Lovinger, D., Humphrey, H. J., & Meltzer, D. O. (2005). Communication failures in patient sign-out and suggestions for improvement: a critical incident analysis. *Quality and Safety in Health Care, 14*(6), 401-407. doi: 10.1136/qshc.2005.015107

Australian Council for Safety and Quality in Health Care. (2005). *Clinical handover and patient safety*. Retrieved from http://www.safetyandquality.gov.au.

Baker, J., Lovell, K., & Harris, N. (2006). How expert are the experts? an exploration of the concept of 'expert' within Delphi panel techniques. *Nurse Researcher, 14*, 59+.

Beach, C., Croskerry, P., & Shapiro, M. (2003). Profiles in Patient Safety: Emergency Care Transitions. *Academic Emergency Medicine, 10*(4), 364-367. doi: 10.1111/j.1553-2712.2003.tb01350.x

Behara, R., Wears, R. L., Perry, S. J., Eisenberg, E., Murphy, L., Vanderhoef, M., . . . Cosby, K. (2005). *A Conceptual Framework for Studying the Safety of Transitions in Emergency Care Advances in Patient Safety: From Research to Implementation (Volume 2: Concepts and Methodology)*. Rockville MD.

Benner, J. P., Hilton, J., Carr, G., Robbins, K., Schutt, R. C., Borloz, M. P., . . . Brady, W. (2008). Information transfer from prehospital to ED health care providers. *The American Journal of Emergency Medicine, 26*(2), 233-235. doi: http://dx.doi.org/10.1016/j.ajem.2007.04.003

Bhabra, G., Mackeith, S., Monteiro, P., & Pothier, D. (2007). An experimental comparison of handover methods. *Annals of the Royal College of Surgeons of England, 89*, 298-300.

Bosk, C. L., Dixon-Woods, M., Goeschel, C. A., & Pronovost, P. J. (2009). Reality check for checklists. *The Lancet, 374*(9688), 444-445. doi: 10.1016/S0140-6736(09)61440-9

Bost, N., Crilly, J., Patterson, E., & Chaboyer, W. (2012). Clinical handover of patients arriving by ambulance to a hospital emergency department: A qualitative study. *International Emergency Nursing, 20*(3), 133-141. doi: http://dx.doi.org/10.1016/j.ienj.2011.10.002

Browning, L. D. (1992). Lists and Stories as OrganizationaI Communication. *Communication Theory, 2*(4), 281-302. doi: 10.1111/j.1468-2885.1992.tb00045.x

Bruce, K., & Suserud, B.O. (2005). The handover process and triage of ambulance-borne patients: the experiences of emergency nurses. *Nursing in Critical Care, 10*(4), 201-209. doi: 10.1111/j.1362-1017.2005.00124.x

Budd, H. R., Almond, L. M., & Porter, K. (2007). A survey of trauma alert criteria and handover practice in England and Wales. *Emergency Medicine Journal, 24*(4), 302-304. doi: 10.1136/emj.2006.038323

Burzotta, L., & Noble, H. (2011). The dimensions of interprofessional practice. *British Journal of Nursing, 20*(5), 310-315.

Carter, A. J. E., Davis, K. A., Evans, L. V., & Cone, D. C. (2009). Information loss in emergency medical services handover of trauma patients. *Prehospital Emergency Care, 13*(3), 280-285. doi: 10.1080/10903120802706260

Centers for Disease Control and Prevention. (2010a). National Hospital Ambulatory Medical Care Survey: 2010 Emergency Department Summary Tables

Centers for Disease Control and Prevention. (2010b). *National Hospital Ambulatory Medical Care Survey: 2010 Emergency Department Summary Tables*. Hyattsville, MD: Retrieved from http://www.cdc.gov/nchs/data/ahcd/nhamcs_emergency/2010_ed_web_tables.pdf.

Chisholm, C. D., Collison, E. K., Nelson, D. R., & Cordell, W. H. (2000). Emergency Department Workplace Interruptions Are Emergency Physicians "Interrupt-driven" and "Multitasking"? *Academic Emergency Medicine, 7*(11), 1239-1243. doi: 10.1111/j.1553-2712.2000.tb00469.x

Clancy, C. M. (2006). Care Transitions: A Threat and an Opportunity for Patient Safety. *American Journal of Medical Quality, 21*(6), 415-417. doi: 10.1177/1062860606293537

Clayton, M. J. (1997). Delphi: A technique to harness expert opinion for critical decision-making tasks in education. *Educational Psychology, 17*(4), 373-386.

Coiera, E., Jayasuriya, R., Hardy, J., Bannan, A., & Thorpe, M. (2002). Communication loads on clinical staff in the emergency department. *Medical Journal of Australia, 176*(9), 415-418.

Cone, D. C., Schmidt, T. A., Mann, N. C., & Brown, L. (2004). Developing research criteria to define medical necessity in Emergency Medical Services. *Prehospital Emergency Care, 8*(2), 116-125. doi: doi:10.1080/312703004209

Dalkey, N. (1968). *Predicting the future*: [Santa Monica, Calif., Rand Corp.] 1968.

Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science (pre-1986), 9*(3).

Davis, J. S. M. D., Graygo, J. M. P. H., Augenstein, J. M. D. P., & Schulman, C. I. M. D. P. (2013). Prehospital Information for Optimal Patient Care. *The American Surgeon, 79*(4), 441-443.

Day, J., & Bobeva, M. (2005). A Generic Toolkit for the Successful Management of Delphi Studies. *The Electronic Journal of Business Research Methodology, 3*(2), 103-116.

Degani, A., & Wiener, E. L. (1993). Cockpit Checklists: Concepts, Design, and Use. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 35*(2), 345-359. doi: 10.1177/001872089303500209

Di Delupis, F. D., Mancini, N., di Nota, T., & Pisanelli, P. (2014). Pre-hospital/emergency department handover in Italy. *Internal and Emergency Medicine*, 1-10. doi: 10.1007/s11739-014-1136-x

Di Delupis, F. D., Pisanelli, P., Di Luccio, G., Kennedy, M., Tellini, S., Nenci, N., . . . Franco Gensini, G. (2014). Communication during handover in the pre-hospital/hospital interface in Italy: from evaluation to implementation of multidisciplinary training through high-fidelity simulation. *International Emergency Medicine*(1970-9366 (Electronic).

Duncan, E. A. S., Nicol, M. M., Ager, A., & Dalgleish, L. (2006). A systematic review of structured group interventions with mentally disordered offenders. *Criminal Behaviour and Mental Health, 16*(4), 217-241. doi: 10.1002/cbm.631

Eisenberg, E. M., Murphy, A. G., Sutcliffe, K., Wears, R., Schenkel, S., Perry, S., & Vanderhoef, M. (2005). Communication in Emergency Medicine: Implications for Patient Safety. *Communication Monographs, 72*(4), 390-413. doi: 10.1080/03637750500322602

Evans, S. M., Murray, A., Patrick, I., Fitzgerald, M., Smith, S., & Cameron, P. (2010). Clinical handover in the trauma setting: a qualitative study of paramedics and trauma team members. *Quality and Safety in Health Care, 19*(6), e57. doi: 10.1136/qshc.2009.039073

Fairbanks, R. J., Bisantz, A. M., & Sunm, M. (2007). Emergency Department Communication Links and Patterns. *Annals of Emergency Medicine, 50*(4), 396-406. doi: 10.1016/j.annemergmed.2007.03.005

Fischer, R. G. (1978). The Delphi Method: A Description, Review, and Criticism. *Journal of Academic Librarianship, 4*(2), 64-70.

Flowerdew, L., Brown, R., Russ, S., Vincent, C., & Woloshynowych, M. (2012). Teams under pressure in the emergency department: an interview study. *Emergency Medicine Journal, 29*(12), e2. doi: 10.1136/emermed-2011-200084

Fontenrose, J. E. (1959). *Python; a study of Delphic myth and its origins*: Berkeley, University of California Press, 1959.

Gilboy, N., Tanabe, P., Travers, D., & Rosenau, A. (2012). *Emergency Severity Index (ESI): A Triage Tool for Emergency Department*.

Goodman, C. M. (1987). The Delphi technique: a critique. *Journal of Advanced Nursing, 12*(6), 729-734. doi: 10.1111/j.1365-2648.1987.tb01376.x

Greenwood, M. J., & Heninger, J. R. (2010). Structured communication for patient safety in emergency medical services: a legal case report. *Prehospital Emergency Care, 14*(3), 345-348. doi: 10.3109/10903121003760788

Haig, K. M. (2006). *Three Areas of Communication Failure.* Paper presented at the Eighth Annual National Patient Safety Foundation Congress San Francisco, CA.

Hales, B. M., & Pronovost, P. J. (2006). The checklist--a tool for error management and performance improvement. *Journal of Critical Care, 21*(3), 231-235. doi: 10.1016/j.jcrc.2006.06.002

Halford, G. S., Baker, R., McCredden, J. E., & Bain, J. D. (2005). How Many Variables Can Humans Process? *Psychological Science, 16*(1), 70-76. doi: 10.2307/40064074

Hamman, W. R. (2004). The complexity of team training: what we have learned from aviation and its applications to medicine. *Quality and Safety in Health Care, 13*(suppl 1), i72-i79. doi: 10.1136/qshc.2004.009910

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform, 42*(2), 377-381. doi: 10.1016/j.jbi.2008.08.010

Haynes, A. B., Weiser, T. G., Berry, W. R., Lipsitz, S. R., Breizat, A. H. S., Dellinger, E. P., . . . Gawande, A. A. (2009). A Surgical Safety Checklist to Reduce Morbidity

and Mortality in a Global Population. *The New England Journal of Medicine, 360*(5), 491-499. doi: http://dx.doi.org/10.1056/NEJMsa0810119

Hilligoss, P. B. (2011). *Patient Handoffs between Emergency Department and Inpatient Physicians: A Qualitative Study to Inform Standardization of Practice and Organization Theory*. (Doctor of Philosphy), University of Michigan. (UMI Number: 3476488)

Horton, J. N. (1980). Nominal group technique. *Anaesthesia, 35*(8), 811-814. doi: 10.1111/j.1365-2044.1980.tb03924.x

Horwitz, L. I., Meredith, T., Schuur, J. D., Shah, N. R., Kulkarni, R. G., & Jenq, G. Y. (2009). Dropping the Baton: A Qualitative Analysis of Failures During the Transition From Emergency Department to Inpatient Care. *Annals of Emergency Medicine, 53*(6), 701-710.e704. doi: 10.1016/j.annemergmed.2008.05.007

Hsu, C.C., & Sandford, B. A. (2007). The Delphi Technique: Making Sense Of Consensus. *Practical Assessment, Research, & Evaluation, 12*(7).

Iedema, R., Ball, C., Daly, B., Young, J., Green, T., Middleton, P. M., . . . Comerford, D. (2012). Design and trial of a new ambulance-to-emergency department handover protocol: 'IMIST-AMBO'. *BMJ Quality and Safety, 21*(8), 627-633. doi: 10.1136/bmjqs-2011-000766

Institute of Medicine. (2006). Emergency Medical Services: At the Crossroads. Retrieved November 20, 2012, from http://www.iom.edu/Reports/2006/Emergency-Medical-Services-At-the-Crossroads.aspx

Jacob, S. L., Jacoby, J., Heller, M., & Stoltzfus, J. (2008). Patient and physician perspectives on ambulance utilization. *Prehospital Emergency Care, 12*(2), 176-181.

Jairath, N., & Weinstein, J. (1994). The Delphi methodology (Part one): A useful administrative approach. *Canadian journal of nursing administration, 7*(3), 29-42.

Jenkin, A., Abelson-Mitchell, N., & Cooper, S. (2007). Patient handover: Time for a change? *Accident and Emergency Nursing, 15*(3), 141-147. doi: 10.1016/j.aaen.2007.04.004

Jensen, S. M., Lippert, A., & ØStergaard, D. (2013). Handover of patients: a topical review of ambulance crew to emergency department handover. *Acta Anaesthesiologica Scandinavica*, n/a-n/a. doi: 10.1111/aas.12125

Johnson, M., Jefferies, D., & Nicholls, D. (2012). Developing a minimum data set for electronic nursing handover. *Journal of Clinical Nursing, 21*(3-4), 331-343. doi: 10.1111/j.1365-2702.2011.03891.x

Joint Commission. (2007). Communication During Patient Hand-Overs. *Patient Safety Solutions, 1*(3).

Kastein, M. R., Jacobs, M., van der Hell, R. H., Luttik, K., & Touw-Otten, F. W. M. M. (1993). Delphi, the issue of reliability: A qualitative Delphi study in primary health care in the Netherlands. *Technological Forecasting and Social Change, 44*(3), 315-323. doi: http://dx.doi.org/10.1016/0040-1625(93)90075-I

KC, D. S. (2014). Does Multitasking Improve Performance? Evidence from the Emergency Department. *Manufacturing & Service Operations Management, 16*(2), 168-183. doi: doi:10.1287/msom.2013.0464

Keeney, S., Hasson, F., & McKenna, H. (2006). Consulting the oracle: ten lessons from using the Delphi technique in nursing research. *Journal of Advanced Nursing, 53*(2), 205-212. doi: 10.1111/j.1365-2648.2006.03716.x

Kensinger, E. A. (2007). Negative Emotion Enhances Memory Accuracy: Behavioral and Neuroimaging Evidence. *Current Directions in Psychological Science, 16*(4), 213-218. doi: 10.2307/20183199

Khatri, N., Brown, G. D., & Hicks, L. L. (2009). From a blame culture to a just culture in health care. *Health Care Management Review, 34*(4), 312-322 310.1097/HMR.1090b1013e3181a1093b1709.

Kinsella, K., & Phillips, D. R. (2005). Global Aging: The Challenge of Success. *Population Bulletin, 60*(1), 3-40.

Klim, S., Kelly, A.M., Kerr, D., Wood, S., & McCann, T. (2013). Developing a framework for nursing handover in the emergency department: an individualised and systematic approach. *Journal of Clinical Nursing, 22*(15/16), 2233-2243. doi: 10.1111/jocn.12274

Knutsen, G., & Fredriksen, K. (2013). Usage of documented pre-hospital observations in secondary care: a questionnaire study and retrospective comparison of records. *Scandinavian Journal of Trauma, Resuscitation, and Emergency Medicine, 21*.

Kosits, L. M., & Jones, K. (2011). Interruptions Experienced by Registered Nurses Working in the Emergency Department. *Journal of Emergency Nursing, 37*(1), 3-8. doi: http://dx.doi.org/10.1016/j.jen.2009.12.024

Kuhn, G. (2001). Circadian rhythm, shift work, and emergency medicine. *Annals of Emergency Medicine, 37*(1), 88-98. doi: http://dx.doi.org/10.1067/mem.2001.111571

Laxmisan, A., Hakimzada, F., Sayan, O. R., Green, R. A., Zhang, J., & Patel, V. L. (2007). The multitasking clinician: Decision-making and cognitive demand during and after team handoffs in emergency care. *International Journal of Medical Informatics, 76*(11,Äì12), 801-811. doi: 10.1016/j.ijmedinf.2006.09.019

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, Calif.: Sage Publications.

Lindstrom, A.-M., & Losavio, K. (2005). 2005 JEMS Platinum Resource Guide. *JEMS : Journal of emergency medical services, 30*(1), 42-57.

Lingard, L., Espin, S., Whyte, S., Regehr, G., Baker, G. R., Reznick, R., . . . Grober, E. (2004). Communication failures in the operating room: an observational classification of recurrent types and effects. *Quality and Safety in Health Care, 13*(5), 330-334. doi: 10.1136/qhc.13.5.330

Linstone, H. A., & Turoff, M. (2002). *The Delphi Method: Techniques and Applications* Retrieved from http://is.njit.edu/pubs/delphibook/delphibook.pdf

Maguire, B. J., Hunting, K. L., Smith, G. S., & Levick, N. R. (2002). Occupational fatalities in emergency medical services: A hidden crisis. *Annals of Emergency Medicine, 40*(6), 625-632. doi: http://dx.doi.org/10.1067/mem.2002.128681

Maguire, B. J., O'Meara, P. F., Brightwell, R. F., & O'Neill, B. J. (2014). Occupational injury risk among Australian paramedics: an analysis of national data. *Medical Journal of Australia, 200*(8), 477-480. doi: 10.5694/mja13.10941

Manser, T., Foster, S., Gisin, S., Jaeckel, D., & Ummenhofer, W. (2010). Assessing the quality of patient handoffs at care transitions. *Quality and Safety in Health Care, 19*(6), 1-5. doi: 10.1136/qshc.2009.038430

Marshall, A. J. (1915, February 28, 1915). Tells development of ambulance service, growth of modern city vehicles from war types described. *New York Times,* p. xii. Retrieved from http://www.nytimes.com

McCoy, C. E., Chakravarthy, B., & Lotfipour, S. (2013). Guidelines for Field Triage of Injured Patients: In conjunction with the Morbidity and Mortality Weekly Report published by the Center for Disease Control and Prevention. *Western Journal of Emergency Medicine, 14*(1), 69-76. doi: 10.5811/westjem.2013.1.15981

McDowell, D. S., & McComb, S. A. (2014). Safety Checklist Briefings: A Systematic Review of the Literature. *Association of Operating Room Nurses. AORN Journal, 99*(1), 125-137.e113. doi: http://dx.doi.org/10.1016/j.aorn.2013.11.015

McMurray, A. (1994). Three Decision-making Aids: Brainstorming, Nominal Group, and Delphi Technique. *Journal of Nursing Staff Development, 10*(2), 62-65.

Meisel, Z. F., Peacock, N., & Mechem, C. C. (2010). 264: EMS to ED Handoffs: A Prospective Observational Analysis. *Annals of Emergency Medicine, 56*(3, Supplement), S87-S88. doi: 10.1016/j.annemergmed.2010.06.313

Miller, G. A. (1994). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 101*(2), 343-352. doi: 10.1037/0033-295X.101.2.343

Miller, L. E. (2006). *Determining what could/should be: The Delphi technique and its application.* Paper presented at the Mid-Western Educational Research Association, Columbus, Ohio.

Mullen, P. M. (2003). Delphi: Myths and reality. *Journal of Health Organization and Management, 17*(1), 37-52.

Murphy, M., Black, N., Lamping, D., McKee, C., Sanderson, C., Askham, J., & Marteau, T. (1998). Consensus development methods, and their use in clinical guideline development. *Health Technology Assessment, 2*(3).

Murray, S. L., Crouch, R., & Ainsworth-Smith, M. (2012). Quality of the handover of patient care: A comparison of Pre-Hospital and Emergency Department notes. *International Emergency Nursing, 20*(1), 24-27. doi: 10.1016/j.ienj.2010.09.004

Murthy, V., Malhotra, S., Bala, I., & Raghunathan, M. (1997). Detrimental Effects of Noise on Anaesthetists. 1. 41, from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=ovftc&NEWS=N&AN=00132586-199702000-00055

Nagpal, K., Vats, A., Ahmed, K., Vincent, C., & Moorthy, K. (2010). An evaluation of information transfer through the continuum of surgical care: a feasibility study. *Annals of Surgery, 252*(2), 402-407. doi: 10.1097/SLA.0b013e3181e986df

National Emergency Medical Services Advisory Council. (2009). *Standardized Certification, Licensure, and Credentialing*. National Highway Traffic Safety Administration

National Highway Traffic and Safety Administration. (2007). *National EMS Scope of Practice Model*. (DOT HS 810 657). Washington, D.C.: Retrieved from http://www.ems.gov/education/EMSScope.pdf.

National Highway Traffic and Safety Administration. (2009). *National Emergency Medical Services Education Standards*. (DOT HS 811 077A). Washington, D.C.: Retrieved from http://www.ems.gov/EducationStandards.htm.

National Highway Transportation Safety Administration. (2013). Emergency Medical Services. Retrieved March 25, 2014, from http://www.ems.gov/mission.htm

Okoli, C., & Pawlowski, S. D. (2004). The Delphi method as a research tool: an example, design considerations and applications. *Information & Management, 42*(1), 15-29. doi: http://dx.doi.org/10.1016/j.im.2003.11.002

Orellana, D., Busch-Vishniac, I. J., & West, J. E. (2007). Noise in the adult emergency department of Johns Hopkins Hospital. *The Journal of the Acoustical Society of America, 121*(4), 1996-1999. doi: doi: http://dx.doi.org/10.1121/1.2642309

Oster, A., & Bindman, A. B. (2003). Emergency Department Visits for Ambulatory Care Sensitive Conditions: Insights into Preventable Hospitalizations. *Medical Care, 41*(2), 198-207. doi: 10.2307/3767533

Owen, C., Hemmings, L., & Brown, T. (2009). Lost in translation: Maximizing handover effectiveness between paramedics and receiving staff in the emergency department. *Emergency Medicine Australasia, 21*(2), 102-107. doi: 10.1111/j.1742-6723.2009.01168.x

Panchal, A. R., Gaither, J. B., Svirsky, I., Prosser, B., Stolz, U., & Spaite, D. W. (2015). The Impact of Professionalism on Transfer of Care to the Emergency Department.

The Journal of Emergency Medicine. doi: Advance online publication. doi:10.1016/j.jemermed.2014.12.062

Parker, J., & Coiera, E. (2000). Improving Clinical Communication: A View from Psychology. *Journal of the American Medical Informatics Association, 7*(5), 453-461. doi: 10.1136/jamia.2000.0070453

Patterson, D., Moore, C. G., Brice, J. H., & Baxley, E. G. (2006). Use of ED diagnosis to determine medical necessity of EMS transports. *Prehospital Emergency Care, 10*(4), 488-493.

Patterson, E. (2008). Structuring flexibility: The potential good, bad and ugly in standardization of handovers. *Quality and Safety in Health Care, 17*, 4 - 5.

Patterson, E., Roth, E., Woods, D., Chow, R., & Gomes, J. (2004). Handoff strategies in settings with high consequences for failure: lessons for health care operations. *International Journal for Quality in Health Care, 16*(2), 125-132. doi: 10.1093/intqhc/mzh026

Patterson, E. S., & Wears, R. L. (2010). Patient Handoffs: Standardized and Reliable Measurement Tools Remain Elusive. *Joint Commission Journal on Quality and Patient Safety, 36*(2), 52-61.

Pepe, P. E., Jerger, J., Miller, R. H., & Jerger, S. (1985). Accelerated hearing loss in urban emergency medical services firefighters. *Annals of Emergency Medicine, 14*(5), 438-442. doi: http://dx.doi.org/10.1016/S0196-0644(85)80288-2

Pickering, S. P., Robertson, E. R., Griffin, D., Hadi, M., Morgan, L. J., Catchpole, K. C., . . . McCulloch, P. (2013). Compliance and use of the World Health Organization

checklist in UK operating theatres. *British Journal of Surgery, 100*(12), 1664-1670. doi: 10.1002/bjs.9305

Pitts, S., Niska, R., Xu, J., & Burt, C. (2008). *National Health Statistics Reports*. Centers for Disease Control and Prevention, Retrieved from http://www.cdc.gov/nchs/data/nhsr/nhsr007.pdf.

Powell, C. (2003). The Delphi technique: myths and realities. *Journal of Advanced Nursing, 41*(4), 376-382. doi: 10.1046/j.1365-2648.2003.02537.x

Prakash, V., Koczmara, C., Savage, P., Trip, K., Stewart, J., McCurdie, T., . . . Trbovich, P. (2014). Mitigating errors caused by interruptions during medication verification and administration: interventions in a simulated ambulatory chemotherapy setting. *British Medical Journal Quality and Safety, 23*(11). doi: 10.1136/bmjqs-2013-002484

Price, R., Bendall, J. C., Patterson, J. A., & Middleton, P. M. (2013). What causes adverse events in prehospital care? A human-factors approach. *Emergency Medicine Journal, 30*(7), 583-588. doi: 10.1136/emermed-2011-200971

Pronovost, P., Needham, D., Berenholtz, S., Sinopoli, D., Chu, H., Cosgrove, S., . . . Goeschel, C. (2006). An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU. *The New England Journal of Medicine, 355*(26), 2725-2732.

Richards, M. E., Hubble, M. W., & Crandall, C. (2006). Influence of ambulance arrival on emergency department time to be seen. *Prehospital Emergency Care, 10*(4), 440-446.

Riesenberg, L. A., Leitzsch, J., & Little, B. W. (2009). Systematic Review of Handoff Mnemonics Literature. *American Journal of Medical Quality, 24*(3), 196-204. doi: 10.1177/1062860609332512

Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting, 15*(4), 353-375. doi: http://dx.doi.org/10.1016/S0169-2070(99)00018-7

Sackman, H. (1974). *Delphi assessment : expert opinion, forecasting, and group process*. Santa Monica, Calif.: Rand.

Sanddal, T. L., Sanddal, N. D., Ward, N., & Stanley, L. (2010). Ambulance Crash Characteristics in the US Defined by the Popular Press: A Retrospective Analysis. *Emergency Medicine International, 2010*. doi: 10.1155/2010/525979

Sarcevic, A., & Burd, R. S. (2009). *Information handover in time-critical work*. Paper presented at the Proceedings of the ACM 2009 international conference on Supporting group work, Sanibel Island, Florida, USA.

Scalise, D. (2006). Clinical Communication and Patient Safety. *Hospitals & Health Networks, 80*(8), 50-54, 52.

Scott, L. A., Brice, J. H., Baker, C. C., & Shen, P. (2003). An analysis of paramedic verbal reports to physicians in the emergency department trauma room. *Prehospital Emergency Care, 7*(2), 247-251.

Slattery, D. E., & Silver, A. (2009). The hazards of providing care in emergency vehicles: an opportunity for reform. *Prehospital Emergency Care, 13*(3), 388-397. doi: 10.1080/10903120802706104

Sohn, Y. W., & Doane, S. M. (2003). Roles of working memory capacity and long-term working memory skill in complex task performance. *Memory & Cognition, 31*(3), 458-466. doi: 10.3758/BF03194403

Solet, D., Norvell, J., Rutan, G., & Frankel, R. (2005). Lost in translation: Challenges and opportunities in physician-to-physician communication during patient handoffs. *Academic Medicine, 80*(12), 1094 - 1099.

Squire, B. T., Tamayo, A., & Tamayo-Sarver, J. H. (2010). At-Risk Populations and the Critically Ill Rely Disproportionately on Ambulance Transport to Emergency Departments. *Annals of Emergency Medicine, 56*(4), 341-347. doi: http://dx.doi.org/10.1016/j.annemergmed.2010.04.014

Stiell, A., Forster, A. J., Stiell, I. G., & van Walraven, C. (2003). Prevalence of information gaps in the emergency department and the effect on patient outcomes. *Canadian Medical Association Journal, 169*(10), 1023-1028.

Sujan, M. A., Chessum, P., Rudd, M., Fitton, L., Inada-Kim, M., Spurgeon, P., & Cooke, M. W. (2013). Emergency Care Handover (ECHO study) across care boundaries: the need for joint decision making and consideration of psychosocial history. *Emergency Medicine Journal*. doi: 10.1136/emermed-2013-202977

Sundar, E., Sundar, S., Pawlowski, J., Blum, R., Feinstein, D., & Pratt, S. (2007). Crew Resource Management and Team Training. *Anesthesiology Clinics, 25*(2), 283-300. doi: http://dx.doi.org/10.1016/j.anclin.2007.03.011

Suserud, B.O., Jonsson, A., Johansson, A., & Petzall, K. (2013). Caring for patients at high speed. *Emergency Nurse, 21*(7), 14-18. doi: 10.7748/en2013.11.21.7.14.e1213

Sutcliffe, K., Lewton, E., & Rosenthal, M. (2004). Communication failures: An insidious contributor to medical mishaps. *Academic Medicine, 79*(2), 186 - 194.

Talbot, R., & Bleetman, A. (2007). Retention of information by emergency department staff at ambulance handover: do standardised approaches work? *Emergency Medicine Journal, 24*(8), 539-542. doi: 10.1136/emj.2006.045906

Thakore, S., & Morrison, W. (2001). A survey of the perceived quality of patient handover by ambulance staff in the resuscitation room. *Emergency Medicine Journal, 18*(4), 293-296. doi: 10.1136/emj.18.4.293

Thompson, J. E., Collett, L. W., Langbart, M. J., Purcell, N. J., Boyd, S. M., Yuminaga, Y., . . . McCormack, A. (2011). Using the ISBAR handover tool in junior medical officer handover: a study in an Australian tertiary hospital. *Postgraduate Medical Journal, 87*(1027), 340-344. doi: 10.1136/pgmj.2010.105569

Tintinalli, J. E. (2010). *EMS : a practical global guidebook*: Shelton, CT. People's Medical Publishing House 2010.

Tredinnick-Moir, J. (2013). *Analysis of nurses' and paramedics' experiences with patient transfers: Antecedents, processes and outcomes.* (3559648 D.H.A.), Central Michigan University, Ann Arbor. Retrieved from http://proxy.lib.duke.edu/login?url=http://search.proquest.com/advanced?url=http://search.proquest.com/docview/1354428154?accountid=10598.

Turoff, M., & Hiltz, S. R. (1996). Computer Based Delphi Processes. http://web.njit.edu/~turoff/Papers/delphi3.html

Urbach, D. R., Govindarajan, A., Saskin, R., Wilton, A. S., & Baxter, N. N. (2014). Introduction of Surgical Safety Checklists in Ontario, Canada. *New England Journal of Medicine, 370*(11), 1029-1038. doi: doi:10.1056/NEJMsa1308261

van Klei, W. A., Hoff, R. G., van Aarnhem, E. E. H. L., Simmermacher, R. K. J., Regli, L. P. E., Kappen, T. H., . . . Peelen, L. M. (2012). Effects of the Introduction of the WHO "Surgical Safety Checklist" on In-Hospital Mortality: A Cohort Study. *Annals of Surgery, 255*(1), 44-49 10.1097/SLA.1090b1013e31823779ae.

Vincent, C. A., & Wears, R. L. (2002). Communication in the emergency department: separating the signal from the noise. *Medical Journal of Australia, 176*(9), 409-4110.

Waldron, R., & Sixsmith, D. M. (2014). Emergency physician awareness of prehospital procedures and medications. *Western Journal of Emergency Medicine, 15*(4), 504-510. doi: 10.5811/westjem.2014.2.18651

Weaver, M. D., Moore, C. G., Patterson, P. D., & Yealy, D. M. (2012). Medical Necessity in Emergency Medical Services Transports. *American Journal of Medical Quality, 27*(3), 250-255. doi: 10.1177/1062860611424331

Welch, S. J., Cheung, D. S., Apker, J., & Patterson, E. S. (2013). Strategies for Improving Communication in the Emergency Department: Mediums and Messages in a Noisy Environment. *Joint Commission Journal on Quality and Patient Safety, 39*(6), 279-286.

Welsh, C. A., Flanagan, M. E., & Ebright, P. (2010). Barriers and facilitators to nursing handoffs: Recommendations for redesign. *Nursing Outlook, 58*(3), 148-154. doi: 10.1016/j.outlook.2009.10.005

Wheatley, M. J. (2006). *Leadership and the new science : discovering order in a chaotic world*. San Francisco, CA: Berrett-Koehler.

Winters, B. D., Gurses, A. P., Lehmann, H., Sexton, J. B., Rampersad, C. J., & Pronovost, P. J. (2009). Clinical review: checklists - translating evidence into practice. *Critical Care, 13*(6), 210. doi: 10.1186/cc7792

Woods, J. A. P. B., Jackson, D. J. P., Ziglar, S., & Alston, G. L. P. (2011). Interprofessional communication. *Drug Topics, 155*(8), 42-53.

World Health Organization. (2008). Safe Surgery Saves Lives. Geneva.

Ye, K., McD Taylor, D., Knott, J. C., Dent, A., & MacBean, C. E. (2007). Handover in the emergency department: Deficiencies and adverse effects. *Emergency Medicine Australasia, 19*(5), 433-441. doi: 10.1111/j.1742-6723.2007.00984.x

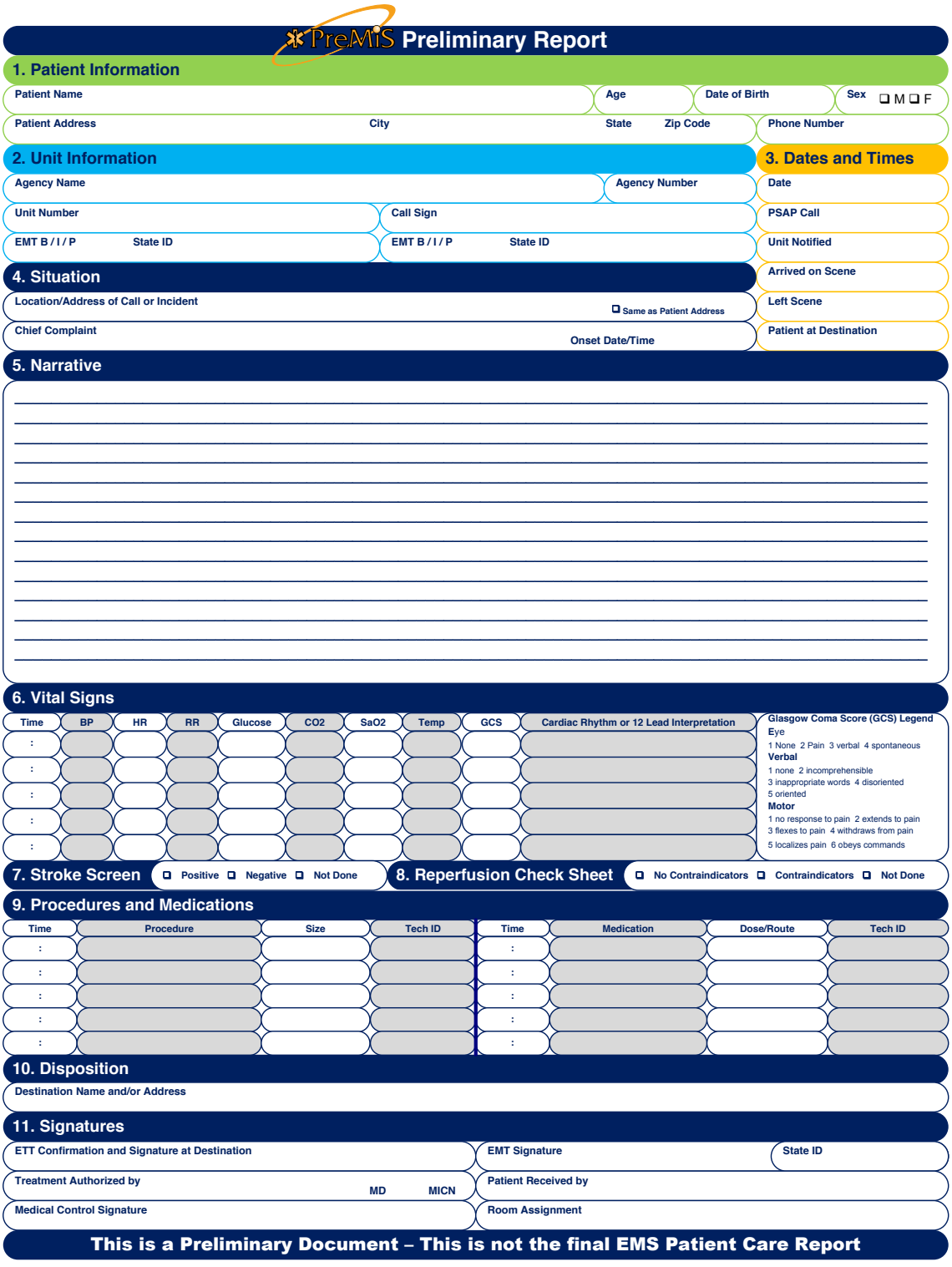
Yong, G., Dent, A. W., & Weiland, T. J. (2008). Handover from paramedics: observations and emergency department clinician perceptions. *Emergency Medicine Australasia, 20*(2), 149-155. doi: 10.1111/j.1742-6723.2007.01035.x

Zhang, Z., Sarcevic, A., & Burd, R. S. (2013). Supporting information use and retention of pre-hospital information during trauma resuscitation: a qualitative study of pre-hospital communications and information needs. *American Medical Informatics Association Annual Symposium Proceedings 2013*, 1579-1588.

Zimmer, M., Wassmer, R., Latasch, L., Oberndorfer, D., Wilken, V., Ackermann, H., & Breitkreutz, R. (2010). Initiation of risk management: Incidence of failures in simulated emergency medical service scenarios. *Resuscitation, 81*(7), 882-886. doi: http://dx.doi.org/10.1016/j.resuscitation.2010.03.009

Appendices

Appendix A - North Carolina Performance Improvement Center Handover Template



PreMIS Preliminary Report

1. Patient Information

Patient Name | Age | Date of Birth | Sex ❑ M ❑ F

Patient Address | City | State | Zip Code | Phone Number

2. Unit Information

Agency Name | Agency Number

Unit Number | Call Sign

EMT B / I / P | State ID | EMT B / I / P | State ID

3. Dates and Times

Date

PSAP Call

Unit Notified

Arrived on Scene

Left Scene

Patient at Destination

4. Situation

Location/Address of Call or Incident ❑ Same as Patient Address

Chief Complaint | Onset Date/Time

5. Narrative

6. Vital Signs

Time	BP	HR	RR	Glucose	CO2	SaO2	Temp	GCS	Cardiac Rhythm or 12 Lead Interpretation
:									
:									
:									
:									
:									

Glasgow Coma Score (GCS) Legend
Eye
1 None 2 Pain 3 verbal 4 spontaneous
Verbal
1 none 2 incomprehensible
3 inappropriate words 4 disoriented
5 oriented
Motor
1 no response to pain 2 extends to pain
3 flexes to pain 4 withdraws from pain
5 localizes pain 6 obeys commands

7. Stroke Screen ❑ Positive ❑ Negative ❑ Not Done

8. Reperfusion Check Sheet ❑ No Contraindicators ❑ Contraindicators ❑ Not Done

9. Procedures and Medications

Time	Procedure	Size	Tech ID	Time	Medication	Dose/Route	Tech ID
:				:			
:				:			
:				:			
:				:			
:				:			

10. Disposition

Destination Name and/or Address

11. Signatures

ETT Confirmation and Signature at Destination | EMT Signature | State ID

Treatment Authorized by | MD | MICN | Patient Received by

Medical Control Signature | Room Assignment

This is a Preliminary Document – This is not the final EMS Patient Care Report

Appendix B - Institutional Review Board Exemption

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal **Pro00033356** entitled:
Emergency Medical Services to Emergency Department Patient Handover Content:
A Delphi Study of Interprofessional Expectations

Submitted by: **Candance Van Vleet**
Department: **Medical University of South Carolina**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved. In accordance with 45 CFR 46.101(b)(2), the referenced study is exempt from Human Research Subject Regulations. No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, you must inform this office of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Research related records should be retained for a minimum of three years after termination of the study.

Approval Date: **5/15/2014**

Type: **Exempt**

Administrator, **IRB - Medical University of South Carolina**
Katherine Bright∗

∗***Electronic Signature****: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

Appendix C - Delphi Round I Survey

EMS to ED Handover Survey Round 1

Thank you for agreeing to serve on the panel of experts investigating the information necessary for an effective EMS to ED patient handover. I hope that you will find participation to be interesting and enjoyable. Your expertise and opinion are valuable to this study.This modified Delphi study will consist of two rounds using questionnaires for both rounds. Please read the directions carefully before answering the questions. Instructions: Review each brief patient scenario and then rate the importance of each element's inclusion in the VERBAL EMS handover report. You will select one rating for each component. At the end of the survey there is a text box where you can enter additional information you believe is necessary for safe EMS to ED handover. Thank you for your participation!Candi Van Vleet candi.vanvleet@duke.edu

1) CONSENT You are invited to participate in this modified Delphi research study because of your expertise in emergency care, specifically related to Emergency Medical Services (EMS) to Emergency Department (ED) patient handover. This study forms part of my dissertation research toward a Doctor of Health Administration degree from Medical University of South Carolina (MUSC). Please read this consent form carefully and take your time making your decision. What is the study about? The purpose of this study is to determine interprofessional expectations of EMS to ED patient handover content. Through the use of the Delphi method, expert opinion will be collected and consensus obtained through a series of feedback rounds. At the conclusion of the study the experts will have defined a descriptive set of EMS handover content expectations. What is a Delphi study? The Delphi method is a research technique where by a consensus of expert opinion addresses a complex issue unquantifiable by traditional methods. The method includes the use of an iterative series of questionnaires to structure group interactions and information acquisition. Final round response distillation results in subject matter experts generating well-found opinions on EMS to ED handover. What does participation in the study involve? You are being asked to participate as a voluntary Delphi panel member. Member participation requires access to a computer with Internet access. All communication/participation is an asynchronous process and participants will be able to work at their convenience. Individual participation in each successive round consists of accessing an online survey, reading five fictional prehospital case scenarios, and selecting the relative importance of each given element to safe patient handover. Participants will have one week to participate in the each survey round. The study should be completed upon the completion of two rounds. The amount of time for completion of each round will vary with each participant, but should range from 15 to 20 minutes for round one, 10 to 15 minutes for round two. In future rounds you will be given the prehospital scenarios again and asked to determine the importance of each element presented. This process will continue until two Delphi rounds have been completed. I appreciate the great demand this places on your time and hope you will find participation interesting. The results of your work will be important to prehospital emergency care. Are there risks to participation in the study? No, there is no expectation of harm or distress by participating. If any part of the study becomes uncomfortable, you may stop your participation at any time, without consequences. Are there benefits to participation? There are no direct benefits to you from participation in this study. However, your participation may benefit you indirectly by contributing to an improvement in EMS to ED patient handover. Does it cost anything to participate or will I receive payment? There is no cost to participate in this study and there will be no payment for participation. A computer and Internet connection are required. How will my confidentiality be protected? Your contact information and responses will remain confidential. The study will take place via the web-based survey software application REDCap and is capable of secure data acquisition and storage. The database will meet Medical University of South Carolina requirements for data security and confidentiality, including use of anti-virus software and protection against unauthorized access. The surveys, research notes, and transcripts will be destroyed within 5 years of the date the study is completed. If you have any further questions, feel free to contact me at candi.vanvleet@duke.edu or 919-695-5958. You may also contact my faculty advisor, Michael Meacham at meachamm@musc.edu or (843) 792-5402. What if I know someone else who would like to participate? If you have colleagues interested in learning more or participating in this research, please forward this link to them or have them contact this researcher directly at candi.vanvleet@duke.edu. You are under no obligation to share this information and whether or not you share this information will not affect your ability to participate in the study. What do I do now? Thank you for reading this information sheet and for considering taking part in this research. If you are happy to proceed, please indicate you have given consent and complete the following survey.

◯ Yes
◯ No

2) What is your profession? (Mark all that apply)

☐ Emergency Medicine Physician
☐ Registered Nurse
☐ Paramedic

Patient A has sustained a gun shot wound to the head. The patient is unresponsive and hypotensive.

Patient Demographics

		Essential	Important	Somewhat Important	Not Important
3)	Patient's name	○	○	○	○
4)	Age	○	○	○	○
5)	Date of birth	○	○	○	○
6)	Gender	○	○	○	○
7)	Location of belongings	○	○	○	○
8)	Insurance Information	○	○	○	○
9)	Weight	○	○	○	○
10)	Primary Care Physician	○	○	○	○

Environment of Care

		Essential	Important	Somewhat Important	Not Important
11)	EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
12)	Geographic location of incident (i.e. street address, intersection name, etc.)	○	○	○	○
13)	Details of incident/accident	○	○	○	○
14)	Decontamination required	○	○	○	○
15)	Photographs of scene	○	○	○	○
16)	Number of total patients from incident	○	○	○	○
17)	Total transport time	○	○	○	○

Clinical Assessment

		Essential	Important	Somewhat Important	Not Important
18)	Chief complaint	○	○	○	○
19)	History of present illness	○	○	○	○
20)	Associated symptoms	○	○	○	○
21)	Current medications	○	○	○	○
22)	Allergies	○	○	○	○
23)	Past medical history	○	○	○	○
24)	Pertinent system findings	○	○	○	○
25)	Time of injury/illness	○	○	○	○
26)	Mechanism of injury	○	○	○	○
27)	Acute or chronic nature of illness	○	○	○	○
28)	Site of physical injuries	○	○	○	○
29)	Baseline vital signs	○	○	○	○
30)	Last set of vital signs	○	○	○	○
31)	Mental status & associated changes	○	○	○	○
32)	Glascow Coma Score	○	○	○	○
33)	Airway patency	○	○	○	○
34)	Pupil exam	○	○	○	○
35)	chest abnormalities	○	○	○	○
36)	Abdominal/pelvic abnormalities	○	○	○	○
37)	Last oral intake	○	○	○	○
38)	Combativeness	○	○	○	○
39)	Skin exam	○	○	○	○
40)	Pain assessment	○	○	○	○
41)	Suspected type of shock	○	○	○	○
42)	Psychiatric history	○	○	○	○
43)	Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
44) Airway intervention	○	○	○	○
45) Oxygen saturation	○	○	○	○
46) 12 lead EKG findings	○	○	○	○
47) CPR performed	○	○	○	○
48) Duration of CPR	○	○	○	○
49) Defibrillation attempts	○	○	○	○
50) Vascular access (gauge & location)	○	○	○	○
51) Volume & Type of IV fluid infused	○	○	○	○
52) Tourniquet placed (time & location)	○	○	○	○
53) Patient initiated treatment prior to EMS arrival	○	○	○	○
54) Time placed on long spine board	○	○	○	○
55) Medications& dosages given	○	○	○	○
56) Glucose level	○	○	○	○
57) EMS notification of other physicians (i.e. cardiologist for cath lab notification)	○	○	○	○
58) Patient response to treatments	○	○	○	○

Additional elements

	Essential	Important	Somewhat Important	Not Important
59) Nature of & person who called 911 dispatch	○	○	○	○
60) Patient reported drug use	○	○	○	○
61) EMS suspicions of drug use	○	○	○	○
62) EMS suspicions of narcotic seeking behavior	○	○	○	○
63) EMS suspicions of self harm/suicide attempt	○	○	○	○
64) EMS suspicions of abuse	○	○	○	○
65) Police involvement during patient encounter	○	○	○	○
66) Presence of news media on scene or enroute to ED	○	○	○	○
67) Family dynamics, presence	○	○	○	○
68) Physical location of outside medical records	○	○	○	○
69) Physical location of EMS documentation/EKG strips	○	○	○	○

Patient B presents with a severe headache. The patient is awake, alert, & oriented. In addition the patient is hypertensive.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
70) Patient's name	○	○	○	○
71) Age	○	○	○	○
72) Date of birth	○	○	○	○
73) Gender	○	○	○	○
74) Location of belongings	○	○	○	○
75) Insurance Information	○	○	○	○
76) Weight	○	○	○	○
77) Primary Care Physician	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
78) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
79) Geographic location of incident (i.e. street address, intersection name, etc.)	○	○	○	○
80) Details of incident/accident	○	○	○	○
81) Decontamination required	○	○	○	○
82) Photographs of scene	○	○	○	○
83) Number of total patients from incident	○	○	○	○
84) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
85) Chief complaint	○	○	○	○
86) History of present illness	○	○	○	○
87) Associated symptoms	○	○	○	○
88) Current medications	○	○	○	○
89) Allergies	○	○	○	○
90) Past medical history	○	○	○	○
91) Pertinent system findings	○	○	○	○
92) Time of injury/illness	○	○	○	○
93) Mechanism of injury	○	○	○	○
94) Acute or chronic nature of illness	○	○	○	○
95) Site of physical injuries	○	○	○	○
96) Baseline vital signs	○	○	○	○
97) Last set of vital signs	○	○	○	○
98) Mental status & associated changes	○	○	○	○
99) Glascow Coma Score	○	○	○	○
100) Airway patency	○	○	○	○
101) Pupil exam	○	○	○	○
102) chest abnormalities	○	○	○	○
103) Abdominal/pelvic abnormalities	○	○	○	○
104) Last oral intake	○	○	○	○
105) Combativeness	○	○	○	○
106) Skin exam	○	○	○	○
107) Pain assessment	○	○	○	○
108) Suspected type of shock	○	○	○	○
109) Psychiatric history	○	○	○	○
110) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
111) Airway intervention	○	○	○	○
112) Oxygen saturation	○	○	○	○
113) 12 lead EKG findings	○	○	○	○
114) CPR performed	○	○	○	○
115) Duration of CPR	○	○	○	○
116) Defibrillation attempts	○	○	○	○
117) Vascular access (gauge & location)	○	○	○	○
118) Volume & Type of IV fluid infused	○	○	○	○
119) Tourniquet placed (time & location)	○	○	○	○
120) Patient initiated treatment prior to EMS arrival	○	○	○	○
121) Time placed on long spine board	○	○	○	○
122) Medications& dosages given	○	○	○	○
123) Glucose level	○	○	○	○
124) EMS notification of other physicians (i.e. cardiologist for cath lab notification)	○	○	○	○
125) Patient response to treatments	○	○	○	○

Additional elements

	Essential	Important	Somewhat Important	Not Important
126) Nature of & person who called 911 dispatch	○	○	○	○
127) Patient reported drug use	○	○	○	○
128) EMS suspicions of drug use	○	○	○	○
129) EMS suspicions of narcotic seeking behavior	○	○	○	○
130) EMS suspicions of self harm/suicide attempt	○	○	○	○
131) EMS suspicions of abuse	○	○	○	○
132) Police involvement during patient encounter	○	○	○	○
133) Presence of news media on scene or enroute to ED	○	○	○	○
134) Family dynamics, presence	○	○	○	○
135) Physical location of outside medical records	○	○	○	○
136) Physical location of EMS documentation/EKG strips	○	○	○	○

Patient C presents with foot pain after kicking a tree. The patient is awake, alert, & oriented.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
137) Patient's name	○	○	○	○
138) Age	○	○	○	○
139) Date of birth	○	○	○	○
140) Gender	○	○	○	○
141) Location of belongings	○	○	○	○
142) Insurance Information	○	○	○	○
143) Weight	○	○	○	○
144) Primary Care Physician	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
145) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
146) Geographic location of incident (i.e. street address, intersection name, etc.)	○	○	○	○
147) Details of incident/accident	○	○	○	○
148) Decontamination required	○	○	○	○
149) Photographs of scene	○	○	○	○
150) Number of total patients from incident	○	○	○	○
151) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
152) Chief complaint	○	○	○	○
153) History of present illness	○	○	○	○
154) Associated symptoms	○	○	○	○
155) Current medications	○	○	○	○
156) Allergies	○	○	○	○
157) Past medical history	○	○	○	○
158) Pertinent system findings	○	○	○	○
159) Time of injury/illness	○	○	○	○
160) Mechanism of injury	○	○	○	○
161) Acute or chronic nature of illness	○	○	○	○
162) Site of physical injuries	○	○	○	○
163) Baseline vital signs	○	○	○	○
164) Last set of vital signs	○	○	○	○
165) Mental status & associated changes	○	○	○	○
166) Glascow Coma Score	○	○	○	○
167) Airway patency	○	○	○	○
168) Pupil exam	○	○	○	○
169) chest abnormalities	○	○	○	○
170) Abdominal/pelvic abnormalities	○	○	○	○
171) Last oral intake	○	○	○	○
172) Combativeness	○	○	○	○
173) Skin exam	○	○	○	○
174) Pain assessment	○	○	○	○
175) Suspected type of shock	○	○	○	○
176) Psychiatric history	○	○	○	○
177) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
178) Airway intervention	○	○	○	○
179) Oxygen saturation	○	○	○	○
180) 12 lead EKG findings	○	○	○	○
181) CPR performed	○	○	○	○
182) Duration of CPR	○	○	○	○
183) Defibrillation attempts	○	○	○	○
184) Vascular access (gauge & location)	○	○	○	○
185) Volume & Type of IV fluid infused	○	○	○	○
186) Tourniquet placed (time & location)	○	○	○	○
187) Patient initiated treatment prior to EMS arrival	○	○	○	○
188) Time placed on long spine board	○	○	○	○
189) Medications& dosages given	○	○	○	○
190) Glucose level	○	○	○	○
191) EMS notification of other physicians (i.e. cardiologist for cath lab notification)	○	○	○	○
192) Patient response to treatments	○	○	○	○

Additional elements

	Essential	Important	Somewhat Important	Not Important
193) Nature of & person who called 911 dispatch	○	○	○	○
194) Patient reported drug use	○	○	○	○
195) EMS suspicions of drug use	○	○	○	○
196) EMS suspicions of narcotic seeking behavior	○	○	○	○
197) EMS suspicions of self harm/suicide attempt	○	○	○	○
198) EMS suspicions of abuse	○	○	○	○
199) Police involvement during patient encounter	○	○	○	○
200) Presence of news media on scene or enroute to ED	○	○	○	○
201) Family dynamics, presence	○	○	○	○
202) Physical location of outside medical records	○	○	○	○
203) Physical location of EMS documentation/EKG strips	○	○	○	○

Patient D was involved in a minor motor vehicle collision. The patient is lethargic and unable to answer questions appropriately.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
204) Patient's name	○	○	○	○
205) Age	○	○	○	○
206) Date of birth	○	○	○	○
207) Gender	○	○	○	○
208) Location of belongings	○	○	○	○
209) Insurance Information	○	○	○	○
210) Weight	○	○	○	○
211) Primary Care Physician	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
212) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
213) Geographic location of incident (i.e. street address, intersection name, etc.)	○	○	○	○
214) Details of incident/accident	○	○	○	○
215) Decontamination required	○	○	○	○
216) Photographs of scene	○	○	○	○
217) Number of total patients from incident	○	○	○	○
218) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
219) Chief complaint	○	○	○	○
220) History of present illness	○	○	○	○
221) Associated symptoms	○	○	○	○
222) Current medications	○	○	○	○
223) Allergies	○	○	○	○
224) Past medical history	○	○	○	○
225) Pertinent system findings	○	○	○	○
226) Time of injury/illness	○	○	○	○
227) Mechanism of injury	○	○	○	○
228) Acute or chronic nature of illness	○	○	○	○
229) Site of physical injuries	○	○	○	○
230) Baseline vital signs	○	○	○	○
231) Last set of vital signs	○	○	○	○
232) Mental status & associated changes	○	○	○	○
233) Glascow Coma Score	○	○	○	○
234) Airway patency	○	○	○	○
235) Pupil exam	○	○	○	○
236) chest abnormalities	○	○	○	○
237) Abdominal/pelvic abnormalities	○	○	○	○
238) Last oral intake	○	○	○	○
239) Combativeness	○	○	○	○
240) Skin exam	○	○	○	○
241) Pain assessment	○	○	○	○
242) Suspected type of shock	○	○	○	○
243) Psychiatric history	○	○	○	○
244) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
245) Airway intervention	○	○	○	○
246) Oxygen saturation	○	○	○	○
247) 12 lead EKG findings	○	○	○	○
248) CPR performed	○	○	○	○
249) Duration of CPR	○	○	○	○
250) Defibrillation attempts	○	○	○	○
251) Vascular access (gauge & location)	○	○	○	○
252) Volume & Type of IV fluid infused	○	○	○	○
253) Tourniquet placed (time & location)	○	○	○	○
254) Patient initiated treatment prior to EMS arrival	○	○	○	○
255) Time placed on long spine board	○	○	○	○
256) Medications& dosages given	○	○	○	○
257) Glucose level	○	○	○	○
258) EMS notification of other physicians (i.e. cardiologist for cath lab notification)	○	○	○	○
259) Patient response to treatments	○	○	○	○

Additional elements

	Essential	Important	Somewhat Important	Not Important
260) Nature of & person who called 911 dispatch	○	○	○	○
261) Patient reported drug use	○	○	○	○
262) EMS suspicions of drug use	○	○	○	○
263) EMS suspicions of narcotic seeking behavior	○	○	○	○
264) EMS suspicions of self harm/suicide attempt	○	○	○	○
265) EMS suspicions of abuse	○	○	○	○
266) Police involvement during patient encounter	○	○	○	○
267) Presence of news media on scene or enroute to ED	○	○	○	○
268) Family dynamics, presence	○	○	○	○
269) Physical location of outside medical records	○	○	○	○
270) Physical location of EMS documentation/EKG strips	○	○	○	○

Patient E presents with a puncture wound to the right hand. The patient is awake, alert, & oriented.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
271) Patient's name	○	○	○	○
272) Age	○	○	○	○
273) Date of birth	○	○	○	○
274) Gender	○	○	○	○
275) Location of belongings	○	○	○	○
276) Insurance Information	○	○	○	○
277) Weight	○	○	○	○
278) Primary Care Physician	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
279) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
280) Geographic location of incident (i.e. street address, intersection name, etc.)	○	○	○	○
281) Details of incident/accident	○	○	○	○
282) Decontamination required	○	○	○	○
283) Photographs of scene	○	○	○	○
284) Number of total patients from incident	○	○	○	○
285) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
286) Chief complaint	○	○	○	○
287) History of present illness	○	○	○	○
288) Associated symptoms	○	○	○	○
289) Current medications	○	○	○	○
290) Allergies	○	○	○	○
291) Past medical history	○	○	○	○
292) Pertinent system findings	○	○	○	○
293) Time of injury/illness	○	○	○	○
294) Mechanism of injury	○	○	○	○
295) Acute or chronic nature of illness	○	○	○	○
296) Site of physical injuries	○	○	○	○
297) Baseline vital signs	○	○	○	○
298) Last set of vital signs	○	○	○	○
299) Mental status & associated changes	○	○	○	○
300) Glascow Coma Score	○	○	○	○
301) Airway patency	○	○	○	○
302) Pupil exam	○	○	○	○
303) chest abnormalities	○	○	○	○
304) Abdominal/pelvic abnormalities	○	○	○	○
305) Last oral intake	○	○	○	○
306) Combativeness	○	○	○	○
307) Skin exam	○	○	○	○
308) Pain assessment	○	○	○	○
309) Suspected type of shock	○	○	○	○
310) Psychiatric history	○	○	○	○
311) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
312) Airway intervention	○	○	○	○
313) Oxygen saturation	○	○	○	○
314) 12 lead EKG findings	○	○	○	○
315) CPR performed	○	○	○	○
316) Duration of CPR	○	○	○	○
317) Defibrillation attempts	○	○	○	○
318) Vascular access (gauge & location)	○	○	○	○
319) Volume & Type of IV fluid infused	○	○	○	○
320) Tourniquet placed (time & location)	○	○	○	○
321) Patient initiated treatment prior to EMS arrival	○	○	○	○
322) Time placed on long spine board	○	○	○	○
323) Medications& dosages given	○	○	○	○
324) Glucose level	○	○	○	○
325) EMS notification of other physicians (i.e. cardiologist for cath lab notification)	○	○	○	○
326) Patient response to treatments	○	○	○	○

Additional elements

	Essential	Important	Somewhat Important	Not Important
327) Nature of & person who called 911 dispatch	○	○	○	○
328) Patient reported drug use	○	○	○	○
329) EMS suspicions of drug use	○	○	○	○
330) EMS suspicions of narcotic seeking behavior	○	○	○	○
331) EMS suspicions of self harm/suicide attempt	○	○	○	○
332) EMS suspicions of abuse	○	○	○	○
333) Police involvement during patient encounter	○	○	○	○
334) Presence of news media on scene or enroute to ED	○	○	○	○
335) Family dynamics, presence	○	○	○	○
336) Physical location of outside medical records	○	○	○	○
337) Physical location of EMS documentation/EKG strips	○	○	○	○

338) (Please list any additional information you believe to be ir

Appendix D - Delphi Round II Survey

Ems To Ed Handover Elements Delphi ROUND TWO

Thank you for agreeing to serve on the panel of experts investigating the information necessary for an effective EMS to ED patient handover. I hope that you will find participation to be interesting and enjoyable. Your expertise and opinion are valuable to this study.This modified Delphi study will consist of two rounds using questionnaires for both rounds. Please read the directions carefully before answering the questions. Instructions: Review each brief patient scenario and then rate the importance of each element's inclusion in the VERBAL EMS handover report. You will select one rating for each component. At the end of the survey there is a text box where you can enter additional information you believe is necessary for safe EMS to ED handover. Thank you for your participation!Candi Van Vleet candi.vanvleet@duke.edu

1) What is your profession? (Mark all that apply)
- ☐ Emergency Medicine Physician
- ☐ Registered Nurse
- ☐ Paramedic

2) Please enter your years of experience in your current profession. _____

Patient A presents with foot pain after kicking a tree. The patient is awake, alert, & oriented.

Patient Demographics

		Essential	Important	Somewhat Important	Not Important
3)	Patient's name	○	○	○	○
4)	Age	○	○	○	○
5)	Gender	○	○	○	○

Environment of Care

		Essential	Important	Somewhat Important	Not Important
6)	EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
7)	Details of incident/accident	○	○	○	○
8)	Decontamination required	○	○	○	○
9)	Number of total patients from incident	○	○	○	○
10)	Total transport time	○	○	○	○

Clinical Assessment

		Essential	Important	Somewhat Important	Not Important
11)	Chief complaint	○	○	○	○
12)	History of present illness	○	○	○	○
13)	Associated symptoms	○	○	○	○
14)					

	Current medications	○	○	○	○
15)	Allergies	○	○	○	○
16)	Past medical history	○	○	○	○
17)	Pertinent system findings	○	○	○	○
18)	Time of injury/illness	○	○	○	○
19)	Mechanism of injury	○	○	○	○
20)	Acute or chronic nature of illness	○	○	○	○
21)	Site of physical injuries	○	○	○	○
22)	Baseline vital signs	○	○	○	○
23)	Last set of vital signs	○	○	○	○
24)	Mental status & associated changes	○	○	○	○
25)	Glascow Coma Score	○	○	○	○
26)	Airway patency	○	○	○	○
27)	Pupil exam	○	○	○	○
28)	chest abnormalities	○	○	○	○
29)	Abdominal/pelvic abnormalities	○	○	○	○
30)	Combativeness	○	○	○	○
31)	Skin exam	○	○	○	○
32)	Pain assessment	○	○	○	○
33)	Suspected type of shock	○	○	○	○
34)	Suspected fractures	○	○	○	○

EMS Interventions

		Essential	Important	Somewhat Important	Not Important
35)	Airway intervention	○	○	○	○
36)	Oxygen saturation	○	○	○	○
37)	12 lead EKG findings	○	○	○	○
38)	CPR performed	○	○	○	○
39)	Duration of CPR	○	○	○	○
40)	Defibrillation attempts	○	○	○	○
41)	Vascular access (gauge & location)	○	○	○	○
42)	Volume & Type of IV fluid infused	○	○	○	○
43)	Tourniquet placed (time & location)	○	○	○	○
44)	Patient initiated treatment prior to EMS arrival	○	○	○	○
45)	Medications& dosages given	○	○	○	○
46)	Glucose level	○	○	○	○
47)	Patient response to treatments	○	○	○	○

	Essential	Important	Somewhat Important	Not Important
48) Patient reported drug use	○	○	○	○
49) EMS suspicions of self harm/suicide attempt	○	○	○	○
50) EMS suspicions of abuse	○	○	○	○
51) Police involvement during patient encounter	○	○	○	○
52) Physical location of EMS documentation/EKG strips	○	○	○	○
53) Patient known to EMS	○	○	○	○

Patient B has sustained a gun shot wound to the head. The patient is unresponsive and hypotensive.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
54) Patient's name	○	○	○	○
55) Age	○	○	○	○
56) Gender	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
57) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
58) Details of incident/accident	○	○	○	○
59) Decontamination required	○	○	○	○
60) Number of total patients from incident	○	○	○	○
61) Total transport time	○	○	○	○

Clinical Assessment

		Essential	Important	Somewhat Important	Not Important
62)	Chief complaint	○	○	○	○
63)	History of present illness	○	○	○	○
64)	Associated symptoms	○	○	○	○
65)	Current medications	○	○	○	○
66)	Allergies	○	○	○	○
67)	Past medical history	○	○	○	○
68)	Pertinent system findings	○	○	○	○
69)	Time of injury/illness	○	○	○	○
70)	Mechanism of injury	○	○	○	○
71)	Acute or chronic nature of illness	○	○	○	○
72)	Site of physical injuries	○	○	○	○
73)	Baseline vital signs	○	○	○	○
74)	Last set of vital signs	○	○	○	○
75)	Mental status & associated changes	○	○	○	○
76)	Glascow Coma Score	○	○	○	○
77)	Airway patency	○	○	○	○
78)	Pupil exam	○	○	○	○
79)	chest abnormalities	○	○	○	○
80)	Abdominal/pelvic abnormalities	○	○	○	○
81)	Combativeness	○	○	○	○
82)	Skin exam	○	○	○	○
83)	Pain assessment	○	○	○	○
84)	Suspected type of shock	○	○	○	○
85)	Suspected fractures	○	○	○	○

EMS Interventions

		Essential	Important	Somewhat Important	Not Important
86)	Airway intervention	○	○	○	○
87)	Oxygen saturation	○	○	○	○
88)	12 lead EKG findings	○	○	○	○
89)	CPR performed	○	○	○	○
90)	Duration of CPR	○	○	○	○
91)	Defibrillation attempts	○	○	○	○
92)	Vascular access (gauge & location)	○	○	○	○
93)	Volume & Type of IV fluid infused	○	○	○	○
94)	Tourniquet placed (time & location)	○	○	○	○
95)					

Patient initiated treatment prior to EMS arrival	○	○	○	○
96) Medications& dosages given	○	○	○	○
97) Glucose level	○	○	○	○
98) Patient response to treatments	○	○	○	○

	Essential	Important	Somewhat Important	Not Important
99) Patient reported drug use	○	○	○	○
100) EMS suspicions of self harm/suicide attempt	○	○	○	○
101) EMS suspicions of abuse	○	○	○	○
102) Police involvement during patient encounter	○	○	○	○
103) Physical location of EMS documentation/EKG strips	○	○	○	○
104) Patient known to EMS	○	○	○	○

Patient C was involved in a minor motor vehicle collision. The patient is lethargic and unable to answer questions appropriately.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
105) Patient's name	○	○	○	○
106) Age	○	○	○	○
107) Gender	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
108) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
109) Details of incident/accident	○	○	○	○
110) Decontamination required	○	○	○	○
111) Number of total patients from incident	○	○	○	○
112) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
113) Chief complaint	○	○	○	○
114) History of present illness	○	○	○	○
115) Associated symptoms	○	○	○	○
116) Current medications	○	○	○	○
117) Allergies	○	○	○	○
118) Past medical history	○	○	○	○
119) Pertinent system findings	○	○	○	○
120) Time of injury/illness	○	○	○	○
121) Mechanism of injury	○	○	○	○
122) Acute or chronic nature of illness	○	○	○	○
123) Site of physical injuries	○	○	○	○
124) Baseline vital signs	○	○	○	○
125) Last set of vital signs	○	○	○	○
126) Mental status & associated changes	○	○	○	○
127) Glascow Coma Score	○	○	○	○
128) Airway patency	○	○	○	○
129) Pupil exam	○	○	○	○
130) chest abnormalities	○	○	○	○
131) Abdominal/pelvic abnormalities	○	○	○	○
132) Combativeness	○	○	○	○
133) Skin exam	○	○	○	○
134) Pain assessment	○	○	○	○
135) Suspected type of shock	○	○	○	○
136) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
137) Airway intervention	○	○	○	○
138) Oxygen saturation	○	○	○	○
139) 12 lead EKG findings	○	○	○	○
140) CPR performed	○	○	○	○
141) Duration of CPR	○	○	○	○
142) Defibrillation attempts	○	○	○	○
143) Vascular access (gauge & location)	○	○	○	○
144) Volume & Type of IV fluid infused	○	○	○	○
145) Tourniquet placed (time & location)	○	○	○	○
146)				

Patient initiated treatment prior to EMS arrival	○	○	○	○
147) Medications& dosages given	○	○	○	○
148) Glucose level	○	○	○	○
149) Patient response to treatments	○	○	○	○

	Essential	Important	Somewhat Important	Not Important
150) Patient reported drug use	○	○	○	○
151) EMS suspicions of self harm/suicide attempt	○	○	○	○
152) EMS suspicions of abuse	○	○	○	○
153) Police involvement during patient encounter	○	○	○	○
154) Physical location of EMS documentation/EKG strips	○	○	○	○
155) Patient known to EMS	○	○	○	○

Patient D presents with a puncture wound to the right hand. The patient is awake, alert, & oriented.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
156) Patient's name	○	○	○	○
157) Age	○	○	○	○
158) Gender	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
159) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
160) Details of incident/accident	○	○	○	○
161) Decontamination required	○	○	○	○
162) Number of total patients from incident	○	○	○	○
163) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
164) Chief complaint	○	○	○	○
165) History of present illness	○	○	○	○
166) Associated symptoms	○	○	○	○
167) Current medications	○	○	○	○
168) Allergies	○	○	○	○
169) Past medical history	○	○	○	○
170) Pertinent system findings	○	○	○	○
171) Time of injury/illness	○	○	○	○
172) Mechanism of injury	○	○	○	○
173) Acute or chronic nature of illness	○	○	○	○
174) Site of physical injuries	○	○	○	○
175) Baseline vital signs	○	○	○	○
176) Last set of vital signs	○	○	○	○
177) Mental status & associated changes	○	○	○	○
178) Glascow Coma Score	○	○	○	○
179) Airway patency	○	○	○	○
180) Pupil exam	○	○	○	○
181) chest abnormalities	○	○	○	○
182) Abdominal/pelvic abnormalities	○	○	○	○
183) Combativeness	○	○	○	○
184) Skin exam	○	○	○	○
185) Pain assessment	○	○	○	○
186) Suspected type of shock	○	○	○	○
187) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
188) Airway intervention	○	○	○	○
189) Oxygen saturation	○	○	○	○
190) 12 lead EKG findings	○	○	○	○
191) CPR performed	○	○	○	○
192) Duration of CPR	○	○	○	○
193) Defibrillation attempts	○	○	○	○
194) Vascular access (gauge & location)	○	○	○	○
195) Volume & Type of IV fluid infused	○	○	○	○
196) Tourniquet placed (time & location)	○	○	○	○
197)				

Patient initiated treatment prior to EMS arrival	○	○	○	○
198) Medications& dosages given	○	○	○	○
199) Glucose level	○	○	○	○
200) Patient response to treatments	○	○	○	○

	Essential	Important	Somewhat Important	Not Important
201) Patient reported drug use	○	○	○	○
202) EMS suspicions of self harm/suicide attempt	○	○	○	○
203) EMS suspicions of abuse	○	○	○	○
204) Police involvement during patient encounter	○	○	○	○
205) Physical location of EMS documentation/EKG strips	○	○	○	○
206) Patient known to EMS	○	○	○	○

Patient E presents with a severe headache. The patient is awake, alert, & oriented. In addition the patient is hypertensive.

Patient Demographics

	Essential	Important	Somewhat Important	Not Important
207) Patient's name	○	○	○	○
208) Age	○	○	○	○
209) Gender	○	○	○	○

Environment of Care

	Essential	Important	Somewhat Important	Not Important
210) EMS agency identification/Transport Method (Air vs. Ground)	○	○	○	○
211) Details of incident/accident	○	○	○	○
212) Decontamination required	○	○	○	○
213) Number of total patients from incident	○	○	○	○
214) Total transport time	○	○	○	○

Clinical Assessment

	Essential	Important	Somewhat Important	Not Important
215) Chief complaint	○	○	○	○
216) History of present illness	○	○	○	○
217) Associated symptoms	○	○	○	○
218) Current medications	○	○	○	○
219) Allergies	○	○	○	○
220) Past medical history	○	○	○	○
221) Pertinent system findings	○	○	○	○
222) Time of injury/illness	○	○	○	○
223) Mechanism of injury	○	○	○	○
224) Acute or chronic nature of illness	○	○	○	○
225) Site of physical injuries	○	○	○	○
226) Baseline vital signs	○	○	○	○
227) Last set of vital signs	○	○	○	○
228) Mental status & associated changes	○	○	○	○
229) Glascow Coma Score	○	○	○	○
230) Airway patency	○	○	○	○
231) Pupil exam	○	○	○	○
232) chest abnormalities	○	○	○	○
233) Abdominal/pelvic abnormalities	○	○	○	○
234) Combativeness	○	○	○	○
235) Skin exam	○	○	○	○
236) Pain assessment	○	○	○	○
237) Suspected type of shock	○	○	○	○
238) Suspected fractures	○	○	○	○

EMS Interventions

	Essential	Important	Somewhat Important	Not Important
239) Airway intervention	○	○	○	○
240) Oxygen saturation	○	○	○	○
241) 12 lead EKG findings	○	○	○	○
242) CPR performed	○	○	○	○
243) Duration of CPR	○	○	○	○
244) Defibrillation attempts	○	○	○	○
245) Vascular access (gauge & location)	○	○	○	○
246) Volume & Type of IV fluid infused	○	○	○	○
247) Tourniquet placed (time & location)	○	○	○	○
248)				

Patient initiated treatment prior to EMS arrival	○	○	○	○
249) Medications& dosages given	○	○	○	○
250) Glucose level	○	○	○	○
251) Patient response to treatments	○	○	○	○
	Essential	Important	Somewhat Important	Not Important
252) Patient reported drug use	○	○	○	○
253) EMS suspicions of self harm/suicide attempt	○	○	○	○
254) EMS suspicions of abuse	○	○	○	○
255) Police involvement during patient encounter	○	○	○	○
256) Physical location of EMS documentation/EKG strips	○	○	○	○
257) Patient known to EMS	○	○	○	○

258) (Please list any additional information you believe to be i