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Preferences for Emergency Medical Service Transport After Childhood Injury: An Emergency Department-Based Mixed Methods Study

Robert Thinnes, BS[a], **Morgan B. Swanson, BS**[b], **Kristel Wetjen, RN**[c], **Karisa K. Harland, PhD, MPH**[d], **Nicholas M. Mohr, MD, MS**[e]

[a]University of Iowa, Carver College of Medicine, Iowa City, IA

[b]University of Iowa, College of Public Health, Department of Epidemiology; Carver College of Medicine, Department of Emergency Medicine, Iowa City, IA

[c]University of Iowa, Stead Family Children's Hospital, Department of Surgery, Division of Pediatric Surgery, Iowa City, IA

[d]University of Iowa, College of Public Health, Department of Epidemiology; Carver College of Medicine, Department of Emergency Medicine, Iowa City, IA

[e]University of Iowa, College of Public Health, Department of Epidemiology; Carver College of Medicine, Department of Emergency Medicine; Department of Anesthesia Critical Care, Iowa City, IA

Abstract

Background.—Pre-hospital emergency medical services (EMS) transport can be associated with benefits following pediatric injury. However, many pediatric trauma patients do not use EMS. The objective of this study was to elucidate guardians' decision factors for pre-hospital transport for children after injury.

Methods.—This is a multi-methods study of pediatric trauma patients (≤14 years) and their guardians presenting to the ED of a Level I Pediatric Trauma Center via both EMS and non-EMS modalities. Demographic information and injury characteristics were collected. Semi-structured interviews were conducted, and qualitative codes were identified and assigned into themes.

Results.—(*Quantitative*): Of the 29 child-guardian pairs, five participants initially presented by EMS, 18 were admitted, and the majority (66%) sustained mild injuries. Guardians' assessment of their child's injury severity did not correlate with Injury Severity Score (ISS). Neither EMS status (did or did not use EMS to transport to first hospital) nor rurality status of participants' place of

Corresponding Author: Nicholas M. Mohr, MD, MS, 1008 RCP, 200 Hawkins Drive, University of Iowa, Iowa City, IA 52242, Ph: (319) 353 - 6360, Fax: (319) 353 - 7006, Nicholas-Mohr@uiowa.edu.

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residence were associated with disparate management in any of the three scenarios. (*Qualitative*): Five themes emerged, which informed guardians' transport decisions: Factors Related to the Nature of the Patient's Injury, Guardian Attributes and Prior Experiences, Access and Availability of EMS, Perceived Risks and Benefits of EMS and Hospital, and Collaborative Decision-Making. Injury characteristics and contextual factors, like perceived EMS response times and advice from family or medical providers, were considered in choices about EMS utilization and hospital selection. Despite the view that EMS response times were important in determining what to do following injury, both EMS and non-EMS users were largely unfamiliar with the capabilities of EMS in their area. Finally, many guardians described cost to be a theoretical risk of EMS use, and a few cited this as a factor contributing to their decision-making.

Conclusions.—Guardians used a variety of considerations to make transport decisions, including the five themes identified above. Future studies could explore modalities to disseminate information about pre-hospital decision-making for guardians and determine the relationship between EMS utilization and patient outcomes.

Keywords

Prehospital Emergency Care; Pediatrics; Wounds and Injuries; Transportation of Patients

Introduction

Unintentional injury is the leading cause of death in US children ages one to fourteen years[1]. Childhood injury is associated with suboptimal physical and mental health of the injured child, even after two years postinjury. [2, 3] Timely and comprehensive trauma care improves survival.[4] Comprehensive trauma care regionalization, or ensuring patient care needs and trauma hospital capabilities are properly matched, provides care from the site of injury to the site of definitive care.[4–6]

In a comprehensive trauma system, emergency medical services (EMS) provide pre-hospital injury stabilization and guide triage decisions. Children who suffer moderate to severe injuries benefit from EMS transport and subsequent triage to an appropriate trauma center through shorter time to hospital care and fewer inter-facility transfers.[7–9] Non-EMS pre-hospital transport may result in presentation at emergency departments (EDs) that are not Pediatric Trauma Centers and increased inter-hospital transfer.[7] However, more than one-third of US pediatric trauma patients do not use EMS, even when severely injured.[7]

Parents and guardians are typically the primary decision-makers in determining whether to utilize EMS for their child following injury.[10] Common reasons for EMS transport among all pediatric ED patients include a perception of medical necessity and security of care and transport.[10] In the United States, the patient and/or the insurance company are usually responsible for the cost of EMS, and for both initial transport and inter-hospital transfer, the financial cost can be a costly burden for families.[11, 12] As rapid onset, generally high baseline health status, and demonstrated benefit of regionalization and triage differentiate trauma from other pediatric emergency and acute conditions, it is important to understand the decision-making process of guardians immediately following injury.

The objectives of this study were to: (1) determine guardians' major factors for choosing between EMS and private vehicle transport after injury, (2) determine the hospital qualities that affect guardians' decisions for where to take their child following injury, and (3) describe how guardians' perception of their child's injury was related to EMS transport decisions.

Materials and Methods

Study Design

This is a multi-methods study, a qualitative study with embedded quantitative methods, of pediatric trauma patients and their legal guardians presenting to the ED and inpatient pediatric units of an academic Level I Pediatric Trauma Center. Participants arrived via both EMS and non-EMS modalities. Written informed consent was obtained from each participating guardian. Written consent or verbal assent was selected based on age and obtained from each pediatric participant as appropriate. Following consent, guardians completed a semi-structured interview, evaluation of three hypothetical injury scenarios, and a questionnaire. The Institutional Review Board at the site of the study approved this study's protocol prior to any data collection. This study was reported in accordance with the STrengthening the Reporting of OBservational Epidemiologic studies (STROBE) guidelines for the quantitative phase, and the COnsolidated criteria for REporting Qualitative studies (COREQ): 32-item checklist for the qualitative phase.[13, 14]

Participants

Pediatric patients (≤14 years) with a trauma designation as defined by the National Trauma Data Standard Patient Inclusion Criteria (including ICD-10-CM of S00-S99 with modifier of A, B, or C; T07; T14; T20-T28 with modifier of A; T30-T32; T79.A1-T79.A9 and excluding S00, S10, S20, S30, S40, S50, S60, S70, S80, S90)[15] and a legal guardian accompanying them were eligible to participate. Exclusion criteria included: non-English speaking guardians, patients arriving in law enforcement custody, intentional injury, and suspected child abuse and neglect cases (as indicated by the institution's electronic medical record or physician evaluation).

Qualitative Phase

Research Team and Protocol. A single trained research assistant (RA) consented all participants and conducted interviews with each guardian (or guardians, if more than one was present). The RA reviewed the chief complaints and admitting diagnoses of pediatric patients in the emergency department, inpatient wards, and intensive care unit for injury and injury-related complaints and diagnoses. Prior to approaching potential participants and their families, the RA verified that the corresponding ICD-10 code was consistent with modifiers listed above. *Relationship with Participants.* Neither the interviewer nor coders had any prior relationship with any of the participants in this study. *Theoretical Framework.* Grounded theory was used to underpin the study. *Sampling and Recruitment.* Purposive sampling was used until thematic saturation was achieved. Analysis for thematic saturation began after the first fifteen interviews and continued in blocks of three interviews at a time. If the fourth interview fell on the same day as the third, it would be included before analysis (in this case,

a block could have four or more interviews). Thematic saturation was then determined based on the absence of new themes related to the study question. Participants were approached for the study face-to-face by the research assistant. Written informed consent was obtained from all guardian participants. Written or verbal consent was obtained from all pediatric participants as appropriate. *Setting.* Participants were approached in emergency department or inpatient pediatric rooms. The research assistant obtained consent and conducted the interviews in a private room. All interview participants were the guardians of a child who had been injured. *Data Collection.* A semi-structured qualitative interview guide was developed, and the same guide was used for each interview (see Figure, Supplemental Online Material 1, the semi-structured guide used for interviews with guardians). The interview guide included questions about the history of injury from time of injury to ED arrival and questions regarding the guardians' concerns, beliefs, and other factors that were considered in pre-hospital decision making. The guide was pilot tested with members of the research team and one set of guardians whose answers were not included in the study. Interviews were conducted in English. No repeat interviews were conducted. Interviews were audio recorded and transcribed verbatim by a member of the research team. Theme saturation was determined by consensus of two research team members responsible for coding. *Data Analysis.* The coding process followed a modified process of the six phases of thematic analysis described by Braun and Clarke.[16] An iterative analysis, rather than analysis after review of the full data, was used to align with the grounded theory framework. First, two research team members familiarized themselves with the data by transcribing or reading the transcripts. Second, codes were initially assigned to participant responses in an open-coding process. Third, codes were grouped into themes using axial coding with the constant comparative method by comparing across and within interviews. Fourth, themes were reviewed and placed in a hierarchical construct by the same two study team members. Fifth, themes were iteratively defined and named among the study team and finalized with group consensus. Sixth, representative quotes were selected as examples of themes for the final report.

Quantitative Phase

Following the interview, the research assistant read three scenarios to each guardian in which a hypothetical child sustains different types of injuries (see Figure, Supplemental Online Material 2, detailing the hypothetical scenarios of pediatric injury used). Guardians first verbally described how they would decide how to care for their child following each injury. Next, they rated their likelihood to call 911 and their likelihood to take their child to see a health care provider for each scenario using 10-cm visual analog scales (VAS). Guardians also listed what type of care they would seek, if applicable. Scenarios were selected based on statewide out-of-hospital trauma triage destination decision protocols. Next, guardians completed a survey (see Figure, Supplemental Online Material 3, the questionnaire form). Questionnaire items were related to demographic information (county and ZIP code of residence and of injury location, type of place of injury), family factors (number of children, birth order of pediatric participant), past emergency medical and telemedicine use, guardian's level of education and health literacy, and the guardian's perception of the severity, seriousness, and significance[17] of their child's injury.

Finally, research staff reviewed each pediatric participant's medical chart. The following items were abstracted: date of birth, sex, arrival method, ED chief complaint, ED triage category, time of hospital arrival, injury severity score (ISS), medical co-morbidities, cause of injury, ED vitals at time of arrival, ED disposition, and whether or not the child was admitted to the hospital or ICU. Following completion of the interview, scenario assessment, and questionnaire, each guardian and child were given one $5 gift card for a total of $10 in compensation for their time.

Data Storage.—All data obtained from participants was maintained on a password-protected drive.

Variables.—Rurality was defined using the 2013 Rural Urban Commuting Code (RUCC) for the participant's county of residence and county of injury (RUCC of 4 to 10 was defined as rural).[18] Likert scales quantified perceived severity, seriousness, and significance of injury on a one-to-five scale with five being most severe/serious/significant.[17] VAS scales from 0 to 10 cm were used to quantify participant's likelihood for actions (i.e. call 911 and see a healthcare provider). ISS was categorized as mild (0 to 8), moderate (9 to 14), severe (15-24), and very severe (25 or greater).[19] ISS was determined by a registered nurse trained in the Abbreviated Injury Scale by the Association for the Advancement of Automotive Medicine. Health literacy status was defined by a validated three-question screen.[20]

Statistical Analysis.—Demographic and medical variables were presented using descriptive statistics. The Jonckheere-Terpstra test, for comparison of ordinal data in two or more groups, compared perceived severity of illness distributions by injury severity scale scores. For each scenario, likelihood of actions was compared by EMS utilization groups and rurality using two-sided Wilcoxon Mann-Whitney U tests. Statistical analysis was performed in SAS (version 9.4, SAS Institute, Cary, NC).

Results

Description of Study Participants

Personal interviews were conducted with 30 participants. One child-guardian pairing was excluded because the hospital visit was for a scheduled surgery (ineligible for study). Another pediatric participant did not sign his copy of the informed consent document; the associated guardian did sign her copy of the document. This participant's quantitative data were included in the study, while the qualitative data were deemed ineligible (by recommendation of the local institutional review board). Thus, the results of 28 interviews and scenario assessments (qualitative portions) and 29 questionnaires and scenario assessments (quantitative portions) were included for analysis.

The consent rate for this study was 81% (29/36). The median age of the pediatric participants was 7 years (IQR: 3 to 11 years), majority were male, and ten were rural residents (Table 1). Most participants (n=19) had mild injuries (ISS ≤8), and five participants used EMS to arrive at the first hospital. The majority of participants (n=16) underwent inter-hospital transfer before arriving at the study hospital.

Qualitative Interviews

Five major themes emerged from decision criteria described by guardian participants: Factors Related to the Nature of the Patient's Injury, Guardian Attributes and Prior Experiences, Access and Availability of EMS, Perceived Risks and Benefits of EMS and Hospital, and Collaborative Decision-Making. (Table 2).

Factors Related to the Nature of the Patient's Injury—Guardians identified factors related to the patient that affected the decision to use or not use EMS. Factors either existed before the injury occurred or were related to the injury itself. Three pre-injury factors were noted to affect decision-making: age, birth order of child, and if the child was the guardian's (as opposed to a child's friend or classmate). Younger age was noted to result in a more conservative management of an injured child by the guardian. *"She's young, we knew she'd need a [hospital]. Yes" (ID#2, non-EMS user).* Guardians were more likely to utilize EMS if the child was not their own. *"If it [were] somebody else's child who fell at my house, I would probably call an ambulance right away. I don't know if that's a good thing or a bad thing" (ID#13, non-EMS user).* The child's birth order also seemed to scale inversely with how conservatively a guardian would treat their injury. *"Our daughter who got hurt this week… our sixth child in the birth order. And if this would have been my first child, I think I would have [over-]reacted" (ID#13, non-EMS user).*

The severity of injury, as perceived by guardians, was one major factor in the decision to use EMS. Extrinsic injury signs (e.g. bleeding, a change in mental status, or loss of consciousness) drove the perceived injury severity for many guardians. *"Assess what's going on… if they're non-responsive, you obviously want medical attention right away," (ID#3, non-EMS user).* As reasons to seek prehospital assistance, guardians cited specific concerns for the following injuries and diseases: broken bone, head injury, peripheral nervous system injury, spinal cord injury, and seizures. *"I also think if he had other associated injuries, like a head injury, or certainly any concern for a spinal injury… I would not have been comfortable just putting him in the back of a [side-by-side utility all-terrain vehicle]" (ID#16, non-EMS user).* Guardians referenced their child not acting normally as a reason for using EMS.

In addition to signs and symptoms of injury, the body location of injury affected decision-making with injuries to parts of body associated with higher-level daily functions (e.g. eyes, hands, head) leading to EMS use. *"He had severe facial trauma, like he has a fractured eye socket, he's got a broken jaw… I was obviously panicked and scared and, and knew we needed a high level of care." (ID#8, EMS user).* High-impact injury mechanisms (e.g., automobile crashes) were also cited by guardians as reasons to use EMS. Finally, guardians cited a perceived need for emergent treatment as a reason to utilize EMS.

Guardian Attributes and Prior Experiences—Some of the factors affecting decisions to use EMS were related to the guardians themselves, as opposed to factors related to their children. Typically, the guardian was the primary decision maker following the injury, and many of the guardians discussed how their *a priori* knowledge, perceptions, and preferences affected the prehospital transport of the child. For instance, guardian healthcare training

affected decisions to use EMS and guardian confidence in their prehospital decision-making. *"He had a little bit of a head bleed, but I, it was fine, controlled, and so I felt comfortable, I'm a nurse, transporting him with us to get him here faster…" (ID#1, non-EMS user).* Non-EMS users who had healthcare training felt comfortable triaging their child based on what they felt was the right next step.

Guardians also noted deferring to other adults with more healthcare training. *"I don't know, maybe there is something hidden. So I… bring her to be seen by a, somebody who is more professional" (ID#12, non-EMS user).* Additionally, the guardian's previous experience with EMS and hospital systems affected prehospital transport and destination. This included prior experience with pediatric injuries *"I've seen the entire range of injuries. So this is non-life-threatening" (ID#23, non-EMS user)*, and past experiences with the care teams *"I figured ortho would be getting involved and I, I just feel like I'm more comfortable here than at a place where I don't know that team" (ID#16, non-EMS user).*

In some cases, concomitant guardian injury and the guardian's lack of availability to transport the child necessitated the use of EMS. *"I think I blacked out for a second… I woke up and my family was standing around me [in the hospital], crying." (ID#5, EMS user).*

An instinct factor or "gut reaction" was noted by participants to affect how they decided when to use EMS for their child. A guardian's intuition was discussed by some, leading to quick decisions about their child's care. *"Usually a parent knows, you can, you can tell when your child is hurt badly" (ID#26, EMS user).*

Paradoxically, both risk aversion and a guardian's underestimation of injury (per their own admission) were factors guardians deemed important. Risk-averse guardians were more willing to call for help, seek medical treatment for their child, and use EMS. *"I don't care what it is, I want to get him checked out, that's my son… Regardless of how small it is, I would like to know if something's wrong with him" (ID#11, non-EMS user).* Guardians who underestimated their child's injury perceived a lack of external signs or symptoms of injury, or otherwise had a sense of optimism regarding their child's injury to lead to medical decisions that were less conservative than they later realized. *"…I'm such an optimist I didn't go down that road of how terrible could it be" (ID#13, non-EMS user).*

Access and Availability of EMS—Factors related to guardians' perceived ability to access EMS or for EMS to access them were said to affect EMS use. Geographic factors, from the place of injury to the emergency department, were important. Accessibility of the place of injury was noted as a factor; one guardian perceived a heavily wooded injury site to be less accessible for EMS. The child's distance from a private vehicle also factored into the decision. *"I think if we had been farther out… away from our vehicle, I would have considered [EMS use]" (ID#16, non-EMS user).*

Time to care was seen as a major consideration in how to transport injured children to the ED. Guardians' opinions on the fastest mode of transport were discordant. Some cited private vehicle as faster. *"We're right in town on [street name]… Honestly, I think it's quicker for us to drive than to call somebody and have them take us…" (ID#23, non-EMS*

user). Others thought that EMS was the faster option. *"It was like, I know the ambulance is gonna get them— him there, faster, and likely safer than I could, so they have experience in this driving fast and this big truck business" (ID#10, non-EMS user).*

Some perceived a risk of ambulance use to be motor vehicle collisions en route to a healthcare facility. "*Um, I guess the only thing that came to my head was 'accident,' cause you are going extremely fast and not necessarily everybody else is paying attention" (ID#10, non-EMS user).*

Availability of EMS was a common decision factor. Some participants cited lower availability of EMS as a deterrent. *"[describing inter-hospital transfer] …Both of the ambulances in our town were tied up, so we had to call the next town over to get an ambulance to bring us here" (ID#18, non-EMS user).* Others used a combination of perceived injury severity and the availability of EMS as reasons not to use EMS. Thinking of EMS as a common good, they elected to reserve the service for other residents who they thought could potentially require EMS at the same time. Sometimes, EMS was already on scene, which increased EMS use. *"Um, well, at first I thought I was just gonna take him, but then I saw the ambulance there" (ID#21, EMS user).*

Some respondents perceived their rural status to negatively affect their ability to access EMS care. *"[Where we live is] rural, so it takes longer for ambulances and even [a helicopter] sometimes to get there, than transferring them yourself" (ID#1, non-EMS user).* Finally, rural respondents tended to be more familiar with the capabilities of their local EMS than respondents from larger municipalities.

Perceived Risks and Benefits of EMS and Hospital—Guardians identified factors related to EMS or potential hospital destinations that affected their decision of whether to use EMS. Factors included both potential benefits and risks of EMS use. Perceived EMS response time was considered a benefit by some and a risk by others, and response time was an important driver of the decision to use EMS. *"I don't have… time to wait for the ambulance" (ID#12, non-EMS user). "It was good …They were able to… respond immediately." (ID#17, EMS user).* EMS-user participants felt that services were able to reach them quickly, while non-EMS users had mixed beliefs.

Some guardians noted EMS levels of training (e.g. First Responder, Emergency Medical Technician-Basic, Paramedic) in their decision process. *"People that know what they're doing for emergency… they can help treat or triage, whatever they gotta do…They have medical knowledge that I do not. That would be a safer place… to be." (ID#10, non-EMS user).* Rural respondents also believed that EMS professionals in their region were not as qualified as their urban counterparts. *"I don't even know if our town is big enough to have an ambulance that… could start an IV and fluid… they're … certainly not paramedic-level" (ID#16, non-EMS user).* Other EMS-related factors included the child's emotional response to EMS, perceived quality of EMS care, and the ability for the guardian to accompany the child.

When guardians discussed generalized, perceived drawbacks of ambulance use, cost was a major source of risk and worry. *"Getting to the hospital via ambulance can be very expensive. And that's troublesome for us right now" (ID#4, non-EMS user).* A few guardians mentioned cost as a factor in their actual determination of mode of transport following their child's injury. However, cost was a relatively less critical factor for guardians discussing their actual determination of transport modality when compared to guardians discussing generalized, perceived drawbacks of EMS use. *"Your kids are worth more than anything, so… yeah. I don't have any downside to it I guess" (ID#8, EMS user).* Qualitatively, perceptions of cost did not vary by participant's educational attainment, suggesting that this theme may be concordant across income levels.

Some perceptions of EMS capabilities were related to exposure of the guardian to popular culture. "*…I like to watch Grey's Anatomy, and… there were two different episodes where there was an ambulance crash. And I will say, sitting in the back of the ambulance, strapped in, that was slightly in the back of my mind [laughs]" (ID#15, non-EMS user). "Yes, but, for that helicopter; I just see it in the American films, so I don't know [laughs] if they use it, or… in what cases" (ID#12, non-EMS user).*

Collaborative Decision-Making—Guardians tend to ask for help following pediatric injury. They consult with resources and people in various roles to seek advice on prehospital care, EMS use, and assessment of injury severity. 'Collaborative Decision-Making' refers to this process of outsourcing and collective decision-making that sometimes occurs following pediatric injury. Many guardians sought advice from family or friends with experience caring for a child's injury. *"How would I decide? Talk to my husband, would be first" (ID#10, non-EMS user).*

Consulting healthcare providers for initial advice was commonly used in the decision-making process for seeking care following pediatric injury. Primary care clinics, including general pediatricians, were used. *"I took him to the pediatric office and then they recommended me to come, just to make sure everything was clear with his injury" (ID#3, non-EMS user).* Sometimes on-site bystanders or EMS advice was a major decision factor. *"The first responders kind of made the decision for me, that you guys need to go. Everybody needs to go because of the severity of the accident… I agreed with it, of course, but it was made by the first responders" (ID#8, EMS user).*

Some participants who used private vehicle to transport their children called the local hospital or ED for information on specialist availability or for care advice. *"… Just talked to [local hospital] just to know that there's no trauma surgeon on-call, which is what I thought with the smaller [hospital]— and that's about it." (ID#1, non-EMS user).*

Once at the local hospital, guardians usually followed the healthcare teams' advice and recommendations on transport mode for interfacility transfers. *"They didn't even leave it as an option. They just said, 'she needs to go by ambulance.' I think with the brain bleed and… they started an IV, just so it'd be ready if she needed anything, they didn't even leave me the option of, 'do you want to drive her yourself or transfer her?'" (ID#13, non-EMS user).*

Quantitative Survey Results

Guardian Perception of Injury Severity—Guardian perceptions of injury severity, significance, and seriousness were compared with the child's injury severity score category (Table 3). Guardian perceptions of injury severity were not associated with the child's injury severity score (p=0.320). All guardians tended to evaluate their child's injury as moderately severe to very severe, regardless of Injury Severity Score.

Likelihood of Care Utilization—Table 4 demonstrates guardians' decision making regarding the three hypothetical, standardized scenarios. Guardians were moderately likely to call 911 after their child experienced a head injury with a brief loss of consciousness (scenario 1), and very likely to take their child to see a health care provider following this injury. Guardians nearly uniformly would call 911 and would take their child to see a health care provider following scenarios 2 (head injury with a sustained loss of consciousness) and 3 (motor vehicle collision with pedestrian and deformed fractured extremities).

EMS utilization for the current visit was not related to the guardians' hypothetical decisions to call 911 or take their child to see a health care provider in any of the three scenarios. Likewise, whether a guardian lives in a rural setting did not seem to affect their hypothetical decisions to call 911 or take their child to see a health care provider in any of the three scenarios.

Discussion

Pediatric trauma pre-hospital decision making was a multi-factorial decision guided by Factors Related to the Nature of the Patient's Injury, Guardian Attributes and Prior Experiences, Access and Availability of EMS, Perceived Risks and Benefits of EMS and Hospital, and Collaborative Decision-Making. While injury characteristics and severity were drivers of EMS utilization and hospital selection, contextual factors, such as perceived EMS response times and advice from family and primary care providers, were also important considerations. When asked about the perceived significance, severity, and seriousness of the child's injury, guardian responses were not associated with a validated Injury Severity Score. This suggests some discordance that may lead to differences between actual and recommended triage behaviors. While lower rates of EMS utilization have been reported among pediatric trauma patients previously,[21] this study provides a more comprehensive understanding of the many considerations for guardian decision-making in the pre-hospital setting.

The results of this study expand upon previous reports of guardian EMS preferences for children in the ED and highlight differences specific to pediatric trauma patients. Among EMS utilizers, guardians previously reported medical necessity and security of care and transport as the most important reasons for using EMS.[10] In this study, patient-related factors, such as injury severity and need for timely care, were important in decision-making, but there were many other considerations unrelated to the specific injury event that were cited as important in the decision process.

Access and availability of EMS are known to be sparser with longer response times in rural compared to urban areas.[22] One surprising finding was the gap between the perceived prehospital resources and the available resources. These perceptions will be reflected back to local hospitals and EMS systems to serve as a basis for local information campaigns to inform the local public about the availability and training of EMS in local communities. In the United States, EMS agencies are commonly staffed by paramedics, emergency medical technicians, and first responders, and rural areas are less likely to be served by EMS agencies staffed by paramedics compared to non-rural areas.[23] Specific to pediatric trauma care, access to Pediatric Trauma Centers and pediatric-ready emergency departments is limited for rural residents.[24, 25] In this study, guardians used personal past experiences or anecdotes from others in their community to inform their understanding of EMS in the area, especially in rural areas. Rurality has previously been associated with higher rates of non-EMS transport among pediatric patients in the ED,[26] and this study provides potential explanations for this disparity in utilization, including Access and Availability of EMS and Perceived Risks and Benefits of EMS and Hospital. As emergency capabilities for adult and pediatric care may vary within a hospital or EMS organization, increased community outreach specific to pediatric emergency care protocols and capabilities may be beneficial.

Trauma care regionalization involves comprehensive systems that begin either with EMS activation (for EMS utilizers) or ED presentation (for non-EMS utilizers). As many pediatric trauma patients do not utilize EMS, public knowledge of hospital capabilities is vital for appropriate initial management and triage of pediatric trauma patients. The results of this study provide various reasons for how and why guardians decide to use EMS, including many guardian-centered considerations that are not currently included in existing out-of-hospital protocols. In this study, telephone consultation with an existing healthcare provider, such as a pediatrician or other primary care clinic, was influential in collaborative triage decisions. As new pre-hospital decision making approaches are considered, guardian preferences for modality, including usability, accessibility, and existing social capital will be important for successful implementation and adoption.

Pediatric trauma patients with non-EMS arrival modes are more likely to undergo transfer,[7] and our study included many pediatric trauma participants who underwent inter-hospital transfer. While most EDs have pediatric transfer agreements,[27] few EDs receive additional pediatric-specific consultation via telemedicine,[28] even though they report a desire to collaborate with pediatric colleagues at higher-volume centers.[29] In this study, guardians who received guidance on EMS transport mode and hospital destination from a provider at a transferring hospital reported following that guidance exactly and considered it as the primary decision factor. This highlights the importance of pediatric transfer protocols and support, especially in areas that have lower densities of Pediatric Trauma Centers.

This study has several limitations. First, interviews were conducted at an academic Pediatric Trauma Center with guardians or parents that reported being involved in pre-hospital decision making for their injured child. This may result in selection bias. Parents are the most common decision-makers in the pre-hospital setting,[10] and likely represent an important audience for dissemination of trauma system information. To partially include those presenting to non-trauma hospitals, pediatric trauma patients transferred into the study

hospital were included and asked about decision-making both between injury and initial ED presentation and during inter-hospital transfer. Second, due to the nature of the study and as participants may have had varying times from initial injury to interview, recall bias may be present. In addition, respondents were asked to provide data on emergent care sought for their children for the past five years. Participants were primed with statements to aid in recall and signpost the interview. Further, only incident injuries were eligible for inclusion in the study. Third, this is a single-center study at an academic medical center in a predominantly rural state; findings may not be representative of all parents and guardians of pediatric trauma patients in all patient settings. Fourth, this study represents the viewpoints of a study sample composed of guardians of children with a variety of injury severities, including mild, moderate, and severe injury. As the benefit of EMS transport following injury is mostly observed in the severely injured group, it is probable that the EMS use would not have improved outcomes for all participants. However, our results suggest guardian perceptions of severity may not be congruent with actual injury severity, and this would make it difficult to recommend parents and guardians base EMS usage decisions on the perceived severity at the time of injury. Fifth, response bias was another possible source of bias. Guardians' answers to questions regarding future or hypothetical medical care for their children might have been more conservative than they would have been if their child were not present in a hospital for an injury.

Conclusion

Parents and guardians of pediatric trauma patients used a variety of considerations, including Factors Related to the Nature of the Patient's Injury, Guardian Attributes and Prior Experiences, Access and Availability of EMS, Collaborative Decision-Making, and Perceived Risks and Benefits of EMS and Hospital to make decisions related to EMS utilization and hospital selection after pediatric injury. While some of the factors used were similar to decision factors in state EMS guidelines for out-of-hospital triage, many factors were unique to parents and guardians. Guardian assessments of their child's injury severity were not associated with validated ISS, suggesting discordance that may lead to differences between recommended and actual triage behaviors. Future studies could explore optimal modalities to disseminate information about pre-hospital decision-making for guardians and determine the relationship between EMS utilization and patient outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Participant Demographics

	Total	
	N	**(%)**
Total	29	(100)
Child's Age (Years)		
Median (IQR)	7	(3 to 11)
Sex		
Male	21	72
Female	8	28
Rurality of Residence		
Rural	10	35
Non-Rural	19	66
Rurality of Injury Location		
Rural	9	31
Non-Rural	20	69
Birth Order – First Child	11	38
Parent's Education Level		
Less than HS Degree – 1	3	10
HS Degree – 2	5	17
Some College – 3,4	10	35
Bachelor's Degree or More – 5-8	11	38
Health Literacy Status		
Adequate	24	83
Low	5	17
Mode of Transportation to First ED		
EMS (Ambulance)	5	17
Private Vehicle	23	79
Walk-In	1	3
Transfer Status		
No transfer	10	35
Sent from clinic to ED	3	10
Via private vehicle	2	67
Via ambulance	1	33
Inter-hospital transfer	16	55
Via private vehicle	1	6
Via ambulance	12	75
Via helicopter	2	13
Via fire truck	1	6
Injury Type		
Extremity Fracture	11	38

	Total	
	N	**(%)**
Extremity Injury – Non-fracture	5	17
Eye Injury	3	10
Skull Fracture	4	14
Other Trauma	6	21
ED Triage Category		
1 (immediate)	1	4
2 (emergent)	11	38
3 (urgent)	13	45
4 (non-urgent)	3	10
Unknown	1	4
Injury Severity Score		
Mild (0 to 8)	19	66
Moderate (9 to 15)	6	21
Severe (16 to 24)	4	14
Very Severe (25 or greater)	0	0
ED Disposition		
Admit to ICU	2	7
Admit to Inpatient Unit	20	69
Discharge to Home	7	24
Hospital Length of Stay (Days) *		
Median (IQR)	2	(1 to 4)

* Only for participants (n=22) admitted to hospital. IQR: inter-quartile range; HS: high school; ED: emergency department; EMS: emergency medical services; ICU: intensive care unit

Table 2.

Themes of Factors that Influence Prehospital Transport Decisions

Theme	Description	Examples
Factors Related to the Nature of the Patient's Injury		
Injury Characteristics	Guardians cited factors directly related to the child's injury that affected how the child should be transported to the hospital.	*"…a brain bleed sounds so significant. In my twenty-three years of parenting, I've never had to deal with that. Y'know, I've dealt with a lot of things, with kids' injuries and sicknesses, but, it's a new one, for me, so I was definitely concerned, and didn't feel very knowledgeable about it" (non-EMS user).* *"Oh, if she was like unconscious or broke, y'know, if she was… not breathing, of course. Choking and not able to resuscitate, those types of things, I guess… so the severity of her injury, would be the biggest thing, I guess" (non-EMS user).* *"But then considering it's the eye, it's a very important organ in your body, so I was like "okay, well, looks, you know, like it has a cut, and it's bleeding, and gotta make sure it's not anything serious" (non-EMS user).* *"…If they're n—um, non-responsive, you obviously want medical attention right away. If they're responsive, they're alert, you know, they're talking to you, but they're in pain, say like a broken bone, then, you know, that stuff you can transport yourself… Eye injury, you know, as long as it's not… like something puncturing the eye or going through the eye or any body part, then, you know, you would not use an ambulance" (non-EMS user).*
Pre-Injury Characteristics	Child demographic and intrinsic factors that guardians cited as influencing transport choice. These are factors related to the child that were present before the injury occurred.	*"…It was pretty dramatic at his age. Considering it was such a big dog, a family dog at that, and him being my son and having to go through surgery, it's pretty, pretty traumatic in a way" (non-EMS user).* *"Yeah so, our daughter… is our sixth child in the birth order. And if this would have been my first child, I think… I wouldn't have been as calm… I think with first-time parents, it's so different. They just tend to overreact" (non-EMS user).*
Guardian Attributes and Prior Experiences		
Defined Characteristics	Objective characteristics of the guardian were noted to affect their decision on transporting the injured child.	*"The pool called me and told me that they thought his arm was broken. I work 25 minutes away from where he was at. My husband was an hour and a half from where he was at. Um, so I called a friend of ours to go pick up, um, our son" (non-EMS user).*
Perceived Characteristics	Guardian mentions a perception or personality quality that relates to their decision for prehospital transport.	*"…the hardest thing to control is your emotional reaction. Cause your mind just is gone once you see your child injured" (EMS user).* *"But I say, "better be safe than sorry," is usually my motto in life. So, I'm going with 'be safe, let's go to the ER"' (non-EMS user).*
Access and Availability of EMS	Guardians identified factors related to their perceived ability to access EMS or for EMS to access them.	*"…we decided to go ahead and try to figure out how to get him out of the location where we were. Um, we were on a bike trail and we were near some houses, but not close to our vehicle. And so… I sent my husband for help and um, and then I stayed with my kid" (non-EMS user).* *"Yes, as quickly as possible, we live in a rural community, we live in [city name], and I mean sometimes it can take a little bit to get to us, but I think the ambulances do they best job they can" (EMS user).*
Perceived Risks and Benefits of EMS and Hospital		
Emergency Medical Services	Perceptions of EMS affected decisions on how to transport the injured child	*"I can't really think of a risk [of using EMS]. I mean… I suppose, the cost. That would be the one thing, but that wouldn't be a factor at all, in your child's health,*

Theme	Description	Examples
		really. Like, yeah. If it was a matter of saving her life or not, then it's not an issue, money's not an issue" (non-EMS user).
		"I wouldn't want to, y'know, take him on a trip like this, from [city] to here, because, I mean, there's just too many things that could happen, y'know, on that kind of a drive. So, I'll leave that to the professionals" (non-EMS user).
Hospital		
Perceptions of hospital-based healthcare affected decisions on how to transport the injured child		*"So… we've come here before, so. It's just easy, so, we're— we're familiar with the process. So" (non-EMS user).*
Collaborative Decision-Making		
Guardians ask for help on how to care for a child injury, consulting friends, family, healthcare authorities, and the Internet.		*"So I definitely went to the Internet and looked at, like, WebMD and some web sites like that, just to see what to do" (non-EMS user).*
		"I kind of went off their expertise and they— they made no apologies or— basically said, "hey, we don't feel comfortable treating that here, we're gonna make a referral to the [hospital in which this interview took place]," so they were honest— which I appreciate… Y'know, so, I kind of relied on their judgment" (non-EMS user).
		"They were— they were amazing. I'd say, I'd say every one of the EMTs that showed up, the firefighters, everybody, everybody— I mean, we, in our case, we had a couple bystanders that [saw it happen], they were— everybody was very helpful" (EMS user).

EMS: Emergency medical services

Table 3.

Comparison of actual and perceived severity

	Minor Injury (ISS < 9) ***(n=19)***	**Moderate Injury (ISS 9 – 15)** ***(n=6)***	**Severe Injury (ISS 16 +)** ***(n=4)***	
	n	**n**	**n**	**p-value**
Perceived Severity				0.320
Strongly Disagree	0	0	1	
Disagree	1	1	0	
Neutral	4	1	0	
Agree	6	3	2	
Strongly Agree	8	1	1	
Perceived Seriousness				0.358
Strongly Disagree	0	0	0	
Disagree	0	0	1	
Neutral	2	0	0	
Agree	8	4	2	
Strongly Agree	9	2	1	
Perceived Significance				0.788
Strongly Disagree	0	1	0	
Disagree	0	0	0	
Neutral	3	1	0	
Agree	6	3	1	
Strongly Agree	10	1	3	

ISS: Injury severity score; IQR: interquartile range

Table 4.

Likelihood of Emergency Care Utilization by EMS Use and Rurality

	All *(N=29)*		EMS Users *(n=5)*		Non-EMS Users *(n=24)*			Rural *(n=10)*		Non-Rural *(n=19)*		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**		**Mean**	**SD**	**Mean**	**SD**	**p-value**
	Scenario 1: Head Injury with Brief Loss of Consciousness											
Call 911	5.43	(3.71)	6.58	(3.85)	4.61	(3.23)	0.134	6.93	(3.10)	5.06	(3.84)	0.290
See a Health Care Provider	8.88	(2.09)	9.00	(2.32)	8.68	(1.92)	0.859	9.17	(1.65)	8.76	(2.34)	0.603
	Scenario 2: Head Injury with Sustained Loss of Consciousness											
Call 911	9.93	(0.18)	9.96	(0.09)	9.92	(0.24)	0.924	9.97	(0.08)	9.92	(0.21)	0.544
See a Health Care Provider	9.93	(0.21)	9.98	(0.07)	9.90	(0.28)	0.582	9.97	(0.08)	9.92	(0.25)	0.739
	Scenario 3: Motor Vehicle Collision with Pedestrian and Deformed Fractured Extremities											
Call 911	9.30	(1.95)	9.98	(0.06)	8.65	(2.64)	0.131	9.98	(0.07)	9.39	(1.60)	0.322
See a Health Care Provider	9.93	(0.17)	9.97	(0.07)	9.91	(0.22)	0.873	9.97	(0.08)	9.97	(0.09)	0.544

EMS: emergency medical services; SD: standard deviation