Volunteer EMS-to-ED Handoff: A Quality Improvement Project

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Abstract

Nature and Scope of the Project: Rural, volunteer emergency medical services (EMS) face unique challenges related to financial viability, resource management, and quality improvement (QI). In order to provide high quality patient care, EMS must improve interprofessional communication and coordination of care. EMS must focus QI effort on handoffs to Emergency Department (ED) staff because effective handoffs are crucial points in the transition of patient care. This project aimed to improve interprofessional communication and increase volunteer EMS comfortability with EMS-to-ED handoff.

Synthesis and Analysis of Supporting Literature: Projects focusing on handoffs, transitions, and communication need to be conducted. The evidence overwhelmingly argued for standardized EMS-to-ED handoff, but it could not narrow recommendations to any one method or tool. The Iowa Model and Lewin's Change Theory served as guiding frameworks for this project.

Project Implementation: Demographic and pre-implementation surveys were administered at a regularly scheduled, monthly ambulance meeting. A short educational session was conducted reviewing the IMIST-AMBO handoff tool. The tool was used for ten weeks within the ambulance service, followed by a post-implementation survey.

Evaluation Criteria: Descriptive statistics were conducted with information collected from the demographic survey. The pre-implementation and post-implementation surveys were analyzed using Mann Whitney U tests. In order to accept or reject the hypothesis that implementing the IMIST-AMBO handoff tool would increase EMS comfortability, a confidence interval of 95% was used.

Outcomes: Outcome, process, and balancing measures were developed and examined for this project. Main outcome measures revolved around EMS comfortability during handoff and EMS perception of handoff pre- and post-implementation. Results were not statistically significant.

Recommendations: Specific recommendations based on this QI project are in progress. However, additional projects must be contributed to EMS literature; especially for rural, volunteer ambulance services.

Keywords: EMS, Ambulance, Rural, Volunteer, Standardized Handoff Tool, IMIST-AMBO

Despite emergency medical services (EMS) having a history dating back to ancient Greece, advancements in technology, policy, and education did not take place in the United States until the second half of the 1960s (Goniewicz, 2013). Rural EMS in the United States largely relies on volunteer ambulance services (Cash et al., 2020). These systems remain arduous to systems change processes in the United States due to lack of standardized care models, limited resources to provide basic care, resistance to alternative management processes, and stringent regulatory requirements (Freeman et al., 2008; O'Meara et al., 2018). To help with quality improvement (QI) surrounding the many interacting components of the EMS system, rural EMS must improve on governance and shared accountability, patient handoffs and care transitions, and communication (Gale et al., 2017).

Patient handoff is the process where a healthcare professional transfers responsibility and accountability for care of a patient to another healthcare professional. During patient handoff, critical patient information is exchanged that is used to guide medical decision making. EMS personnel most frequently transfer patients to Emergency Department (ED) staff. In EMS-to-ED handoff, the "senders" of patient information include first responders, emergency medical technicians (EMTs), and paramedics. The "receivers" of the patient handoff include nurses, advanced practice providers, or physicians. The "senders" generally have a couple of months to a couple of years of formal training (as EMTs or Paramedics), and the "receivers" have a couple years to a dozen years of formal training (as RN's, NP/PA's, or Physicians). Often, none of them are formally trained in this handoff process, or they are trained very differently from one another (Guasconi et al., 2022).

It is crucial that patient handoff be an effective and efficient process to avoid adverse effects and maintain patient safety (Troyer & Brady, 2020). Variations and lack of

standardization during patient handoff has proven to adversely affect transfer of care, patient safety, and treatment time (Amaniyan et al., 2019; O'Connell et al., 2018; Troyer & Brady, 2020). In summary, non-standardized operations and management in volunteer ambulance services cause dysfunction to the involved healthcare systems. This carries the potential to impact patient care and patient outcomes, thus making shared accountability, patient handoffs and care transitions, and communication top priorities for EMS QI.

Nature of the Problem

The definition of EMS within this project refers to volunteer and career medical personnel in the prehospital care system. It excludes trauma centers, critical access hospitals, or the non-ambulance workforce, such as law enforcement and firefighters. EMS "personnel" are commonly referred to as EMS "crew".

EMS personnel are divided into one of two categories: those who are paid for their time, and those who volunteer their time. Cash et al. (2020) found that 13% of the EMS workforce serve primarily as volunteers with the majority volunteers being EMTs working in rural areas. More rural states such as Vermont and Minnesota have a significantly higher percentage of volunteers (Cash et al., 2020 [Figure 1]). Rural EMS relies on volunteers, and volunteers generally have less advanced licenses and less formal EMS education, which pose unique challenges and limitations (Cash et al., 2020; Mueller et al., 2021).

Ten million rural Americans receive EMS care every year, yet financing and payments do not adequately cover standby and fixed costs for rural ambulance agencies (Mueller et al., 2021). Rural, volunteer EMS faces unique challenges with financial viability, staffing, and day-to-day operations; in addition, EMS face exposure to infectious disease, workplace violence, and ethical dilemmas (Cheraghi et al., 2019; Murray et al., 2020; Richey et al., 2021). QI can help shore up

weaknesses in the EMS system, but QI projects in EMS are exceedingly difficult because ambulance agencies lack reliable evidence-based quality performance measures and useable quantitative EMS data from the National EMS Information System (Becknell & Simon, 2016, pp. 12-13; Gale et al., 2017; Redlener, 2018).

The lack of explicitly defined, evidence-based performance measures causes substantial variability in how metrics are tracked as indicators of quality in EMS agencies (Redlener et al., 2018). The QI process requires quantifiable data to track changes in quality of performance and processes. Yet, EMS agencies in the United States must get creative and individually develop quality metrics from varied sources because they do not have access to standardized quality measures or patient outcomes data from hospitals (Redlener et al., 2018). Volunteer ambulance services are less likely to implement QI than paid services because they do not have dedicated quality staff or paid staff to track quality measures (Redlener et al., 2018).

To develop a professional and quality system, EMS professionals must have accessible education on QI, evidence-based data and quality metrics, and evidence-based tools to make system change (O'Meara et al., 2018; Gale et al., 2017; Redlener et al., 2018). Because the current evidence for EMS handoff lacks patient outcome measures, projects must develop from the synthesis of qualitative evidence and suboptimal quantitative measures of handoff efficacy. With the lack of an evidence-base for interprofessional handoff in EMS, projects must focus on synthesizing qualitative evidence together from studies reporting quantitative measures that are not directly patient outcome-based.

The Gap Analysis

The goal of the literature review was to support a project with an evidence-based, standardized EMS-to-ED handoff tool in a rural, southeastern Minnesota volunteer ambulance

service. Gale et al. (2017) identified “coordination of care” (p. 159) as a priority domain for EMS performance improvement and measurement. Improving EMS-to-ED handoff fits within that domain and is feasible within the target organization.

In a systematic review by Desmedt et al. (2021), several academic sources recommended implementing a standardized healthcare handoff tool to improve information transfer, increase work satisfaction, and decrease patient safety events. A handoff tool is a physical or electronic list that leads the order and content of handoff. They allow for documentation of pertinent patient information, so that information may be verbally reported or electronically sent to the receiving personnel. Handoff tools focus on organization, efficiency, and completeness of information. Tools often contain information from the MIST mnemonic: Mechanism of injury/Medical complaint, Injuries/Inspections, Signs (vital signs), and Treatments (Maddry, 2020).

Tortosa-alted et al. (2021) recommended using a systematic process to disseminate information in the chaotic and complex ED environment (Tortasa-Alted et al., 2021). Pocket cards, written reports, and mnemonics were strategies found to be used within transfer of care to facilitate bidirectional communication and information exchange (Guasconi et al., 2022; Troyer & Brady, 2020). Standardized handoff tools improve knowledge transfer across healthcare settings and improve the perception of information exchange and interprofessional communication between EMS and ED staff (Desmedt et al., 2020; Maddry, Simon, et al., 2020; Troyer & Brady, 2020). Standardized information exchange between healthcare staff improves patient safety and reduces adverse events during the transition of care in many healthcare settings (Desmedt et al., 2020).

Although multiple handoff tools exist within healthcare literature, few are tailored specifically for the EMS-to-ED handoff. Some of the handoff tools applicable to EMS included

MIST, DeMIST, IMIST-AMBO, Trauma Time-Out, SBAR, and TeamSTEPPS methods (Desmedt et al., 2020; Guasconi et al., 2022; Nolan et al., 2017). In one study of the MIST tool implementation, study respondents felt like they were more informed of prehospital treatments, assessments, critical trauma criteria, and the mechanism and location of injury from the MIST report and report data matched inpatient electronic medical record documentation (Maddry, Arana, et al., 2020; Maddry, Simon, et al., 2020).

There is limited translational evidence for implementing a handoff tool and supporting its validity, usability, feasibility, and efficacy. As such, the aim of this project was to improve EMS-to-ED handoff using the evidence currently available with a QI initiative focusing on a rural, volunteer ambulance service in southeastern Minnesota.

PICO Question

This project focused on the PICO question, "How does the implementation of a standardized EMS-to-ED handoff tool (I) impact the handoff process relative to inter-professional communication and comfortability (O) between volunteer EMS personnel (P) when compared to no standardized bedside handoff process (C)?".

Organizational Project Information

The organization selected for this project is a rural, volunteer ambulance service in southeastern Minnesota. The ambulance service was founded as part of a fire department in 1976 and then transferred to a city department in 1991. In 1994, poor recruitment and tight budget cuts threatened to dissolve the ambulance service, so those who valued EMS as a vital community service formed an independent Board of Directors and transitioned the service to non-profit status. Currently, the ambulance service is recognized as a municipal instrumentality of the city in which it resides, and serves the surrounding townships in the region. The ambulance continues

as a volunteer, non-profit service with a Medical Director, Ambulance Director, Director of Operations, Treasurer, and Secretary. The current Ambulance Director was appointed to his position in 1996, about two years after joining the service.

In 2020, the service area held 1,560 e911 addresses containing 3,822 citizens. In 2021, the ambulance service transported 188 patients to hospitals, and it had more than 261 calls for service. In 2022, the organization's service area spanned over 120 square miles consisting of rural and semi-rural cities, segments of major highways, and primary schools. The service area expanded in 2022 as an adjacent ambulance service permanently shut down, and there was an unprecedented number of mutual aid calls from nearby services between 2020 and 2022.

The volunteer crew consists of individuals of assorted ages and backgrounds with varying levels of time and commitment to the service. The crew members strive to provide excellent care with the common belief that the ambulance service is a necessity for public safety and without it, the community would face harm. With past practice changes, there was not significant resistance within the ambulance service, likely because of the Ambulance Director's tactful implementation and positive attitude.

O'Meara et al. (2018) described how small ambulance services in the U.S. have personality-driven quality management processes in which the Medical Director was the key to action. Although the Medical Director for this EMS agency has some part in QI, the main driving personality is the Ambulance Director himself. The Ambulance Director is a doctorate-educated pharmacist with decades of experience in clinical pharmacy, rural EMS, and organizational leadership. He promotes a culture of progress by contributing to healthcare education, evidence-based practice, and health policy. At the ambulance service's monthly meetings, the Ambulance Director has described literature reviews he has conducted and thoroughly described

opinions of others when facing a task. The Ambulance Director has made his evidence-based actions evident to the crew, and others, when he has chosen to divert from the practices of other ambulances within the EMS consortium.

Stakeholders

The primary stakeholders of this QI initiative included the Ambulance Director, the EMS crew members, and the patients. The secondary stakeholders consisted of the Medical Director, the Minnesota Emergency Medical Services Regulatory Board (EMSRB), regional EDs, and the local municipalities.

The primary stakeholders needed to be engaged in the implementation of this project. All crew members are encouraged to participate in and give feedback on changes to handoff, but it was understood that some of the crew only drive the ambulance and perform care at the scene of the call. Crew members who act as the primary caregiver of patients during transport perform patient handoff in the emergency department, so they were the primary targets for this intervention. The Ambulance Director was a mentor for this project and is a content expert in organizational leadership, management, and evidence-based medical practice. The secondary stakeholders may have had interest in supporting the QI work being done, but the ED staff were only engaged during handoff by crew members because it would be too difficult and low yield to engage them and their organization directly in this QI project.

Needs Assessment

A needs assessment via a fishbone diagram (Figure B1) was performed to determine what contributes to ineffective EMS-to-ED handoff for this organization. Trends in the literature were compared to this agency's practices known to the authors from personal experience, informal conversations with crew members over the past two years, and informal conversations about

handoffs with crew members in the last several months. This project aligned with the Ambulance Director's goals because of his wish to implement formal QI processes within the ambulance service. The project also aligned with the goals of the crew because it sought to improve patient care without using organizational finances or increasing workload.

This project sought out an effective EMS-to-ED handoff as the ideal condition. The needs assessment classified observations into like domains to help identify key problems that could have caused ineffective EMS-to-ED handoff. The gap analysis, the literature synthesis, and the needs assessment were used to identify and prioritize evidence-based interventions for the specific needs of this organization.

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

The agency's strengths, weaknesses, opportunities, and threats (SWOT) in relation to this project were analyzed by both authors. An overview of these findings can be found in Table B1.

Strengths. Some of the most important strengths of this southeastern Minnesota volunteer ambulance service stem from the highly educated, respected, and engaged Ambulance Director. He has established a team of like-minded individuals that value the community as the team members are devoted to providing quality prehospital emergency care. The Ambulance Director continually exposes the crew to the existence of evidence-based practice by talking about the literature.

In addition, the Ambulance Director works as a clinical pharmacist and several of the crew members hold primary occupations as nurses, paramedics, and EMTs on paid services. Crew members outside of the medical field provide vast depths of knowledge in the automotive, agricultural, and business management realms. This combination of volunteers from all walks of life and experience levels contributes to a family-like comradery. Everyone comes together at

monthly meetings to catch up with one another, review the previous month's calls, receive education from the Ambulance Director, and complete consortium training from the regional regulatory entity, Southeastern Minnesota EMS. The apparent dedication and strength of the EMS team serves to leverage the strength of the QI project

Weaknesses. Despite the countless strengths of the EMS agency, weaknesses exist. QI processes are unfamiliar due to lack of a formal committee. Some crew members may be used to doing things "the way they've always been done" and a difficult-to-implement project could result in resistance to change. Limited face-to-face contact with other volunteers outside of monthly meetings could cause challenges with sustaining change due to underdeveloped teamwork. Because this service is both rural and volunteer, it faces unique challenges when compared to its paid EMS counterparts. The volunteer status of the organization means there will be little to no reimbursement or financial incentive for the organization or staff to spend time on this project, and limited call volume may result in difficulty maintaining competency and practice in new processes along with rarely used skills. Also, high stress situations that the EMS crew may face could decrease the perceived importance of a thorough EMS-to-ED handoff, as other tasks take precedence. Many of these weaknesses can be bolstered or circumvented. This project will not rely on any financial resources from the ambulance service. This project will begin by informing the crew of the need for change, and a thorough change plan will be disseminated. The authors will express openness and willingness to reassess, reevaluate, and revamp the project when results and feedback are to be analyzed.

Opportunities. This southeastern Minnesota volunteer ambulance service has several opportunities that this project can capitalize on when standardizing EMS-to-ED handoff. Growth opportunities for this agency are greatest in its relationships with other stakeholders within the

region and state. Some local and state government officials are invested in EMS as a priority; this means potential government backing for rural and volunteer EMS QI in the future. Push-back by crew members of the EMS organization is predicted to be minimal because they have been open to new ideas and processes. Standardizing an EMS-to-ED handoff tool would benefit the volunteer ambulance service and inspire EMS QI initiatives locally and regionally.

The Ambulance Director is seen as well-versed in QI and supportive of ideas brought forward by crew members. He is willing to serve as a valuable stakeholder within the community and local hospitals. The Ambulance Director also facilitates and maintains excellent relationships with the Minnesota EMSRB, Southeastern Minnesota EMS, and the ED's EMS liaison, which provides opportunities to apply and disseminate knowledge from this QI project across various EMS groups. This project has the potential to contribute to the expansion of quality improvement in EMS QI and gain support from outside entities and individuals to implement this and future changes.

Threats. There are threats to this project and future QI in this EMS agency. At a systems level, Medicare and Medicaid reimbursement rates are a threat because of low payments by the aging clientele and resultant financial strain (King et al., 2019; Mueller et al., 2021). In fact, this volunteer ambulance service had to write off $103,000 in losses to Medicare in 2021. When organizations are trying to make ends meet, there is a lack of time to focus on other pressing issues, such as QI. Volunteer basic life support (BLS) services can be looked down upon by paid advanced life support (ALS) services, nurses, and providers. Local EDs and ED staff have their preferred ways of transitioning patient care and might have been resistant to new ways of doing things. The lack of evidence definitively validating the best EMS-to-ED handoff practices has

the opportunity to lead to the implementation of a process that would be outdated in the near future.

Anecdotally, there used to be far more disrespect from hospital staff towards ambulance crews in the area, but ambulance crews are now thought to have valuable information for the hospital. There was a traditional hierarchy in medicine and EMS that has made some of the volunteer EMS crew members feel ridiculed, misunderstood, and undervalued in their actions by other healthcare workers. Whether they be misunderstandings or incivility, comments and actions by hospital staff have caused crew members to be frustrated with evidence-based practice changes made by the service in the past, and some of the crew believed that this conflict was caused because they are on a volunteer ambulance service as opposed to a professional, paid ambulance service.

Also of note is that the Ambulance Director of this volunteer EMS agency has been faithfully serving since 1996, and changes in leadership are expected in the future. Loss of the crew's leader threatens the culture and success of the agency. Although, EMS crew's internal interests for the position of Ambulance Director could remedy threats to the agency brought about by this transition.

Available Knowledge

Methods

Search Strategy. A literature review was conducted by two independent authors during the months of September and October in 2022. Google Scholar, CINAHL Ultimate, and The College of Saint Scholastica's (CSS) SOLAR databases were used throughout the search. Key terms were combined using boolean phrases and consisted of variations of "prehospital", "volunteer or rural", "EMS", "emergency medical services", "EMS background, handoff,

handoff tool, handoff problems", and/or "EMS quality challenges." References from included systematic reviews were screened for relevance and usability and included where appropriate.

Inclusion/Exclusion Criteria. Peer-reviewed, academic articles written in English and published between 2017 and 2022 were included. Articles were excluded if they were not relevant to EMS, prehospital care, EMS handoff tools, or EMS quality challenges (Table 1). Studies that examined electronic handoff tools between EMS and the ER were also excluded, as the intervention of interest relates to face-to-face communication. Articles meeting inclusion and exclusion criteria were abstract screened for relevance by both authors and duplicate results were removed.

Table 1

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Peer-reviewed academic articles	Intervention not face-to-face communication
Published between 2017-2022	Articles not relevant to keywords
	Articles in languages other than English

Literature Matrix Development. The first step of the matrix development was to organize the remaining studies with the column headings: "APA Citation"; "Study Design"; "PICOT/Aim/Research Question"; "Sample"; "Methods"; "Intervention"; and "Key Findings." Both authors extracted data from each article and placed it in the corresponding column. Next, the included articles were critically appraised using the appropriate Joanna Briggs Institute (JBI) Critical Appraisal Checklist, and a column was added to the matrix to reflect the total percentage of qualifications met. Finally, the two authors reviewed each included article and developed the overarching themes of the literature. Additional columns were added to the matrix ("Critical

Appraisal [JBI]"; "Theme(s)"; and "Notes") after the literature search to aid the authors in organization and theme generation. The literature matrix can be seen in Appendix C.

Critical Appraisal

Study design was determined by both authors. When design was not readily apparent, the University of Oxford's Centre for Evidence-Based Medicine (2022) *Study Design Tree* was used to assist in article classification. All articles included in this literature review were evaluated using the corresponding JBI Critical Appraisal Tool. The JBI Critical Appraisal Checklist for Systematic Reviews was utilized for all included academic literature review articles, due to study design and lack of a more appropriate tool. In order to provide transparency to the reader about credibility of referenced articles and to serve as a quick reference for the authors, a percentage for each article was calculated to disseminate the amount of criteria met from the JBI Critical Appraisal Tools. Each JBI criteria was scored with, "Yes", "Unknown", or "No." Points were assigned based on the score as follows: "Yes" equals one point; "Unknown" equals one half of a point; and "No" equals zero points. Granted points were totalled and divided by the number of questions on the JBI Critical Appraisal Tool. Finally, the resulting number was multiplied by 100% and displayed in the literature matrix. For example, if a systematic review article scored a total of eight out of eleven points, the percentage displayed on the literature matrix would equal 72.72%. Another way to interpret this is that the article met 72.72% of the JBI critical appraisal criteria. The critical appraisal checklists and scoring may be seen in Appendix C.

Results

The initial literature search among all three of the databases with limiters (date range: 2017-2022, English language, academic journals) yielded 1,064 results (Google Scholar [n = 106]; CSS SOLAR [n = 763]; CINAHL Ultimate [n = 195]). After further examination,

application of inclusion and exclusion criteria, and abstract screening, a total of 31 (Google Scholar [*n* = 13]; CSS SOLAR [*n* = 10]; CINAHL Ultimate [*n* = 8]) articles were included in the literature synthesis. Databases, search strings, and results are depicted in Table 2.

Table 2

Databases and Search Strings

Database	Search Strings	Results
Google Scholar	"prehospital handoff problems"	*n* = 8
	"volunteer ems" challenges	*n* = 5
CSS SOLAR	(emergency medical services handoff tool) AND (confidence) NOT (huddle) NOT (shift)	*n* = 8
	prehospital handoff confidence	*n* = 2
CINAHL Ultimate	(emergency medical services OR ems OR prehospital OR pre-hospital OR emergency medical technician) AND (handoff OR handover OR hand off OR hand-off OR shift report)	*n* = 1
	(emergency medical services OR ems OR prehospital OR pre-hospital OR paramedic) AND "rural" AND quality	*n* = 5
	(volunteer EMS OR volunteer EMT OR volunteer ambulance) AND documentation	*n* = 2

Each of the 32 included articles were reviewed using the appropriate JBI Critical Appraisal Checklist (Table 3). The JBI Checklist for Systematic Reviews was utilized for 14 academic literature review articles. Eight articles were evaluated using the Prevalence Studies checklist. The remaining nine articles were appraised using the Analytical Cross-Sectional Study (*n* = 4), Qualitative Research (*n* = 3), and Text and Opinion Article (*n* = 3) checklists.

Table 3

JBI Critical Appraisal Checklist Types, Number, and Average Appraisal Scores of Articles

JBI Checklist	Number of Articles	Average Appraisal Score (%)
Systematic Review	*n* = 14	89.7
Prevalence Study	*n* = 8	93.1
Analytical Cross-Sectional Study	*n* = 4	90.6
Qualitative Research	*n* = 3	85
Text and Opinion Article	*n* = 3	72.2

Literature Synthesis

The literature search was conducted to gain insight about the available knowledge relating to the PICO question, "How does the implementation of a standardized EMS-to-ED handoff tool (I) impact the handoff process relative to inter-professional communication and comfortability (O) between volunteer EMS personnel (P) when compared to no standardized bedside handoff process (C)?". From the 32 included articles, four themes relating to volunteer EMS and EMS-to-ED handoff were noted:

1. Rural, volunteer EMS agencies face unique challenges.
2. There are several, multifaceted barriers to effective EMS-to-ED handoff.
3. Ineffective EMS-to-ED handoff may contribute to poor patient outcomes.
4. Standardized handoff is recommended for all transitions of care.

These findings led to a deeper understanding of the topic. The aim of this synthesis was to thoughtfully connect key points in the literature and apply it to the southeastern Minnesota volunteer ambulance service.

Volunteer EMS Agencies Face Unique Challenges. A substantial body of evidence described that volunteer EMS professionals are the backbone of prehospital care in rural America (Cash et al., 2021; King et al., 2019; Mueller et al., 2021). However, a number of challenges unique to volunteer EMS need to be addressed. For instance, little is known about the core functions, capabilities, and evidence-based guideline implementation of rural EMS agencies, notably those that rely heavily on volunteer personnel (Fishe et al, 2018; Gale et al., 2017). Rural EMS organizations are responsible for larger service areas and sicker patients with far less funding, staff, and access to care compared to their urban counterparts (Cash et al., 2021; King et al., 2019; Mueller et al., 2021). Additionally, the scope of practice for volunteer EMS professionals was described as varied compared to that of the paid professional, partially attributed to less advanced certification levels and longer implementation times for evidence-based practice (Cash et al., 2021; Fishe et al., 2018). These findings were in accordance with the challenges that the targeted southeastern Minnesota volunteer EMS agency faced. According to Reavy (2016), leaders best serve their organization when they have perspective about the functions of the agency and understand the complexity of the system (p. 32).

Barriers to Effective EMS-to-ED Handoff. Contrary to expectations, the literature search did not identify volunteer-specific barriers to effective EMS-to-ED handoff. However, the majority of articles referenced at least one type of hindrance to a smooth transition of care. Troyer & Brady (2020) described barriers to effective EMS-to-ED handoff in four descriptive themes: educational barriers, operational barriers, cultural barriers, and cognitive barriers (p. 1500). Frequently cited impediments of EMS-to-ED handoff included frequent interruptions during verbal report, a lack of standardization or training, disinterest or disrespect from ED staff, and a chaotic environment (Amaniyan et al., 2020; Desmedt et al., 2020; Fitzpatrick, McKenna,

et al., 2018; Guasconi et al., 2022; Peran et al., 2019; Tortosa-Alted, Reverte-Villarroya, et al., 2021; Troyer & Brady, 2020). The majority of these roadblocks stemmed from ineffective communication, which continues to be a complex issue.

Zaccagnini and Pechacek (2021) discussed common obstacles to effective interprofessional communication, with many points aligning with the barriers noted in the literature regarding EMS-to-ED handoff. Despite slight differences in terminology, the evidence supported the need for conflict resolution skills and emotional intelligence to reduce communication breakdown (Zaccagnini and Pechacek, 2021).

Ineffective EMS-to-ED Handoff Contributes to Poor Patient Outcomes. EMS-to-ED handoff contains crucial information about patient demographics, history of present illness, past medical history, mental status, medications, and allergies. Multiple studies found that incorrect reporting of these components had the potential to contribute or cause a sentinel event in a vast array of healthcare settings (Amaniyan et al., 2020; Hagiwara et al., 2019; Troyer & Brady, 2020). Information degradation, omission, and misinterpretation were found to be associated with increased length of stay, delayed treatment, and medication errors (Amaniyan et al., 2020). In fact, some studies showed up to 87% of resuscitations had at least one form of ineffective communication, and a complete set of vital signs were not reported in half of the handoffs using non-standardized tools (Goldberg et al., 2017; Sumner et al., 2019). In summary, patient safety, ED workflow, and the efficient, appropriate, and timely use of ED resources were dependent on accurate transfer of pertinent patient information (Reay et al., 2019, p. 422).

Unfortunately, several studies mentioned that EMS agencies have a near-impossible time obtaining patient outcomes from hospitals due to systems issues (Fishe et al., 2019; Gale et al., 2017; O'Meara et al., 2018; Redlener et al., 2018). As a result, the literature could not explicitly

state that ineffective EMS-to-ED handoff is causative of detrimental patient outcomes. However, it is reasonable to infer that missing critical data, like medication allergies, site of injury, or vital signs, carries the potential to cause harm to patients.

EMS Should Use Standardized Handoff Tools. "The totality of the literature ensured that the standardization of communication during the [emergency handover of critical patients] is the best method of information transfer in addition to being associated with reduced errors and improved patient safety" (Tortosa-Alted, Martinez-Segura, et al., 2021, p.8). Several articles concluded that protocols, tools, and technology are ways to improve structure and standardization in EMS-to-ED (Fitzpatrick, McKenna, et al., 2018; Peran et al., 2019; Reay et al., 2019; Troyer & Brady, 2020; Maddry, Simon, et al., 2020; Tortosa-Alted, Reverte-Villarroya, et al., 2021). Reay et al. (2019) recommended that these protocols have required components while allowing for additional, supplemental information; and protocol implementation should follow interdisciplinary handoff training (p. 431). This aligned with the recommendations that EMS-to-ED handoff training is needed to improve information transfer (Tortosa-Alted, Reverte-Villaroya, et al., 2021; Guasconi et al., 2022).

Popular EMS report tools described by the literature included MIST, SBAR, and I-PASS. Variations of the MIST handoff tool were the most prevalent, but there was an incomplete evidence-base to support its effectiveness (Fitzpatrick, McKenna, et al., 2018; Maddry, Arana, et al., 2020; Maddry, Simon, et al., 2020; Nagaraj et al., 2021). Although several sources recommended implementing a standardized EMS-to-ED handoff tool, the literature sorely lacked evidence validating any specific method. The evidence that was available showed mixed results.

In a study by Maddry, Simon, et al. (2020), ED providers reported an overall improved experience during transfer of care with the implementation of the MIST handoff tool, but nurses

reported no change. However, the overall subjective view of handoff and perception of sufficient time to convey pertinent information was improved (Maddry, Simon, et al., 2020). Maddry, Arana, et al. (2020) found modest improvements in ED staff documentation alignment with EMS report when implementing a MIST handoff. The MIST tool has been found to increase reports of mechanism of injury and prehospital trauma criteria, but actually has increased the number of interruptions during EMS-to-ED handoff (Maddry, Arana, et al., 2020; Maddry, Simon, et al., 2020; Nagaraj et al., 2021). Overall, EMS-to-ED handoff tools were an important part of EMS quality improvement because they brought standardization, but further research should focus on validating specific EMS-to-ED handoff tools (Tortosa-Alted, Martinez-Segura, et al., 2021).

Conceptual Framework and Change Theory

This project utilized The Iowa Model for Evidence-Based Practice (The Iowa Model) as a conceptual framework for evidence-based practice. The Iowa Model presented a well-defined framework for evidence-based practice. The ambulance service has a culture of discussing evidence-based practice at monthly meetings, and many crew members want to demonstrate that a rural, volunteer ambulance service can provide excellent healthcare services like their professional counterparts. *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care*, an updated title by the Iowa Model Collaborative (2017), was found to perfectly align with the ambulance service's mission.

The Iowa Model is a stepwise process giving specific guidance on each step in the process of implementing evidence based practice change. Steps to the model include identifying an issue or opportunity, analyzing the literature, designing and piloting a practice change, integrating and sustaining the practice change, and disseminating results (Iowa Model Collaborative, 2017). There are several points along the algorithm where one must decide if they

go back to the start of the cycle, redesign the project, or consider another opportunity based on what has developed.

Again, the Iowa Model is an incredibly thorough conceptual framework for implementing evidence-based practice every step along the way, but it was not comprehensive enough in all aspects. Shirey (2013) said there is great utility of using theory in addition to change management and project management principles when initiating any kind of change. Lewin's Theory of Planned Change is used to guide critical thinking throughout this project because the Iowa Model is incapable of comprehensively discussing how to sustain change (Iowa Model Collaborative, 2017, p. 180). Lewin's theory was a useful conceptual framework for this project because it helps to understand and explain relationships and make sense of human interactions (Kivunja, 2018, pp. 45-46).

Lewin's Theory of Planned Change is a valuable strategic resource to conceptualize and mobilize the "people side" of change (Shirey, 2013). This theory is a useful set of concepts to help describe phenomena and overcome barriers faced while implementing change. Countless human components are thought to affect EMS-to-ED handoff quality, and Lewin's theory helps define the factors affecting human components of change as a "dynamic balance of driving and opposing forces" (Zaccagnini & Pechacek, 2021, p. 371). Lewin's force field analysis is useful because it helps discover forces that need to be enhanced or inhibited in different stages of change (Shirey, 2013 & New World Encyclopedia, n.d.).

A force field analysis of factors promoting and preventing change is integral to Lewin's Model of Change. The Model of Change has three stages: the unfreezing stage in which people are convinced to let go of the old way of doing things, the movement stage in which people are

persuaded to move to a new way doing things, and the refreezing stage that ensures the change endures beyond the implementation period (Zaccagnini & Pechacek, 2021, p. 371).

The unfreezing and moving processes seeks to appeal to the crew members through logic (a standardized handoff process appearing to improve patient outcomes in a vast array of healthcare realms), emotion (scholarly quality improvement shows other healthcare professionals that the crew is serious about care and should taken seriously), and economics (better reports lead to faster hospital courses and fewer superfluous, expensive diagnostics ordered by the ED). The refreezing process requires the analysis of feedback and results to ensure that the intervention is easy enough, convenient enough, and has enough perceived impact to continue indefinite use within the ambulance service.

The Iowa Model of Evidence Based Practice and Lewin's Theory of Planned Change used in conjunction allow for a comprehensive, holistic approach to this evidence-based practice, QI project.

Project Plan and Methodology

Purpose, Goals, and SMART Objectives

Zaccagnini (2021) defines goals as "broad statements that identify future outcomes, provide overarching direction to the project, and point to the expected outcomes of the project" (p. 369). The overarching goal for this project is to improve interprofessional communication. Specific, measurable, achievable, realistic, and timely (SMART) objectives are crucial to moving a project towards the overall goal (Zaccagnini, 2021, p. 369). The SMART objectives of this proposed project are disseminated in Figure D1.

The overarching goal of this QI project is to improve EMS interprofessional communication. This will be achieved in weeks two and four by completing a comprehensive

literature review and synthesizing the discovered data to develop an EMS-to-ED handoff tool. Next, demographic, pre-implementation, and post-implementation surveys will be developed during weeks six and seven. By week eight, the demographic and pre-intervention surveys will be disseminated at a monthly ambulance meeting, followed by education on the IMIST-AMBO handoff tool. Four weeks later, the post-implementation survey will be administered to the EMS crew and statistical analysis completed. Over a period of four weeks after final survey administration, the final results will be assessed and dissemination strategies planned. A 3MT and poster will be created for dissemination to the authors' DNP cohort. The poster along with survey results will be shared via email to the ambulance crew members; further feedback will be encouraged, and plans to discuss the project at future ambulance meetings will be made.

A handoff tool was indicated for this service because it relied less on EMS education and experience to perform a standardized report. Low call volume, limited certifications, and the volunteer EMS demographic increased the need for interventions that did not rely on highly experienced EMS staff. Brief education was indicated because volunteer time was valuable and training time was limited. Many interventions were not feasible because of the limited time for education the ambulance staff had. The crew members were already donating their time to be on call and at training sessions. Once per month ambulance meetings were generally the only time where crew members came together to discuss ambulance operations and participate in education and training, and this meeting was only around two hours per month.

There were other recommendations made in the literature to improve EMS-to-ED bedside handoff, but brief education and a low-tech standardized handoff tool best met the organizational and training needs of this ambulance service. The ambulance service previously filled out a standardized dry-erase form to lead pre-alert radio reports with hospital dispatch. The dry-erase

form created an organized, standardized report between the ambulance and dispatch. Because the dry-erase form is very useful and ingrained into the ambulance operations, another simple, convenient, and easy written form will be added to be used during all bedside handoffs. This new form contains mnemonic-prompted written information read during bedside handoff. The form was further modified to lead pre-alert radio reports and bedside handoffs, so that the crew did not have to fill out two separate forms. This type of low-tech handoff card had been shown to be useful, feasible, and effective to ambulance staff members (Fitzpatrick, McKenna, et al., 2018). Although Fitzpatrick, McKenna, et al. (2018) reported a well-liked, personally issued, reusable pocket card for EMS staff to use to gather information for handoff, the plan for this project was to use a 8-½" x 11" paper form for each. The paper form was adapted from the emergency department form of Fitzpatrick, McKenna, et al. (2018) that included IMIST-AMBO content that was initially developed by Ledema et al. (2012).

Electronic handoff tools sounded extremely useful because of the possibility to communicate electronically to the hospital, but they were not feasible for this ambulance service. The ambulance service previously made several attempts to transition to electronic transfer of EMS patient care reports to the receiving hospitals, but the hospitals had denied the attempts at leveraging technology in favor of the ambulance crew printing and then faxing EMS patient care reports to the hospital. Simulation and interdisciplinary training sessions could have been high-yield, but there were too many barriers of resources and organizational priorities for the ambulance crew and hospital staff. Standardized report-taking procedures for hospital staff had the possibility of improving handoff effectiveness, but QI affecting hospital processes was beyond the reach of this project.

Evaluation of outcomes was planned to be measured through pre- and post-surveys of handoff comfortability and self-efficacy. These outcome measures were selected because patient outcome data and hospital staff data were very difficult or impossible to obtain as an EMS agency, and the data collection period planned was two months with an estimated 20 to 30 responses.

Context

In the United States, volunteer ambulance services are the backbone of rural EMS. Rural EMS agencies face non-standardized care models, limited resources, resistance to alternative management processes, and regulatory requirements. Due to these hurdles, QI initiatives are poor within the culture of volunteer EMS. EMS professionals must have accessible education on QI, evidence-based data and quality metrics, and evidence-based tools to make change. The literature supported improvements in several areas of care, but of specific interest to this project was the transition of care between EMS and ED staff.

EMS-to-ED handoff is a point of critical information exchange in a chaotic healthcare environment. The body of literature examining EMS handoff education, tools, and quality improvement projects made many general recommendations for improvement. This QI project addresses specific needs of the targeted organization. By utilizing, implementing, and evaluating an evidence-based EMS-to-ED handoff tool, this project aims to improve interprofessional communication and comfortability in the handoff process for a rural, volunteer, southeastern Minnesota ambulance service.

Outcome Measures and Data Analysis Plan

The authors planned for project outcome measures and balancing measures to be assessed via surveys and manual audits of the number of turned-in handoff tools compared to the number

of patient transports. Parts of the survey and the handoff tool were adapted from the ED staff survey of Fitzpatrick, McKenna, et al. (2018). The measures chosen were developed to understand EMS comfortability in handoff in different scenarios, and to understand EMS perceptions of handoff qualities and ED staff receptiveness. Main measures were developed to be easily understood, closed-ended questions. The closed-ended questions allow for distinct interpretation of answers. Balancing measures were developed to be binary yes/no questions along with a space for open-ended feedback on the handoff tool.

These measures will seek to understand the feelings of crew members to allow the creation of a continuous quality improvement within an organization; the measures and not being used produce generalizable results. Likert Scale surveys with 5 categories were chosen because the data could be used as approximately continuous variables in data analysis, and the sums of likert scale data can be used to further analyze the data (Norman, G., 2010). A paired t-test was planned to analyze pre-post differences in individual survey responses. ANOVA analysis was planned for use during data analysis to assess the means of survey responses between two time periods. The goal was to assess “whether mean differences exist on multiple repeated scale variables by one or more categorical variables" (Intellectus Statistics, 2019).

The demographic and pre-implementation surveys will be supplied to members who attend a regularly scheduled ambulance meeting, so that there is a standardized experience for those being surveyed. After the ambulance meeting, an email will be sent to all those not in attendance with instructions to take the electronic survey within one week and then watch the attached education. The post-implementation surveys will again be handed out at a regularly scheduled ambulance meeting as well, and electronic surveys will again be sent to all of those not in attendance with instructions to take the survey within one week.

Implementation Plan

The aim of this QI project is to improve EMS comfortability and interprofessional communication within the EMS-to-ED handoff process by implementing a cost-effective, evidence-based handoff tool. The authors will present evidence and educate a southeastern Minnesota volunteer EMS crew on how to use the IMIST-AMBO tool. EMS crew members will be educated to take notes on the tool, and give handoffs in order of the mnemonic IMIST-AMBO. The outcome measures, process measures, balancing measures, and their operational definitions for this QI project are disseminated in Table D1. Surveys will be administered to the crew for pre-implementation and one month post-implementation of the tool (Appendix F). The data collected from the three surveys will be statistically analyzed using Intellectus Statistics (2019).

Weekly, the ambulance will be checked to ensure there are writing utensils and blank copies of the tools available to be used by the staff. Tools will be stocked within a storage clipboard. Copies of tools will also be left by the run-report. A reminder to use the handoff tool will be posted in the back of the ambulance.

Logic Model

A logic model was developed for this project to depict relationships from resource inputs, to activities, to outputs, and to outcomes throughout the project (Figure D2). Inputs included the literature review, partner agency efforts, project leaders and mentor efforts, and time investment. Following these inputs, come surveys, handoff tool implementation, and crew education activities. Outputs expected include survey response data, an educated crew, and an implemented handoff tool. Outcomes expected included increased relevant information transfer between EMS and ED staff and increased EMS crew understanding of the handoff process in the short term.

Intermediate and long term expected outcomes include increased efficacy and comfortability with the handoff process, and improved patient outcomes.

Work Plan

A formal project proposal was required by CSS for any DNP projects. Part of the proposal included a work plan, which consisted of seven phases from The Iowa Model (2017). The framework was used with permission from the authors of The Iowa Model and displayed in Figure D3. The phases consist of:

1. Identify Triggering Issues/Opportunities
2. State the Question or Purpose
3. Form a Team
4. Assemble, Appraise, and Synthesize Body of Evidence
5. Design and Pilot the Practice Change
6. Integrate and Sustain the Practice Change
7. Disseminate Results

Graduate Nursing Faculty broadly outlined the project timeline with scheduled synchronous classes and online forum discussions between classmates. These took place two to four times per month over three academic semesters. Table D2 provides a link to this QI project's Gantt-WSB chart.

Identify Triggering Issues and Opportunities. The first phase of the QI project focused on identifying the broad issue. Quality improvement for rural and volunteer EMS was researched. The project leaders chose standardized handoff in a rural EMS agency as the QI topic because of the identified need during the organization's needs assessment and SWOT analysis. Once the issues and opportunities were identified, the PICO question was developed.

State the Question or Purpose. Stating the question or purpose was the second phase of this QI project. The authors reinforced and reidentified the need for a standardized handoff tool within the potential agency. An EMS-to-ED standardized handoff tool was identified as a priority due to a brief search of the literature and informal input from the EMS crew and Ambulance Director. The question and purpose of the QI project evolved throughout the first four phases of the project and was finalized during the last two phases. The final PICO question is disseminated throughout this paper.

Form a Team. A team was formed early on in the project process, as the project leaders had been assigned two CSS project chairs with intention to involve the EMS agency's Ambulance Director and crew. The team for this project initially consisted of the two project leaders, the two CSS project chairs, the agency mentor (Ambulance Director), and the EMS crew members. Only one CSS project chair remained up until just before project implementation. Then, two new project chairs replaced the previous project chairs. Once identified and finalized, the project leaders continued through the framework.

Assemble, Appraise, and Synthesize Body of Evidence. For the third phase of the QI project's framework, a systematic review was conducted as previously described in the available knowledge methods section. The included evidence was deemed sufficient and was critically appraised using the appropriate JBI tool, so the project leaders moved on to the next phase.

Design and Pilot the Practice Change. During the fourth phase, the project leaders used data gathered from the literature review, personal knowledge of the agency, and knowledge of the main ED's patient intake forms to develop a standardized handoff tool. The project leads identified and noted available resources and potential barriers in a documented plan. The plan

was submitted for IRB approval at CSS. Once the IRB application was approved by the DNP chairs, project implementation began.

The plan was to survey, educate, and then implement change at the monthly ambulance meeting on April 10, 2023. Electronic surveys were to be sent to active members not in attendance at the meeting. Responses were to be transferred into a password-protected spreadsheet on the project leaders' laptops one week after the educational session. The survey process was planned to be completed again at the May 8th, 2023 ambulance meeting. Surveys were to be administered in-person and then emailed to active crew members not in attendance. Responses were to be transferred into a password-protected spreadsheet on the project leaders' laptops one week after the educational session.

The leaders planned to analyze the data using the Intellectus Statistics (2019) software and evaluate the EMS-to-ED handoff tool's use alongside crew feedback to determine if the change is appropriate for a long-term adoption into practice.

Integrate and Sustain the Practice Change. The second to the last phase included identifying and engaging key personnel, hardwiring change into the system, monitoring key indicators through QI, and reinfusing the need of the change (Iowa Model, 2017). If the EMS-to-ER handoff tool was decided to be kept by the key stakeholders, the tool would be modified as needed and used in daily practice. EMS crew feedback would be vital in determining the utility and adoption of the IMIST-AMBO handoff tool.

Disseminate Results. Final results of the QI project were to be disseminated to EMS crew members at the July 10, 2023 ambulance meeting. This would give the project leaders time to organize, analyze, and display the data in a poster format. By August 14, 2023, the QI project was planned to be electronically submitted to the Sigma Repository and the Doctoral Project

Repository. The project was planned to be presented to the CSS Graduate Nursing students as part of the program requirements by August 25, 2023.

Communication Matrix

The communication matrix is located within the Project Charter and Action Plan in Appendix A. It describes plans for communication between project leaders, primary stakeholders, and project chairs. The two project leaders communicated with each other at minimum every week throughout all phases of the project; plans for the future and summaries of what work had been accomplished was discussed. The primary stakeholder was the Ambulance Director. The Ambulance Director served as a mentor for the project leaders, and the Ambulance Director and project leaders met at minimum twice before implementing change. The project leaders communicated about once per month with the project chair via email or video conference; there were two formal meetings between the project chair and the project leaders during each of the three semesters that this project spanned.

Budget

This QI project did not accrue any exorbitant costs or increase the financial value of the EMS agency. One of the major expenditures related to this project was related to the paper, printer toner, and pens needed to disseminate and fill out the surveys and handoff tool. The project leaders assumed responsibility and absorbed any costs associated with the supplies mentioned above. If the EMS agency decides to permanently adopt this practice change, the agency will assume financial responsibility for necessary supplies. Education materials were created with already-purchased software. Intellectus Statistics (2019) was provided as part of the doctoral program at CSS, and it did not incur any additional cost to the EMS agency or project leaders.

Ethical Considerations

This was a quality improvement project that is aligned with the American Nurses Association Code of Ethics, National Association of Emergency Medical Technicians EMS Code of Ethics, National Association for Healthcare Quality Code of Ethics, and the Health Insurance Portability and Accountability Act regulations. As a part of this, the patients were recognized as the most vulnerable stakeholders of this project. These patients could have been anyone living in or passing through the ambulance's service area. The ambulance members and the ER staff were also considered in the ethical considerations.

This quality improvement project had minimal or no risk to all parties involved. Both completed CITI program ethics training, and this project underwent review and approval by CSS's Institutional Review Board (IRB). Potential vulnerable populations affected by this QI project included patients seeking EMS care. However, the intervention was non-invasive to the patients and aimed to only improve patient care. As a precaution, EMS crew were informed to revert back to prior individual handoff methods and immediately notify the project leaders and the Ambulance Director if the new handoff tool was interfering with or adversely affecting patient care. The project followed the ethical principles of beneficence, nonmaleficence, and justice.

The participants were informed that the survey data was to be used for QI for the ambulance service and a DNP project. Participants were informed that unidentifiable data could be read by the general public. No names or identifiers were collected from crew members who chose to participate in the surveys, and the demographic survey was not linked to the pre- and post-surveys. Participant confidentiality was upheld throughout the project. A consent was not used as this project was within the normal scope of work and training found at this agency.

Survey data was kept in a secured file, and any electronically stored information was password protected. There was inherently a risk to the privacy of the patients when documenting and exchanging private health information. The risk to privacy in this project did not exceed what is normal of EMS-to-ED handoff as patient name and date of birth are often written down in order to provide identifying information to ED staff. The tools filled out for each EMS-to-ED handoff were turned into the same box that patient face sheets, EKGs, and other ambulance run information was placed into after each patient encounter. This box was within the crew-quarters of the ambulance hall that is only accessible to individuals who have the pin-code to the hall doors. HIPAA compliance was previously taught to and expected of all crew members.

Both investigators are volunteers for the ambulance and employees of the main receiving hospital, but there were no conflicts of interest. Pen and paper surveys were to be used instead of electronic surveys; pen and paper were more accessible and user-friendly for the entire crew. The investigators were able to identify a few subjects based on the above answers or handwriting, but that was limited by having pre-selected choices that would not single out any one crew member. The questions had been formulated to limit highly identifying answers, but if the investigators identified an individual based on answers, they did not share the identification with others.

Results and Findings

Description of Implementation

A recruitment letter was emailed and text messaged explaining the project, the surveys, and publicity of the results was sent 48 hours prior to implementation to the entire ambulance roster list. This recruitment letter was also projected on the wall and handed to each table of personnel at the monthly ambulance meeting on April 10, 2023.

EMS personnel present at the meeting were then asked to complete the demographic and pre-implementation surveys immediately before handoff tool education. The Ambulance Director and project leaders answered questions posed by the crew members during the survey completion. 17 individuals were surveyed in-person on that day, and then the meeting attendance list was compared to the roster of active members. Nine active members who were not present for the ambulance meeting were emailed google forms surveys along with the recorded Google Slides presented at the ambulance meeting. Active members were subjectively selected by project leaders by looking at members who took call time in the last several months or would likely take call time in the next several months. The email list was given explicit instructions to complete the surveys within one week prior to watching the Google Slides for their reference. Four members replied to electronic surveys that added up to a cumulative 21 surveys completed at the pre-implementation phase. A project leader labeled each paper survey numerically 1 through 17 and then transferred responses to password-protected spreadsheets on the project leaders' laptops one week after the educational session.

All members of the crew were educated to utilize the IMIST-AMBO handoff tool for every patient handoff (in-person, or via emailed Google Slides) unless safety concerns were to present themselves. Writing utensils were stocked within a box adhered to a counter in the back of the ambulance. Handoff tools were stocked within a storage clipboard. Copies of the tools were also left by the run report lockbox. Two reminders to use the handoff tool were posted in the back of the ambulance, and one reminder was posted by the run-report lockbox that paperwork is turned into after every call. For two weeks, the ambulance was checked for enough handoff tools and writing utensils. Several months worth of handoff tools got printed off and

stocked alongside dozens of pens, so the supply stock was not a concern and weekly monitoring stopped.

The initial plan was to assess the post-implementation survey at the May ambulance meeting one month later with primarily in-person written services and secondarily electronic surveys. Following suggestions and permission from project faculty and permission from the Ambulance Director, the post-implementation survey was pushed back to the June 12, 2023 ambulance meeting. Both project leaders knew ahead of time that they would be unable to be present at the June ambulance meeting to assess surveys, so they planned ahead of time for the Ambulance Director to administer paper surveys to the crew during the June meeting. Unfortunately, circumstances surrounding the June meeting made the surveys impractical for the Ambulance Director to administer the surveys. There was a high-yield training opportunity presented to the crew that involved off-site water rescue and drowning practice, so the survey was deferred by the Ambulance Director until the project leaders could administer it.

The project leaders sent a Google Forms link for post-implementation surveys to emails and cell phones of the same 26 members on Saturday, June 17th at 11:00 a.m. These were the same people who were initially surveyed in-person and electronically. Only five surveys were received in one-week's time. A second email and text were sent on June 24th, and a third email and text were sent on June 25th; these second and third communications asked for valuable feedback and stated the last chance for survey participation was to be the night of June 25th.

Statistical analyses were completed through July 9th, 2023 using Intellectus Statistics (2019). Final results were disseminated to the rest of the DNP cohort via Zoom presentation on July 27th, 2023; the project also received final approval for IRB closure at that time. The project findings were disseminated to the project agency's crew members at the monthly ambulance

meeting on August 14th, 2023. Submission to the Sigma Repository and the Doctoral Project Repository was completed by August 25th, 2023.

Results from Data Collection

The demographic and pre-implementation surveys were administered at the same time to the same population; it yielded a total of 21 responses. The post-implementation survey yielded a total of 13 responses. In total, 34 sets of data were collected and underwent descriptive and statistical analyses.

MANOVA analysis of the Likert Scales was not shown because the data failed to meet the assumption of multivariate normality on Chi-square Q-Q plot for squared Mahalanobis distances. Multiple two-tailed Mann-Whitney two-sample rank-sum tests were conducted to examine whether there were significant differences between the pre- and post-implementation survey results (Intellectus Statistics, 2019). Paired Samples t-Test did not get used because the two-tailed Mann-Whitney was used because most of the data did not meet the assumption of normality required by the Independent Samples t-Test (Intellectus Statistics, 2019). Ideally, an independent t-test or MANOVA would have been conducted; however, the overwhelming majority of data collected were unable to meet the assumption of normality, so the Mann-Whitney test was used to promote the consistency of data reporting. An alpha-value of 0.05 was used to evaluate for acceptance or rejection of the null hypothesis.

Data Omissions. During the in-person survey period, one error was found in which “45 to 60” and “60+” for age demographics were options; as a group, “45 to 60” was changed to “45 to 59”, and the corrected value was input into the electronic survey prior to emailing to members not in attendance. Later, an error was found in the pre-implementation survey in which “7-9 months” and “9-12 months” were overlapping options, but nobody selected either of the options

in-person or via initial electronic surveys, and the error was corrected for the post-implementation survey. In the paper demographics survey, one member circled 50-99 and 100+ average hours per month; this was not omitted but rather entered as "50-99" into the demographics spreadsheet so as not to omit this information from a high-output member of the team. The pre-implementation electronic survey also allowed for multiple responses within the Likert Scale answers; one respondent answered both "disagree" and "neutral" for the question "My EMS-to-ED handoffs are not interrupted". In order to minimize bias, both of this respondent's answers to this question were omitted from the final spreadsheet.

Several answers on demographic surveys, pre-implementation, and post-implementation surveys were left blank. Blank answers were omitted from the final spreadsheet, this data was omitted from final calculations and averages. The post-implementation survey had additional spaces for free-text comments that were intended to be optional. One of the additional free-text questions was incidentally programmed as mandatory, so several answers such as "no" or "N/A" were collected.

Once all of the surveys were submitted to the project leaders, statistical analysis was completed using the Intellectus Statistics (2019) software. Evaluation of the EMS-to-ED handoff tool's use, crew feedback, and the Ambulance Director's discretion determined if the change was appropriate for a long-term adoption into practice.

Demographics

Descriptive statistics were calculated to examine the respondents' age range, level of education and EMS certification, years of experience in EMS, and previous handoff training. Demographic data is displayed in Table 4. Frequency distributions and percentages for the ordinal and nominal variables (i.e., "How long ago did you last give an EMS-to-ED handoff?";

"On average, how often do you give an EMS-to-ED handoff?"; "Have you ever given an EMS-to-ED handoff with the IMIST-AMBO handoff tool?"; "Do you think this crew's handoffs are too long? "; and "Do you think this crew's handoffs are too short?") are displayed in Table 5.

Table 4

Demographic Survey Responses

Variable	Frequency
What is your age?	
25 or less	4 (19.05%)
26-44	10 (47.62%)
45-59	5 (23.81%)
60+	2 (9.52%)
Missing	0 (0%)
What is your highest level of college education?	
No College Degree	3 (14.29%)
Associate's Degree	5 (23.81%)
Bachelor's Degree	10 (47.62%)
Master's/Doctorate Degree	2 (9.52%)
Missing	1 (4.76%)
What is your highest EMS certification/licensure?	
EMR	2 (9.52%)
EMT	17 (80.95%)
Paramedic	1 (4.76%)
Missing	1 (4.76%)
How many years have you worked or volunteered in EMS?	
1-4 years	10 (47.62%)
5-9 years	5 (23.81%)
10+ years	6 (28.57%)
Missing	0 (0%)
How many years have you volunteered for this agency?	
< 1 year	1 (4.76%)
1-4 years	9 (42.86%)
5-9 years	7 (33.33%)
10+ years	4 (19.05%)
Missing	0 (0%)
On average, how many hours per month do you volunteer for this EMS agency?	
Less than 25	3 (14.29%)
25-49	4 (19.05%)
50-99	8 (38.10%)
100+	6 (28.57%)
Missing	0 (0%)

Table 4

Demographic Survey Responses

Have you worked with acutely sick or injured patients outside of this EMS agency?	
Yes	14 (66.67%)
No	6 (28.57%)
Missing	1 (4.76%)
Have you worked for a career or paid EMS entity as an EMR, EMT, or Paramedic?	
Yes	4 (19.05%)
No	17 (80.95%)
Missing	0 (0%)
Have you received training in the handoff process?	
Yes	14 (66.67%)
No	6 (28.57%)
Missing	1 (4.76%)
Have you received training in the handoff process from this agency?	
Yes	13 (61.90%)
No	7 (33.33%)
Missing	1 (4.76%)

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

Table 5

Frequency Table for Nominal and Ordinal Variables

	Test Period	
Variable	Pre	Post
How Often		
Weekly	7 (33.33%)	5 (41.67%)
Monthly	10 (47.62%)	6 (50.00%)
Every 3 Months	3 (14.29%)	1 (8.33%)
Every 6 Months	1 (4.76%)	0 (0%)
Missing	0 (0%)	0 (0%)
Last Handoff		
0-3 Months	19 (90.48%)	12 (100.00%)
4-6 Months	2 (9.52%)	0 (0%)
Missing	0 (0%)	0 (0%)
IMIST AMBO Used		
Yes	0 (0%)	10 (83.33%)
No	20 (95.24%)	2 (16.67%)

Table 5

Frequency Table for Nominal and Ordinal Variables

	Test Period	
Variable	Pre	Post
Missing	1 (4.76%)	0 (0%)
Too Long		
Yes	1 (4.76%)	2 (16.67%)
No	14 (66.67%)	10 (83.33%)
Unsure	5 (23.81%)	0 (0%)
Missing	1 (4.76%)	0 (0%)
Too Short		
Yes	2 (9.52%)	3 (25.00%)
No	10 (47.62%)	8 (66.67%)
Unsure	8 (38.10%)	1 (8.33%)
Missing	1 (4.76%)	0 (0%)

Note. Due to rounding error, percentages may not sum to 100%.

Handoff Qualities, EMS Handoff Comfortability, and ED Receptiveness

Tables 6, 8, and 10 show frequency of responses response frequencies for the Handoff Qualities, EMS Handoff Comfortability, and ED Receptiveness to Handoff Likert Scales.

Tables 7, 9, and 11 show results of analysis of the Likert Scale responses via two-tailed Mann-Whitney U tests. This test was performed by turning the 5-point ordinal Likert Scale answers into scale variables of 1, 2, 3, 4, and 5. All 13 Likert Scale responses showed improvement from pre-intervention period to post-intervention period, but this was not significant because all p-values were greater than 0.05.

Table 6

Frequency Table for Handoff Qualities

Variable	Test Period	
	Pre	Post
My EMS-to-ED handoff is structured.		
Strongly Agree (5)	3 (14.29%)	4 (33.33%)
Agree (4)	9 (42.86%)	6 (50.00%)
Neutral (3)	6 (28.57%)	2 (16.67%)
Disagree (2)	3 (14.29%)	0 (0.00%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
My EMS-to-ED handoff is standardized.		
Strongly Agree (5)	3 (14.29%)	4 (33.33%)
Agree (4)	5 (23.81%)	3 (25.00%)
Neutral (3)	8 (38.10%)	4 (33.33%)
Disagree (2)	4 (19.05%)	1 (8.33%)
Strongly Disagree (1)	1 (4.76%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
My EMS-to-ED handoff is focused		
Strongly Agree (5)	2 (10.00%)	4 (33.33%)
Agree (4)	8 (40.00%)	5 (41.67%)
Neutral (3)	9 (45.00%)	3 (25.00%)
Disagree (2)	1 (5.00%)	0 (0.00%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	20 (100.00%)	12 (100.00%)
My EMS-to-ED handoffs are not repetitive.		
Strongly Agree (5)	2 (10.00%)	2 (16.67%)
Agree (4)	6 (30.00%)	3 (25.00%)
Neutral (3)	9 (45.00%)	5 (41.67%)
Disagree (2)	3 (15.00%)	2 (16.67%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	20 (100.00%)	12 (100.00%)
My EMS-to-ED handoffs are not interrupted.		
Strongly Agree (5)	0 (0.00%)	1 (8.33%)
Agree (4)	2 (10.53%)	3 (25.00%)
Neutral (3)	9 (47.37%)	5 (41.67%)
Disagree (2)	6 (31.58%)	3 (25.00%)
Strongly Disagree (1)	2 (10.53%)	0 (0.00%)

Table 6

Frequency Table for Handoff Qualities

Variable	Test Period	
	Pre	Post
Total	19 (100.00%)	12 (100.00%)

Note. Due to rounding error, percentages may not sum to 100%.

Table 7

Two-Tailed Mann-Whitney Test by Pre- and Post-Implementation Handoff Qualities

Variable	Pre		Post				
	Mean Rank	*n*	Mean Rank	*n*	*U*	*z*	*p*
My EMS-to-ED handoff is standardized.	15.21	21	20.12	12	88.50	-1.46	.145
My EMS-to-ED handoff is structured.	14.86	21	20.75	12	81.00	-1.79	.073
My EMS-to-ED handoff is focused	14.38	20	20.04	12	77.50	-1.77	.077
My EMS-to-ED handoffs are not repetitive.	16.32	20	16.79	12	116.50	-0.14	.885
My EMS-to-ED handoffs are not interrupted.	14.08	19	19.04	12	77.50	-1.58	.115

Table 8

Frequency Table for EMS Handoff Comfortability

Variable	Test Period	
	Pre	Post
I feel prepared to give an EMS-to-ED handoff.		
Strongly Agree (5)	7 (33.33%)	6 (50.00%)
Agree (4)	11 (52.38%)	6 (50.00%)
Neutral (3)	3 (14.29%)	0 (0.00%)
Disagree (2)	0 (0.00%)	0 (0.00%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
I feel comfortable giving EMS-to-ED handoffs for routine transports.		
Strongly Agree (5)	8 (38.10%)	7 (58.33%)
Agree (4)	10 (47.62%)	5 (41.67%)
Neutral (3)	3 (14.29%)	0 (0.00%)

Table 8

Frequency Table for EMS Handoff Comfortability

Variable	Test Period	
	Pre	Post
Disagree (2)	0 (0.00%)	0 (0.00%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
I feel comfortable giving EMS-to-ED handoffs for medical resuscitations.		
Strongly Agree (5)	4 (19.05%)	4 (33.33%)
Agree (4)	10 (47.62%)	5 (41.67%)
Neutral (3)	4 (19.05%)	3 (25.00%)
Disagree (2)	3 (14.29%)	0 (0.00%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
I feel comfortable giving EMS-to-ED handoffs for trauma resuscitations.		
Strongly Agree (5)	4 (19.05%)	4 (33.33%)
Agree (4)	7 (33.33%)	5 (41.67%)
Neutral (3)	7 (33.33%)	2 (16.67%)
Disagree (2)	3 (14.29%)	1 (8.33%)
Strongly Disagree (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)

Note. Due to rounding error, percentages may not sum to 100%.

Table 9

Two-Tailed Mann-Whitney Test by Pre- and Post-Implementation EMS Comfortability

Variable	Pre		Post				
	Mean Rank	*n*	Mean Rank	*n*	*U*	*z*	*p*
Prepared	15.57	21	19.50	12	96.00	-1.25	.210
Routine	15.43	21	19.75	12	93.00	-1.37	.171
Medical Resus	15.81	21	19.08	12	101.00	-1.00	.319
Trauma Resus	15.48	21	16.97	12	94.00	-1.25	.211

Table 10

Frequency Table for ED Receptiveness to Handoff

	Test Period	
Variable	Pre	Post
ED staff value the information I convey during EMS-to-ED handoff.		
Always (5)	2 (9.52%)	0 (0.00%)
Often (4)	6 (28.57%)	7 (58.33%)
Sometimes (3)	13 (61.90%)	5 (41.67%)
Rarely (2)	0 (0.00%)	0 (0.00%)
Never (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
ED staff take the time to listen to my EMS-to-ED handoff.		
Always (5)	2 (9.52%)	0 (0.00%)
Often (4)	5 (23.81%)	7 (58.33%)
Sometimes (3)	14 (66.67%)	5 (41.67%)
Rarely (2)	0 (0.00%)	0 (0.00%)
Never (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
I am treated with respect by ED staff when giving EMS-to-ED handoffs.		
Always (5)	2 (9.52%)	1 (8.33%)
Often (4)	9 (42.86%)	8 (66.67%)
Sometimes (3)	10 (47.62%)	3 (25.00%)
Rarely (2)	0 (0.00%)	0 (0.00%)
Never (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)
ED staff allows me to finish my handoff before interrupting with questions.		
Always (5)	0 (0.00%)	0 (0.00%)
Often (4)	11 (52.38%)	7 (58.33%)
Sometimes (3)	8 (38.10%)	4 (33.33%)
Rarely (2)	2 (9.52%)	1 (8.33%)
Never (1)	0 (0.00%)	0 (0.00%)
Total	21 (100.00%)	12 (100.00%)

Note. Due to rounding error, percentages may not sum to 100%.

Table 11

Two-Tailed Mann-Whitney Test by Pre- and Post-Implementation EMS Comfortability

	Pre		Post				
Variable	Mean Rank	*n*	Mean Rank	*n*	*U*	*z*	*p*
ED Value	16.12	21	18.54	12	107.50	-0.79	.432
ED Listen	15.83	21	19.04	12	101.50	-1.05	.293
ED Respect	15.81	21	19.08	12	101.00	-1.04	.296
ED Interrupt	16.64	21	17.62	12	118.20	-0.32	.752

Outcome, Process, and Balancing Measures

This section will focus on reporting the outcome, process, and balancing measures of the measures previously noted in Table D1 using information provided by descriptive and Mann-Whitney U test analyses.

Outcome Measures. The outcome measures for this project focused on percentages of change in handoff qualities, EMS comfortability, and ED receptiveness pre- and post-implementation of the IMIST-AMBO handoff tool. Percentages were calculated by averaging the respondents who “agree” or “strongly agree” with the corresponding survey questions. These results are disseminated in Table 12 and organized by each broad category of outcome measures (i.e., handoff qualities, EMS comfortability, and ED receptiveness). The “Percent Change” column identifies if a positive or negative difference was noted in the pre- and post-implementation periods; all three outcome measures experienced a percentage increase.

Table 12

Outcome Measures Pre- and Post-Implementation

Variable	Test Period		Percent Change
	Pre	Post	
Percent of change in respondents who "agree" and "strongly agree" their handoff is perceived as structured, standardized, focused, not repetitive, and not interrupted (i.e., handoff qualities).	19.58%	29.17%	+9.59%
Percent of change in respondents who answered "agree" or "strongly agree" in EMS comfortability for giving handoff (i.e., EMS comfortability).	36.31%	43.75%	+7.44%
Percent of change in respondents who answered "agree" or "strongly agree" the perceived communication qualities of EMS-to-ED handoff (i.e., ED receptiveness).	22.02%	31.25%	+9.23%

Process Measures. The percentage of respondents who had given handoff since handoff tool implementation was 83.33%. The percentage of the EMS crew who received in-person EMS-to-ED handoff education was 68%; education provided independently via emailed Google Slides presentation was 16%. A combined total of 84% of the volunteer EMS crew received education on the IMIST-AMBO handoff tool as evidenced by the number of individuals who complete the pre-implementation surveys. The percentage of active EMS crew members who completed the demographic and pre-implementation surveys was 84%. The post-implementation survey received less participation, with a 48% response rate. 41 IMIST-AMBO handoff tools were submitted for collection by the project leaders between April 10, 2023 at 8:00pm to July 3, 2023 at 8:00pm. In that time frame, there were 74 ambulance calls that were billed for service. 48 patients were treated and transported to the hospital, and three patients were treated and transferred to another ambulance service. 23 of these 74 ambulance calls involved assessment or

treatment of patients with no transport of patients to a hospital or other ambulance service. There were likely handoff tools submitted for 41/51 appropriate calls.

Balancing Measures. The percentage of respondents who thought the EMS crew's handoffs were too long was 4.76% pre-implementation and 16.67% post-implementation of the IMIST-AMBO handoff tool. The percentage of respondents who thought the EMS crew's handoffs were too short was 9.52% pre-implementation and 25% post-implementation of the IMIST-AMBO handoff tool. 100% of respondents in the post-implementation survey reported that using the IMIST-AMBO handoff tool did not negatively impact patients. 83% of post-implementation respondents thought that using the IMIST-AMBO handoff tool did not negatively impact EMS or ED staff; 17% thought it did and three comments were made explaining the responses. One comment stated that some of the ED staff "would start to tune out" and "I got a few eye rolls from the nursing staff". One comment shared indifference, and one comment stated that "the age of the patient may affect staff decision making." 91% of post-implementation respondents reported that they thought the IMIST-AMBO handoff tool should be used to lead every EMS-to-ED handoff; 9% disagreed.

Interpretation of the Results

Demographics

From 84% response rate pre-implementation to 48% response rate post-implementation is concerning for bias and may make it difficult for the data to meet assumptions of normality. The Mann-Whitney U is a very reliable test to use for this distribution of data, but none of the Likert-Scale questions changed significantly from pre-intervention to post-intervention ($p > 0.05$). It is insightful that 29% of the crew had never received training in the handoff process. This points towards a need for education to improve handoff. In general, the volunteers are 26 to

44-year-old EMT's with bachelor's degrees who volunteer more than 50 hours per month. 66% of the crew members have worked with acutely sick or injured patients outside of this agency, and 29% of the crew has more than 10 years of experience in EMS. 80% of the crew has never worked for a career or paid EMS entity.

The crew is generally college educated individuals with experience caring for acutely ill patients outside of this service. But, it is important to note that 33% of the crew does not have work experience with acutely ill patients outside of this service. This seems to indicate that this ambulance service is the only source of medical training and practice that one-third of the crew has. With only a couple hours of education and an estimated five hours of active patient care time per month, maintaining competency with handoff is challenging.

Outcome, Process, and Balancing Measures

The domain of handoff qualities showed a general increase in respondents who "strongly agree" that their handoff is structured, standardized, and focused increased substantially. There was an 18% increase in respondents who "strongly agree" that their handoff is structured; a 19% increase in respondents who "strongly agree" that their handoff is standardized; and a 23% increase in respondents who "strongly agree" that their handoff is focused. This could indicate that implementing a standardized tool and providing education to the volunteer EMS crew clearly set expectations for EMS-to-ED handoff.

There was a 12% increase in survey respondents who think the crew's handoffs are too long, and there was a 15% increase in survey respondents who think the crew's handoffs are too short. In summary, there are more people who think the handoffs are too long, and there are more people who think the handoffs were too short. This was a very interesting development and requires further investigation to understand the phenomenon. Because far fewer people answered

"unsure" to these questions, the crew may have acquired enough knowledge or experience to express their opinions on the length of handoff. This suggests that more people have opinions or are able to express their opinions about handoff, and this should help with future developments.

With a standardized process being completed by EMS, the EMS and ED staff could come to develop a common expectation for consistent, concise, and relevant information transfer during handoff. But, because the ED staff worked with this ambulance crew for only a small fraction of their handoffs, this common understanding seems unlikely to develop spontaneously. To develop this common understanding, further attempts at communication between organizational leadership may be helpful. Because the process is now standardized and has defined expectations, improvement in the future should be much easier to develop. This project sets a baseline that the crew can work to improve upon.

Literature Comparison

The demographic data for this QI population was similar to Cash et al.'s (2019) study, which had a much larger sample size. Cash et al. (2019) reported an average volunteer EMS age of 41 years old, while 47% age of this EMS agency was between 26 and 44 years old. The percentage of volunteer EMT certification was nearly the same in this agency versus nationally (81% versus 82% nationally). 28% of volunteer EMS in Cash et al.'s (2019) study had an associate degree, while this agency's crew consisted of 24% associate's degree education. An interesting difference between the national volunteer demographics noted in Cash et al.'s (2019) article and this QI project, was the percentage of volunteer EMS professionals that had a bachelor's degree or higher. 37% of volunteer EMS nationally had a bachelor's degree or more, while this agency boasted an impressive 57.14%. The higher level of education of this EMS agency may be attributed to the geographical area and proximity to a tertiary medical center.

Despite this increase in education level, almost a quarter of the volunteer EMS personnel had never received EMS-to-ED handoff training, which supports the previously mentioned gap in knowledge related to this skill.

The interventions of this project had to be highly individualized because of organizational barriers and needs of the ambulance service. Fitzpatrick et al. (2018) used a similar prompting tool for ambulance crew members, but also included more collaboration with the ED staff. The ED staff had note-taking sheets provided based on the IMIST-AMBO handover mnemonic for pre-alert and bedside handoff (Fitzpatrick et al., 2018). Most of the results reported by Fitzpatrick et al. (2018) revolved around ED staff perceptions or objective measures content in pre-alerts; these were not feasible measures for this project. In Fitzpatrick et al. (2018), 72% of the ambulance respondents reported that the handover components of their tool was “useful” to “very useful” on a Likert Scale. A similar measure in this project showed that 91% of respondents believed that the implemented handoff tool should continue to be used for every EMS-to-ED handoff. In hindsight, using a Likert scale of usefulness may have been helpful to understand the feelings of the ambulance crew.

In comparison, this QI project did not include ED staff because of organizational barriers. This project used a larger, paper form as opposed to a laminated card used in the Fitzpatrick et al. (2018) study. These adaptations were necessary to meet the needs of this targeted organization. This project did not use a shared mnemonic as a shared mental model like Fitzpatrick et al. (2018) did in their study, but the tool used in this project was adapted to target the information on the emergency department’s pre-alert intake forms. This project also ensured that the information during handoff includes the same information in the emergency department’s standardized trauma report guideline.

Discussion

Of note, the one crewmember who thought IMIST-AMBO should not be used for every handoff came to the project leaders personally to identify herself for the project leaders and for the readers of the paper. This crew member, a professional paramedic who volunteers on this service, did not use the tool for her handoffs during the implementation. She expressed indifference towards the tool, and on the survey this member wrote "I truthfully believe I have my flow of handoffs already and I had a very hard time trying to transition to another format". This is not an unexpected response from very experienced crew members; this tool format is thought to improve the performance of less-experience crew members more than experienced professionals. Further discussion will be important.

The main findings of this project included a general increase in handoff qualities, EMS comfortability, and ED receptiveness after implementing the IMIST-AMBO handoff tool. 91% of the respondents think this tool should be used to lead every EMS-to-ED handoff; this is evidence that the crew finds this QI project highly relevant. Additionally of note, 29% of the pre-implementation respondents had never received *any* form of handoff training and 80% of the crew had never worked in a paid-EMS role. The average crew member volunteered more than 50 hours per month, was 26 to 44 years old, an EMT, and possessed a bachelor's degree. There was a 10-15% increase in survey respondents who thought the crew's handoffs are too long between the implementation periods.

Contributions to the Profession of Nursing

This project shows promise in the utility of nursing knowledge when it comes to quality improvement in the prehospital environment. The intervention in this project came from the culmination of the best evidence, but the literature did not paint a clear guide. It was up to the

two project leads developing this project to assess all components of the organization to decide which of the widely-recommended interventions could lead to real impact. This project shows the feasibility of a nurse creating change in EMS where the best practice is ambiguous. Involved nurses can vanguard further quality initiatives across the healthcare system, even in highly variable and highly individual rural, volunteer ambulance services.

Recommendations

There is not high level evidence or generalizable knowledge gained from this project, but this crew showed a great willingness to participate in the change. 91% of final survey respondents thought this tool should continue to be used for every EMS-to-ED handoff. The ambulance director is very supportive of continuing this initiative, and multiple crew members have expressed interest in continuing the tool and creating a dry-erase form that can be used. This tool will remain in use and continue to be developed. Going forward, the crew has the ability to print copies of the tool as needed. The tool will continue to be used, and feedback will be given informally to the Ambulance Director and project leads.With luck, this service will work with ED staff in future QI projects.

Similar projects should be replicated with other volunteer services and disseminated to further the volunteer EMS evidence-base. If a similar project is implemented in other volunteer ambulance services in the future, there must be an understanding of what it takes to get sufficient survey responses by crew members. Results may vary depending on the culture of the service, but with this agency, the survey collections absolutely must happen during a regularly scheduled meeting to ensure adequate responses. It is not reasonable to expect volunteers to have to go above and beyond their time spent serving the community. Assuring that surveys are answered

in-person would also help decrease the attrition rate, which is something noted in the post-implementation portion of this project.

It is important that future initiatives recognize the importance of aligning with the personality-driven leadership that is so common in volunteer EMS; support from this agency's Ambulance Director was vital to the project's success. EMS crews replicating this QI project should work with ED staff, in order to gain perspective, monitor receptiveness, and further validate the tool. Volunteer EMS agencies must acknowledge the utility and importance of QI.

Dissemination

Dissemination is integral to the development of evidence-based practice because it clarifies the purpose of the project, provides information and insight for potential use by others, generates awareness for the practice change, and generates interest for project expansion in the form of grants and large-scale research (Reavy, 2016, p. 242). This DNP project was submitted to both the Sigma Repository and the Doctoral Project Repository. In addition, results were formally presented to the authors' cohort of graduate nursing students and to the EMS crew of the participating agency. With dissemination, this project has potential to be enhanced and added to by future DNP students. Finally, the authors plan to pursue publication in an academic journal and will attempt to implement the IMIST-AMBO handoff tool to regional and statewide volunteer EMS agencies.

Limitations

This QI project has limitations, potential for bias, and is not considered research. With that in mind, all data collected and statistically analyzed is not generalizable. Additionally, a validated handoff tool specifically for volunteer EMS was absent in the literature. The presence of a validated tool or previous study protocol would have been helpful in contributing to the

evidence-base with the potential for project repeatability. Unfortunately, going from 84% response rate pre-implementation to 48% response rate post-implementation is concerning for bias and may make it difficult for the data to meet assumptions of normality during statistical analysis.

Attempts to decrease the risk for bias were considered and implemented as appropriate by the project leaders. The project leaders promoted anonymity, but the population of interest (n = 25) was small and the ambulance crew were acquainted with the project leaders, so anonymity was not guaranteed for all responses. The project design depended on data collected from surveys which posed a risk for sampling and response biases. Further limitations included the project's small sample size and time constraints.

Conclusion

As the need for volunteers to fill the gap in rural emergency care increases, it is vital to consider the unique challenges these EMS agencies face. Limited training, resources, practice, and time make QI a challenging but necessary endeavor for EMS. The lack of explicitly defined, evidence-based performance measures causes substantial variability in how metrics are tracked as indicators of quality in EMS agencies. Additionally, EMS professionals must have accessible education on QI, evidence-based data and quality metrics, and evidence-based tools to make system change.

Coordination and transitions of care is an essential domain for EMS performance improvement. Patient handoff falls within this domain and is the process where a healthcare professional transfers responsibility and accountability for care of a patient to another healthcare professional. EMS-to-ED handoff improvement aligned with the volunteer agency’s needs. This was a feasible project that was well-used and highly-supported by the crew members. The review

of current literature does not show a validated EMS-to-ED handoff tool for volunteer EMS; however, this project used the IMIST-AMBO handoff tool and tailored it to the needs of the project agency. Further QI and research must assess the best handoff tool for volunteer EMS and validate its impact on patient care.

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Appendix A

DNP Project Charter/Action Plan

Project Title: Volunteer EMS-to-ED Handoff: A Quality Improvement Project

Project Members: Brooke Cote and Matthew Kraus

Project Organization/Agency: Eyota Volunteer Ambulance Service

DNP Project Agency Approval Form: DNP Project Agency Approval Form (Su22)

Agency Specific Requirements for the DNP Student Project and Link to Agency Page Describing Requirements: N/A

Project Champions: Dr. Lisa Starr, Dr. Rhea Ferry, Dr. Christopher Kemnitz, Dr. Matthew Nygren, and Dr. Christopher Arendt

Project Start Date: September 6, 2022

Projected Date of Project Completion: August 7, 2023

Project Charter: Final DNP Project Charter

Contact Information

Team member Name	Location/Time Zone	Phone Number	Email/Tweet	Communicate Best Via	Project Lead Role
Brooke Cote	Rochester, MN (CST)	(218) 404-6500	bcote@css.edu	Text, Email, or In-Person	Joint Leadership
Matthew Kraus	Rochester, MN (CST)	(507) 993-8484	mkraus1@css.edu	Text, Email, or In-Person	Joint Leadership

Ground Rules

1) The team will communicate via group text, email, google documents, and Zoom meetings (see chart above).
2) Assignments will be completed by individual or group-decided deadlines (see chart below).
3) If any issues arise with deadlines, it must be communicated with all team members. (“Communication is Key”)
4) The designated Project Leader will be the sole person to submit the team assignment before/on submission due date.
5) The Project Leader for each project will rotate each semester to allow multiple students to experience the lead role responsibilities.
6) The Project Leader will initiate contact, delegate tasks, and assign team roles for their assigned project.

7) Team members will keep each other accountable and on task via weekly communication via text message in a respectful and considerate manner.
8) If any issues arise, team members will address this directly via email, zoom, tweet or text to allow for open communication between all members and to help each other out when needed. Further issues can be discussed as a team with the professor for additional guidance and feedback.
9) Team members will recognize each other's strengths and weaknesses and will understand and use these skills accordingly to work together to complete team projects.
10) Team members will recognize each other's strengths and weaknesses and will appreciate the evolution of individual growth.
11) Upon project completion each student will reflect on strengths and weaknesses that have evolved throughout the project work.
12) Feel free to explore materials and resources outside the ones provided in this course to develop your project and leadership skills.

Leadership

As you embark on your DNP project you will evolve into a "transformational leader", you should aim to inspire confidence, respect and trust into your project communications to assure an optimal project outcome. Role clarity is key with a group or team as it increases adaptation of team members through interdependence, integrity and relational growth all of which contribute to the achievement of identified common goals (Reavy, 2016). If you have determined that you will pursue an individual project, the team leader "will be you"! For a group effort of multiple students working on a single project, a team leader will need to be identified upon determining your project team. Determining the individual strengths and weaknesses of each team member will aid in identifying which team member may lead a specific project component.

Soon after the formation of your team, enter your impression of your own strengths and weaknesses, then of your entire team's strengths and weaknesses collectively, if applicable. Consider individual skills, leadership qualities or any other unique contributions for carrying out a large project.

Project Member's Name	**Strengths**	**Weaknesses**
Brooke Cote	● Academic writing ● Literature reviews ● EMS and ED RN perspective ● Focusing on specific tasks	● Being patient and open to communication ● Looking at the "big picture" (i.e., tunnel vision) ● Indecisive ● Teamwork
Matthew Kraus	● Systems Thinking ● Seeking, Providing Feedback	● Individual Focus ● Disorganized Methods

	• Facilitating Group Discussion, Understanding, Unified Focus • Replicable Literature Reviews, Projects	• Exhaustive Literature Reviews

As a Team	• EMS and RN perspectives
	• Goal-directed
	• Attention to detail
	• 2 differing opinions on priorities (helps in gaining multiple angles to view a problem)
		• Mismatched priorities
		• Not staying focused on specific topic (we like to get ahead of ourselves with this project)
		• Our differences in work style
		  ○ Brooke: Independent thinker, impatient, often forgets to include other team members in big decisions
		  ○ Matthew: Team thinker, likes to talk things out step-by-step, loses focus on singular tasks

Timeline

Review the DNP Project Schedule/checklist Update this table **prior to meeting with your Project Chair** as this document will serve as an informational guide to the project process through its evolution. (deadline dates and or revisions can vary/change as needed with proper group communication)

Course	**Project Task**	**Person Responsible**	**Draft Completion Date**	**Submission/ Due Date**
8201	Scholarly Paper 1a	Brooke	10/1/22	10/2/22
	Literature Matrix	Brooke/Matthew	10/9/22	10/10/22
	Gap Analysis/Needs Assessment	Matthew	10/20/22	10/23/22
	SWOT Analysis Table & Overview	Matthew	10/20/22	10/23/22
	Scholarly Paper 1b	Brooke	10/20/22	10/23/22
	Final Presentation	Matthew	11/27/22	11/29/22
	Scholarly Paper 1c	Brooke	12/02/22	12/04/22

	DNP Project Approval Form	Brooke/Matthew	12/10/22	12/11/22
8206	Project Goals, Recommendations, Outcomes, & Objectives Discussion	Brooke/Matthew	01/22/23	01/24/23
	Scholarly Paper 6a	Brooke	01/25/23	01/29/23
	DNP Project Approval Form	Brooke	12/10/22	02/05/23
	Measures and Data Analysis Discussion	Matthew	2/05/23	02/07/23
	Implementation Plan & Logic Model Discussion	Matthew	2/19/23	02/21/23
	Ethical Considerations Discussion	Matthew	2/26/23	02/28/23
	Project Pitch PowerPoint	Matthew	2/05/23	02/07/23
	Scholarly Paper 6b	Brooke/Matthew	03/03/23	03/05/23
	Project Proposal PowerPoint	Matthew	03/05/23	03/06/23
	First Draft of IRB Application	Brooke	02/20/23	03/12/23
	Final Project Charter Discussion	Brooke	03/17/23	03/21/23
	Final IRB Application	Brooke/Matthew	03/24/23	03/26/23
	Scholarly Paper 6c	Brooke/Matthew	04/07/23	04/09/23
	Final Project Charter Action Plan	Brooke/Matthew	04/07/23	04/09/23
	Begin Project Implementation	Brooke/Matthew	04/07/23	04/10/23
	3MT TedTalk	Brooke/Matthew	04/20/23	04/23/23
8207	Scholarly Paper 7a	Brooke/Matthew	05/27/23	05/28/23
	Scholarly Paper 7b	Brooke/Matthew	06/25/23	06/25/23
	DNP Project Poster	Brooke	07/07/23	07/09/23
	Project 3MT	Matthew	07/14/23	07/16/23
	Scholarly Paper 7c	Brooke/Matthew	07/20/23	07/23/23
	Final Project Charter/Action Plan	Brooke/Matthew	07/22/23	07/23/23
	Final Project Evaluation Form	Brooke/Matthew	07/23/23	07/23/23

	IRB Protocol Closure Report	Brooke	07/30/23	07/30/23
Notes				

Project Communication Matrix

Ask your sponsor/s HOW they want you to share your progress (e.g., memo, email, video, discussion) and how OFTEN (e.g., twice per term, every other month, etc). Do they want to be a part of your meetings with the project chair? You also need to ask how they want your final results (e.g., 1-page summary, poster, the scholarly paper, 3-minute video).

ID #	Purpose/Objectives	Method Of Communication	Frequency	Recipients	Person Responsible	Notes
	Touch base monthly with a formal meeting over zoom twice per semester.	Email	Monthly	Project Chairs	Brooke	
	Meet at least once during design and planning phases. Email resources/updates that may be of interest.	In-person, E-mail	As Needed	Primary Stakeholder (Mentor, Ambulance Director)	Matthew	
	Text, or in-person discussion. Discuss where we are weekly, and make plans for when we will discuss & work on certain parts of the project.	Text, in-person	Weekly	Team Members Co-Communication	Matthew	

Project Evaluation

Post Project, toward the end of 8207, reflect on your own strengths and weaknesses and then your entire team's strengths and weaknesses collectively. This can be related to individual skills, leadership qualities or any other unique contributions that you feel was beneficial for carrying out a large project.

Project Member's Name	Strengths	Weaknesses
Brooke Cote	• Literature search and appraisal • Disseminating results • Graphic designs for poster/3MT • APA 7th edition formatting • Experience writing academic papers	• Communicating patiently with team member • Finding and dedicating time to work solely on the project • Working ahead without wholly considering partner's point of view
Matthew Kraus	• Systems Thinking • Seeking, Providing Feedback • Facilitating Group Discussion • Replicable Literature Reviews, Projects • Stakeholder Communication/Presentation	• Definitive Forward Action • Disorganized Methods • Providing Direction and Focus to Team Activities • Managing Team Time
Entire Team	• Good relationship with partner agency • Passionate about volunteer EMS • Generally easy-going and able to adapt to situations when needed	• Conflicting priorities of team members • Direction and focus in team activities • Coordinating schedules with each team member to dedicate time to working on the project

Write a comprehensive yet concise reflection (toward the end of 8207) by answering the following questions. *Each team member is to write a reflection.* See how to write a reflection.

1. How have strengths & weaknesses evolved from the beginning of your project to the end project?
2. What high and/or low points will help you move forward in any future leadership endeavors?

Name: Brooke Cote
Reflection: The strengths at the beginning of our project focused mainly on specific skills and personality traits. Throughout the project they have seemed to evolve past personality-based strengths and into task-oriented strengths. This could be that we have figured out how to work with each other and know how our strengths can become weaknesses or we are less focused on team dynamics at this point. Weaknesses remained fairly similar before and after the project, which could show that our weaknesses were exacerbated by the project or did not improve. However, I feel that we are both grateful to have this opportunity and it has helped us both be aware of our strengths and weaknesses when it comes to intensive-group work. Moving forward, I know that I will definitely need more patience with my team members. This is a skill that I have been trying to develop and will continue developing throughout my career. Another thing that I have gleaned from this project is that I need clear roles to function efficiently, at my best. By this I mean that I do well as a defined leader, or a defined follower. Moving

back and forth between the two roles may cause conflict with interpersonal and professional relationships. Overall, this has been a constructive experience and I feel much more confident to implement QI as a DNP leader.
Name: Matthew Kraus Reflection: I feel I now understand what it takes to be efficient in a quality improvement project or evidence-based practice change. Through the experiences gained, I think I could repeat a similar project with 10-times the efficiency. I have experienced what it is like to be an agent of change. I think I am still very strong at giving feedback to others and receiving feedback myself, but I do still struggle to objectively step back and assess my own work. With this experience, I feel I will be a much better member of a QI team in the future, but I do fear that I still struggle to manage team time and provide direction and focus to team activities. I need a lot of improvement in my team leadership, but this is good because, before this project, I did not know where to focus my development. I have gotten stronger in literature synthesis and efficient task-planning. I feel that participation with our classmates was a high point for my future leadership endeavors. Watching the progress of everyone, providing feedback to others, and receiving feedback from others were great learning experiences. The development, application, and dissemination of this project were all incredibly valuable as they helped me synthesize and use all of my DNP competencies to date. I felt many low points for my team were caused by me trying to re-work things that needed to stay put. Many of these were very unreasonable by me because the project was constantly changing and evolving, so things could not be perfectly polished at all times. Part of this is because I struggled to watch the project evolve as opposed to controlling the evolution.

Part of a team/Group? Complete the DNP Group Project Peer Evaluation form (make copy visible to Chair only). Place a link to the form here at the end of each course; 8201, 8206 & 8207.

Brooke Cote:
8201 Brooke Cote DNP Group Project Peer Evaluation Form
8206 Brooke Cote DNP Group Project Peer Evaluation Form
8207 Brooke Cote DNP Group Project Peer Evaluation Form

Matthew Kraus:
8201 Matthew Kraus DNP Group Project Peer Evaluation Form
8206 Matthew Kraus DNP Group Project Peer Evaluation Form
8207 Matthew Kraus DNP Group Project Peer Evaluation Form

Project Chair's Recommendations

Date of Meeting	Topic of Discussion	Action Recommended	Date to be completed	Mark X when Completed
09/15/22	Project-> starting broad and becoming narrow.	Search the broad problem then narrow. Engage other stakeholders ASAP.	10/1/22	X
09/27/22	PICO, aims/goals/objectives problem statement brainstorming	Develop focus and don't complicate things. Complete SMART goals & objectives.	10/24/22	X
11/09/22	Goals, paper 8201b	Solidify main goal, fix objectives	12/4/22	X
02/20/23	IRB first draft	Finalize project resources, develop recruitment flyer/speech, attach needed appendices	03/17/23	X
03/20/23	IRB, next steps	Submit IRB Application	03/20/23	X
04/14/23	Establish relationships and update newly assigned DNP project chairs.	Prolong implementation to 12 weeks. Modify paper to reflect change. Prepare for statistical analyses.	06/12/23	X
06/07/23	Paper 8207a Feedback	Went through recommendations for paper tenses, result dissemination, and general syntax. Looked forward to DNP poster, 3MT.	06/30/23	X
07/07/23	Results	DNP poster looks good, a few recommendations and modifications to wording done. Start on 3MT. Changed tenses in paper as recommended by DNP chair.	07/23/23	X

Appendix B

Organizational, Needs Assessment, and Gap Analysis Supporting Documents

This figure depicts an organizational needs assessment examining the causes of ineffective EMS-to-ED handoff. Evidence was pulled from the literature, as well as from the authors' personal experiences in the EMS community.

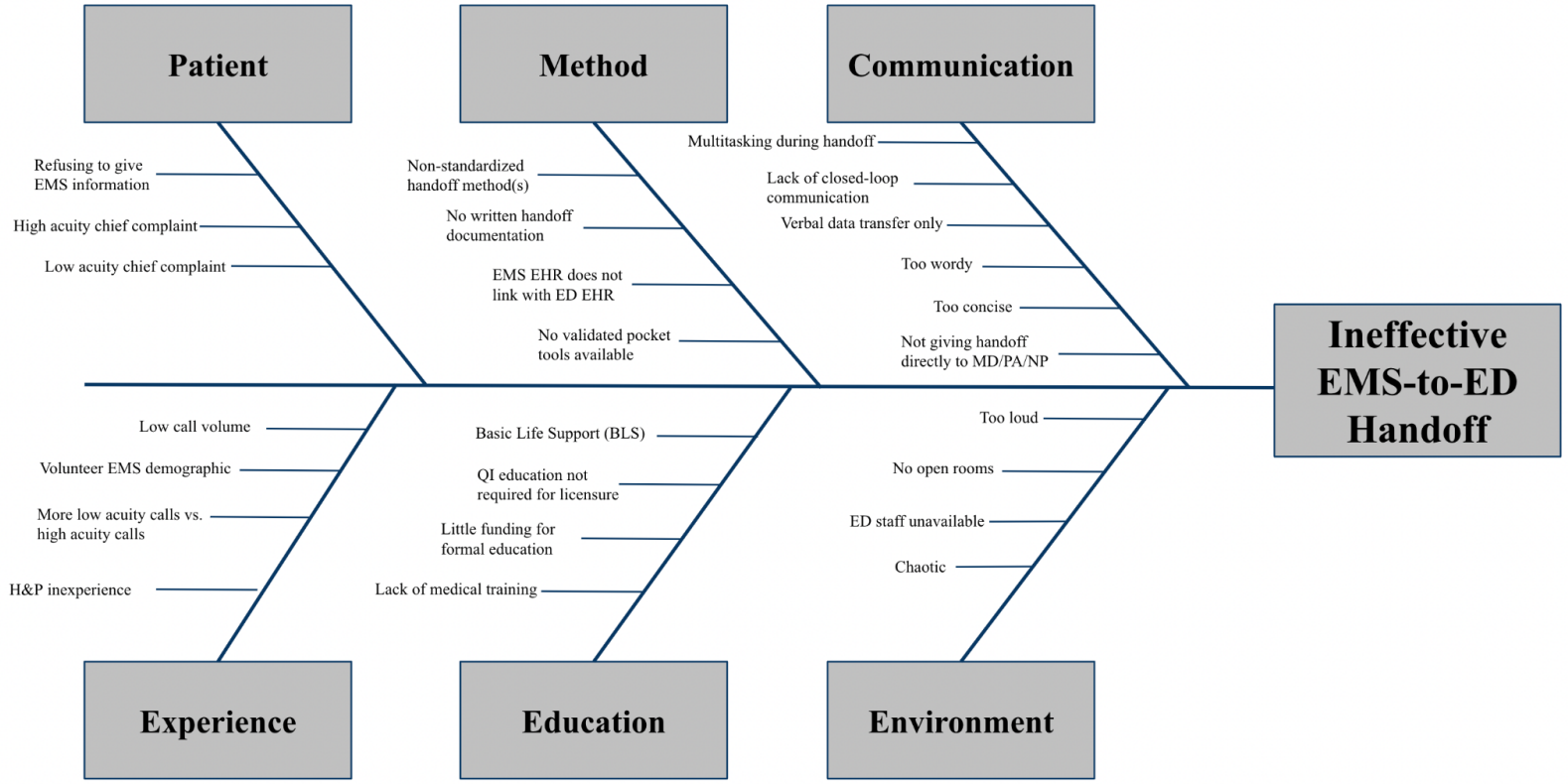

Figure B1. Fishbone Diagram for Ineffective EMS-to-ED Handoff.

The strengths, weaknesses, opportunities, and threats (SWOT) analysis is important in identifying risks and opportunities internal and external to an organization. It also assists in disseminating the needs of the organization and identifying the gap.

Strengths	Weaknesses
- Highly educated, respected, and engaged Ambulance Director - Dedicated roles and committees within the agency - Monthly meetings with high rates of crew attendance - Agency crew members strive to provide excellent, evidence-informed patient care - Staff with medical training outside of the agency - Dedicated core group of members for call time - Comradery and loyalty between crew members - Effective at implementing changes with shared decision making	- General lack of QI process education and familiarity - Little to no reimbursement or incentive for time spent surrounding QI - No standardized EMS-to-ED handoff tools used consistently - Agency crew members used to doing things “how they’ve always been done” - Limited face-to-face contact with volunteers from other agencies - Limited call volume to maintain competency in rarely used skills - High stress situations decrease perceived importance of a thorough EMS-to-ED handoff
Opportunities	**Threats**
- Local and state policy to improve EMS - Excellent relationship with Minnesota EMSRB and local ED MDs - EMS-Hospital Liaison - Opportunity to contribute to EMS QI literature - Ambulance Director supports crew to initiate and engage QI projects - Ability to be involved in regional protocol change	- Local EDs have “their way” of doing EMS-to-ED handoff - Potential change of leadership within the agency - Lack of evidence-base validating specific EMS-to-ED handoff tools - Hierarchical structure of EMS and medicine - Medicare/Medicaid reimbursement is low, resulting in financial strain within the agency

Table B1. SWOT Analysis for Implementing a Standardized Handoff Tool in a Southeastern Minnesota Volunteer Ambulance Service.

The gap analysis for a rural, volunteer, southeastern Minnesota Ambulance Service examining the gap noted in EMS-to-ED handoff.

Identified gap	Evidence to Validate Gap	Gap Due to Knowledge, Skill and/or Practice	Learning Outcome	Method of Evaluation
Crew members do not know the importance of standardized handoff. Crew members do not have an easy way to perform a standardized hand off.	Direct observation by authors and other crew members: handoffs are disorganized and not standardized. No current policy or encouragement for standardized bedside handoff. Currently used pre-alert standardized format makes pre-alert reports organized and efficient.	Knowledge: unaware of existing standardized handoff tools Knowledge: unaware of usefulness of standardized handoff tools Skill: variable bedside handoff content and performance Skill: lack of standardized handoff use	Increased comfortability	Comfortability scale pre-post surveys

Table B2. Gap Analysis in a Southeastern Minnesota Volunteer Ambulance Service.

Appendix C

Google Sheets Link for the Literature Matrix and Critical Appraisal Results

Due to the immature nature of this project, the literature matrix and critical appraisal results were chosen to be presented in the form of the link for concern for formatting issues. Once the project is finalized, formal dissemination in a tabular format will be ensured.

Link: https://docs.google.com/spreadsheets/d/1r4LGlvz3qHvj4zcWLjbGHwD2Z6kAS135IP2V-dthge0/edit?usp=sharing

Appendix D

Project Plan and Methodology Supporting Documents

The project goals and objectives worksheet for the EMS-to-ED handoff QI project in a rural, southeastern Minnesota ambulance service.

Last Revised 03/05/2023

PROJECT GOAL AND OBJECTIVES WORKSHEET

PROJECT NAME	DATE CREATED
Volunteer EMS-to-ED Handoff: A Quality Improvement Project	11/09/2022

PICO QUESTION

Does implementing a standardized EMS-to-ED handoff tool (I) improve interprofessional communication and comfortability in the handoff process (O) when implemented by volunteer EMS crews (P) compared to no standardized bedside handoff process (C)?

GOAL STATEMENT

Our goal is to improve EMS interprofessional communication.

OBJECTIVES

By week two, complete a comprehensive literature review of best practices related to EMS-to-ED handoff in rural ambulance services.
By week four, synthesize and develop an EMS-to-ED handoff tool and a brief, evidence-based educational program
By week six, develop a demographics survey for EMS crew.
By week seven, develop an evidence-based pre- and post-intervention survey of handoff comfortability, quality, and ED receptiveness.
By week eight, conduct the pre-intervention survey of handoff comfortability, quality, and ED receptiveness of all EMS crew members at a monthly ambulance meeting.
By week eight, educate providers about the evidence-based EMS-to-ED handoff tool.
Immediately after educating providers during week 8, implement the evidence-based EMS-to-ED handoff tool.
By week 12, complete the second and final post-education and -implementation survey of the crew on handoff comfortability and effectiveness of evidence-based intervention.
By week 15, disseminate findings and pursue academic publication.

Figure D1. Project Goal Statement and SMART Objectives.

This table disseminates the outcome, process, and balancing measures of the EMS-to-ED handoff QI project.

Outcome Measures		
Percent of change in respondents whose handoff is perceived as: ● *Structured* ● *Standardized* ● *Focused* ● *Not repetitive* ● *Not interrupted*	Percent of people who respond that handoff "strongly agree" or "agree": ● Is structured ● Is standardized ● Is focused ● Avoids repetition ● Avoids interruptions Responses are numbered 1-5 for each Likert Scale question column. Add up every single response organized by column to get the grand total for the group for each column. Repeat for pre- and post- implementation groups. **Measure percentage of change by calculating ([pre-actual response / maximum score] x 100%) - ([post-actual response / maximum score] x 100%.**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation. ● What is to be included or excluded? ○ Include all completed or partially completed surveys.
Percent of change in EMS comfortability for giving handoff to ER staff pre- and post- implementation.	Responses are numbered 1-5 for each Likert Scale question column. Add up every single response organized by column to get the grand total for the group for each column. Repeat for pre- and post- implementation groups. Also, consider individual changes for each question. **Measure percentage of change by calculating ([pre-actual response / maximum score] x 100%) - ([post-actual**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation. ● What is to be included or excluded? ○ Include all completed or partially completed surveys.

	response / maximum score] x 100%.	
Percent of change in the perceived information transfer between EMS and ER during handoff pre- and post-implementation.	Responses are numbered 1-5 for each Likert Scale question column. Add up every single response organized by column to get the grand total for the group for each column. Repeat for pre- and post- implementation groups. **Measure percentage of change by calculating ([pre-actual response / maximum score] x 100%) - ([post-actual response / maximum score] x 100%.**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation. ● What is to be included or excluded? ○ Include all completed or partially completed surveys.
Percent of change in the perceived communication qualities of EMS-to-ER handoff pre- and post-implementation.	Responses are numbered 1-5 for each Likert Scale question column. Add up every single response organized by column to get the grand total for the group for each column. Repeat for pre- and post- implementation groups. **Measure percentage of change by calculating ([pre-actual response / maximum score] x 100%) - ([post-actual response / maximum score] x 100%.**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation ● What is to be included or excluded? ○ Include all completed or partially completed surveys.
Process Measures		
Percentage of respondents who have given handoff since handoff tool implementation.	Number of actual respondents (R_A) who have given handoff since post-implementation divided by total number of respondents (R_T), multiplied by 100%. **$(R_A / R_T) \times 100\%$**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation. ● What is to be included or excluded? ○ Include all completed or partially completed

		surveys.
Percent of crew who received our EMS-to-ER handoff education.	Number of actual crew (C_A) present for educational presentation divided by total number of crew (C_T), multiplied by 100%. **(C_A / C_T) x 100%**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation ● What is to be included or excluded? ○ Include all completed or partially completed surveys
Percent of crew who completed the demographic, pre-implementation, and post-implementation surveys.	Number of actual respondents (R_{AD}) who completed the demographic survey divided by total number of crew (C_{TD}), multiplied by 100%. **(R_{AD} / C_{TD}) x 100%** Number of actual respondents (R_{APre}) who completed the pre- implementation survey divided by total number of crew (C_{TPre}), multiplied by 100%. **(R_{APre} / C_{TPre}) x 100%** Number of actual respondents (R_{APost}) who completed the post- implementation survey divided by total number of crew (C_{TPost}), multiplied by 100%. **(R_{APost} / C_{TPost}) x 100%**	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At time of pre-implementation and 1 month post-implementation. ● What is to be included or excluded? ○ Include all completed or partially completed surveys.

Percent of patient transports that submitted the filled out, paper version of the IMIST-AMBO handoff tool.	Number of actual patient transports with a completed IMIST-AMBO handoff tool (P_A) divided by the total number of patient transports (P_T), multiplied by 100%.
	
	$(P_A / P_T) \times 100\%$
		• Who is responsible for collecting the data?
		  ○ Brooke and/or Matthew
		• How often will the data be collected (e.g., hourly, daily, weekly)?
		  ○ At least biweekly or more often
		• What is to be included or excluded?
		  ○ Include all completed or partially completed surveys
		  ○ Include all completed or partially completed paper IMIST-AMBO handoff tools

Balancing Measures		

Percent of respondents who think that our crew's handoffs are too long.	"Do you think the crew's handoffs are too long?"
	
	"Yes" / "No" / "Unsure"
		• Who is responsible for collecting the data?
		  ○ Brooke or Matthew.
		• How often will the data be collected (e.g., hourly, daily, weekly)?
		  ○ At time of pre-implementation and 1 month post-implementation.
		• What is to be included or excluded?
		  ○ Include all completed or partially completed surveys.

Percent of respondents who think that our crew's handoffs are too short.	"Do you think the crew's handoffs are too short?"
	
	"Yes" / "No" / "Unsure"
		• Who is responsible for collecting the data?
		  ○ Brooke or Matthew.
		• How often will the data be collected (e.g., hourly, daily, weekly)?
		  ○ At time of pre-implementation and 1 month post-implementation.
		• What is to be included or excluded?
		  ○ Include all completed or partially completed surveys.

Percent of respondents who think that using the IMIST-AMBO handoff tool has negative impacts on the patient.	Do you think using the IMIST-AMBO handoff tool negatively impacts the patient? (Yes) / (No) If you circled "Yes" please describe how the tool affects patient care or the patient experience:	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At the 1-month post-implementation. ● What is to be included or excluded?
Percent of respondents who think that using the IMIST-AMBO handoff tool negatively impacts EMS or ED staff.	Do you think using the IMIST-AMBO handoff tool negatively impacts EMS or ED staff? (Yes) / (No) If you circled "Yes" please describe how the tool affects EMS or ED staff:	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At the 1-month post-implementation. ● What is to be included or excluded?
Percent of respondents who think the IMIST-AMBO tool should be used to lead every handoff.	Do you think the IMIST-AMBO tool should be used to lead every handoff? (Yes) / (No) Please provide any positive or negative feedback on the IMIST-AMBO tool below:	● Who is responsible for collecting the data? ○ Brooke or Matthew. ● How often will the data be collected (e.g., hourly, daily, weekly)? ○ At the 1-month post-implementation. ● What is to be included or excluded?

Table D1. Outcome, Process, and Balancing Measures.

A logic model was developed for this project to depict relationships from resource inputs, to activities, to outputs, and to outcomes throughout the project.

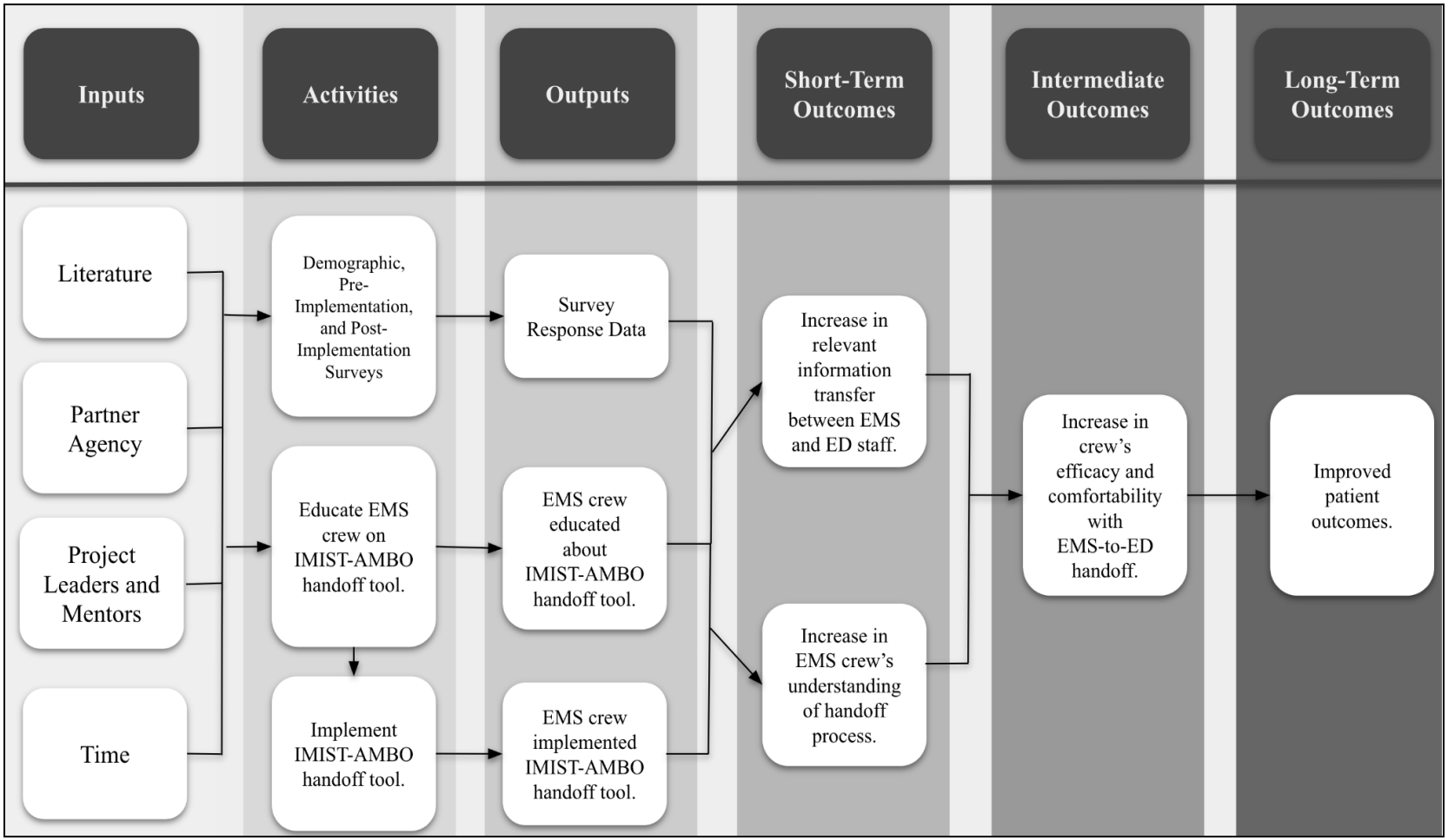

Figure D2. Logic Model.

A formal project proposal is required by CSS for any DNP projects. Part of the proposal includes a work plan. The work plan for the QI project consists of seven phases from The Iowa Model (2017). This model is used with the permission of the authors.

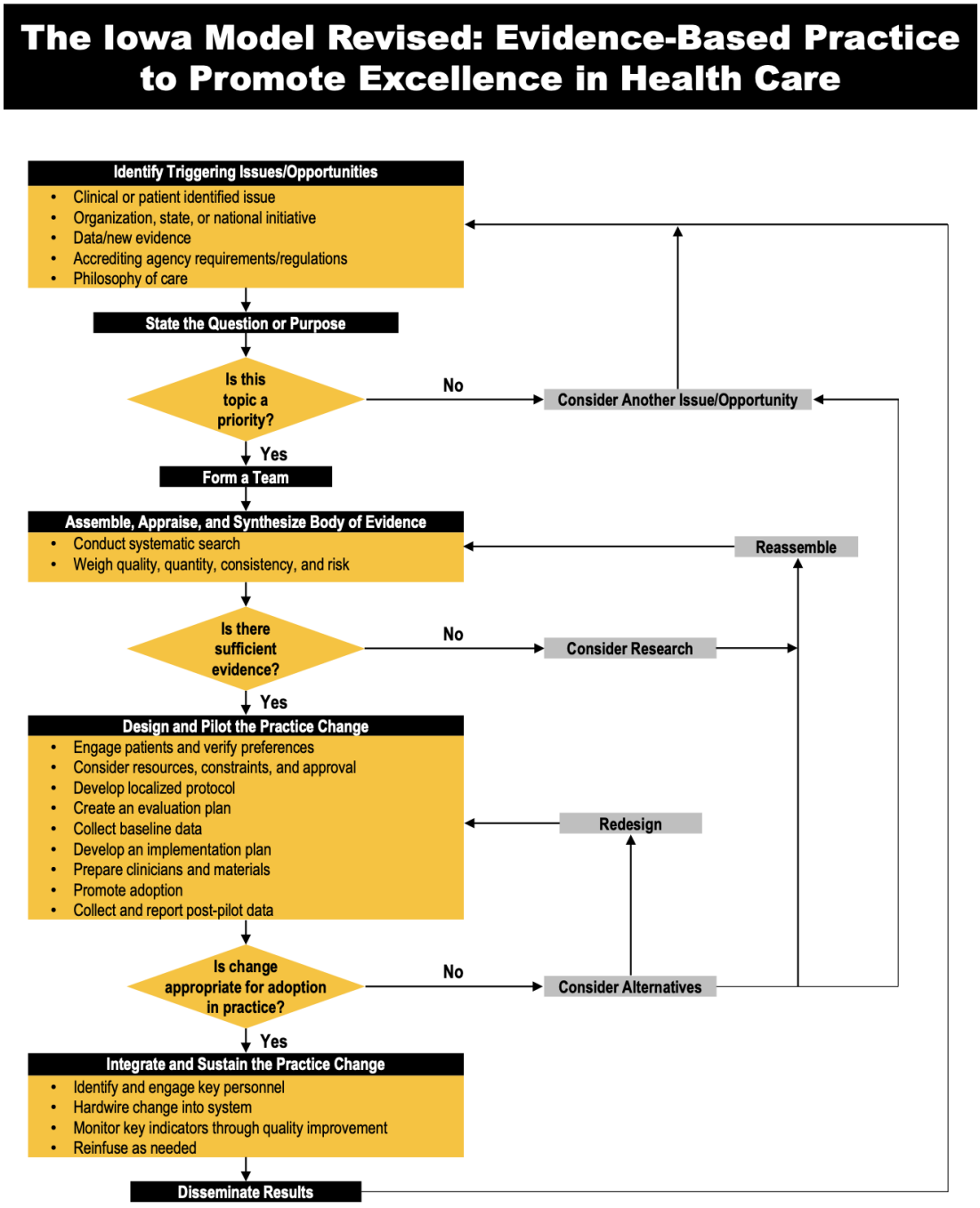

Figure D3. Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.

The link to the Gantt-WSB chart displaying the timeline for the QI project. It is disseminated in a Google Sheets document.

Link:	WSB-GANTT

Table D2. Gant-WSB Chart Link.

Appendix F

Demographic, Pre-Implementation, and Post-Implementation Surveys

Demographic Information Survey

Note: EMS-to-ED Handoff is when an ambulance crew member gives information about a patient to an emergency department staff member and transfers professional responsibility and accountability for care. For example, an EMT transferring a patient to an RN or MD/NP/PA in the emergency department. Standardized handoff is when there is a defined process for when and how handoff is to be given.

1. Have you received training in the handoff process? (Yes) / (No)
2. Have you received training in the handoff process from this agency? (Yes) / (No)
3. How many years have you worked or volunteered in EMS?

   <1 year 1-4 years 5-9 years 10+ years
4. How many years have you volunteered for this agency?

   <1 year 1-4 years 5-9 years 10+ years
5. Have you worked with acutely sick or injured patients outside of this EMS agency? (Yes) / (No)
6. Have you worked for a career or paid EMS entity as an EMR/EMT/Paramedic? (Yes) / (No)
7. What is your age?

   25 or less 26 - 44 45 - 59 60+ Choose Not to Disclose
8. What is your highest level of college education? (Circle One)

   No College Degree Associate's Degree Bachelor's Degree Master's/Doctorate Degree
9. What is your highest EMS certification/licensure?

   Driver EMR EMT Paramedic

10. On average, how many hours per month do you volunteer for this EMS agency? (Less than 50) (50 to 99) (100+)

Pre-Implementation Survey

Note: EMS-to-ED Handoff is when an ambulance crew member gives information about a patient to an emergency department staff member and transfers professional responsibility and accountability for care. For example, an EMT transferring a patient to an RN or MD/NP/PA in the emergency department. Standardized handoff is when there is a defined process for when and how handoff is to be given.

1. How long ago did you last give an EMS-to-ED handoff?

   0-3 Months 4-6 Months 7-9 Months 9-12 Months 13+ Months

2. On average, how often do you give an EMS-to-ED handoff?

   Weekly Monthly Every 3 months Every 6 months Yearly Less than Yearly

3. Have you ever given EMS-to-ED handoff with the IMIST-AMBO handoff tool? (Yes) / (No)
4. Do you think this ambulance crew's handoffs are too long? (Yes) / (No) / (Unsure)
5. Do you think this ambulance crew's handoffs are too short? (Yes) / (No) / (Unsure)

Please turn the page over for the rest of the survey.

Comfortability	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I feel prepared to give EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for routine transports.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for medical resuscitations.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for trauma resuscitations.	**1**	**2**	**3**	**4**	**5**

Handoff Qualities (adapted from Fitzpatrick, McKenna, et al. 2018 ER staff survey)	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
My EMS-to-ED handoff is structured.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoff is standardized.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoff is focused.	**1**	**2**	**3**	**4**	**5**
My handoffs are not repetitive.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoffs are not interrupted.	**1**	**2**	**3**	**4**	**5**

ED Receptiveness	Never	Rarely	Sometimes	Often	Always
ED staff value the information I convey during EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
ED staff take the time to listen to my EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
I am treated with respect by ED staff when giving EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
ED staff allows me to finish my handoff before interrupting with questions.	**1**	**2**	**3**	**4**	**5**

Post-Implementation Survey

Note: EMS-to-ED Handoff is when an ambulance crew member gives information about a patient to an emergency department staff member and transfers professional responsibility and accountability for care. For example, an EMT transferring a patient to an RN or MD/NP/PA in the emergency department. Standardized handoff is when there is a defined process for when and how handoff is to be given.

1. How long ago did you last give an EMS-to-ED handoff?

   0-3 Months 4-6 Months 7-9 Months 9-12 Months 12+ Months

2. On average, how often do you give an EMS-to-ED handoff?

   Weekly Monthly Every 3 months Every 6 months Yearly Less than Yearly

3. Have you ever given EMS-to-ED handoff with the IMIST-AMBO handoff tool? (Yes) / (No)
4. Do you think this crew's handoffs are too long? (Yes) / (No) / (Unsure)
5. Do you think this crew's handoffs are too short? (Yes) / (No) / (Unsure)
6. Do you think using the IMIST-AMBO handoff tool negatively impacts the patient? (Yes) / (No)
   a. If you circled "Yes" please describe how the tool affects patient care or the patient experience:

   _____

2. Do you think using the IMIST-AMBO handoff tool negatively impacts EMS or ED staff? (Yes) / (No)
   a. If you circled "Yes" please describe how the tool affects EMS or ED staff:

3. Do you think the IMIST-AMBO tool should be used to lead every handoff? (Yes) / (No)
    a. Please provide any positive or negative feedback on the IMIST-AMBO tool below:

Please turn the page over for the rest of the survey.

Comfortability	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I feel prepared to give EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for routine transports.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for medical resuscitations.	**1**	**2**	**3**	**4**	**5**
I feel comfortable giving EMS-to-ED handoff for trauma resuscitations.	**1**	**2**	**3**	**4**	**5**

Handoff Qualities (adapted from Fitzpatrick, McKenna, et al. 2018 ER staff survey)	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
My EMS-to-ED handoff is structured.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoff is standardized.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoff is focused.	**1**	**2**	**3**	**4**	**5**
My handoffs avoid repetition.	**1**	**2**	**3**	**4**	**5**
My EMS-to-ED handoffs avoid interruption.	**1**	**2**	**3**	**4**	**5**

ER Receptiveness	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
ED staff value the information I convey during EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
ED staff take the time to listen to my EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
I am treated with respect by ED staff when giving EMS-to-ED handoff.	**1**	**2**	**3**	**4**	**5**
ED staff allows me to finish my handoff before interrupting with questions.	**1**	**2**	**3**	**4**	**5**