



# Patient Safety Perceptions in Pediatric Out-of-Hospital Emergency Care: Children's Safety Initiative

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**Objective** To characterize emergency medical service (EMS) providers' perceptions of the factors that contribute to safety events and errors in the out-of-hospital emergency care of children.

**Study design** We used a Delphi process to achieve consensus in a national sample of 753 emergency medicine physicians and EMS professionals. Convergence and stability were achieved in 3 rounds, and findings were reviewed and interpreted by a national expert panel.

**Results** Forty-four (88%) states were represented, and 66% of participants were retained through all 3 rounds. From an initial set of 150 potential contributing factors derived from focus groups and literature, participants achieved consensus on the following leading contributors: airway management, heightened anxiety caring for children, lack of pediatric skill proficiency, lack of experience with pediatric equipment, and family members leading to delays or interference with care. Somewhat unexpectedly, medications and communication were low-ranking concerns. After thematic analysis, the overarching domains were ranked by their relative importance: (1) clinical assessment; (2) training; (3) clinical decision-making; (4) equipment; (5) medications; (6) scene characteristics; and (7) EMS cultural norms.

**Conclusions** These findings raise considerations for quality improvement and suggest important roles for pediatricians and pediatric emergency physicians in training, medical oversight, and policy development. (*J Pediatr* 2015;167:1143-8).

Emergency medical services (EMS) providers are an integral part of the pediatric care delivery system. Out-of-hospital emergency care relies upon professionals with a range of training to make time-sensitive, critical decisions under conditions of uncertainty while interacting with highly complex environments and technologies. In these situations, mistakes can occur, and their consequences can be severe. Although the contributors to adverse events in hospitals are well described,<sup>1,2</sup> the nature of adverse events and associated contributors in the out-of-hospital environment are largely unknown.<sup>3,4</sup> Furthermore, relatively few, if any, studies take a global look at contributors to safety in out-of-hospital emergency care and even fewer report on the care of children.<sup>4,5</sup> Pediatric care deserves special attention as it poses unique challenges that can increase the occurrence of medical errors, including the inability of young children to provide a medical history or clearly communicate complaints; age-dependent anatomic and physiologic differences; physical and developmental characteristics; and variations in weight-based medication dosing and size-based equipment needs.<sup>6-10</sup>

The Children's Safety Initiative-EMS is a large, multiphase study funded by the National Institutes of Health (NICHD R01HD062478) to describe the epidemiology of patient safety events in the out-of-hospital emergency care of children. The study includes: (1) focus groups; (2) national Delphi study; (3) chart review; and (4) in situ simulation. Each phase of the study builds an increasingly detailed understanding of the nature of safety events and their associated contributors in the out-of-hospital setting. This study presents results from the national Delphi study intended to understand what practicing EMS providers perceive as the major contributors to patient safety events in the emergency care of children.

## Methods

We conducted a national Delphi study to gain a consensus among EMS providers around the contributors to patient safety events. The Delphi technique is a multi-stage survey methodology intended to obtain a reliable and objective consensus among independent experts.<sup>11,12</sup> Its design is intended to reduce the biasing effect of dominating individuals and group pressure allowing experts to provide

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EMS	Emergency medical service
EMT-B	Emergency medical technician-basic
EMT-I	Emergency medical technician-intermediate
EMT-P	Emergency medical technician-paramedic

their responses independent from one another.<sup>13</sup> A response rate of 40%-50% is considered the recommended standard for Delphi surveys.<sup>14</sup> Before each new survey round, experts' responses were analyzed and reflected in subsequent rounds. Surveys were administered electronically by SurveyMonkey, and all rounds were completed between August 2011 and July 2012.

We acknowledge that most states recently reclassified EMS providers, by moving to the national standard for classification of EMS providers as described by the National Registry of Emergency Medical Technicians. At the time of this study, the participants indicated their provider level based on their state regulations. The researchers have an understanding of the National Registry system for providers (eg, know that EMT-B is not currently used in EMS provider terminology).

EMS direct care (field) providers (emergency medical technician-paramedic [EMT-P], EMT-intermediate [EMT-I], EMT-basic [EMT-B], and first responders) and administrative leaders, emergency department physicians and nurses (general and pediatric specialists), and respiratory therapists participating in out-of-hospital transports were eligible to participate in this study. Participants were recruited through e-mail lists of US EMS and emergency medicine specialty societies and professional groups in attempts to obtain an unbiased national sample of providers. Potential participants were offered the opportunity to be included in a raffle for an electronic tablet. The study was approved by the Oregon Health and Science University Institutional Review Board (IRB00006942) and informed consent was obtained.

### Survey Design

Survey questions were developed through focus groups, and the literature as previously described.<sup>15</sup> Cognitive interviews were conducted to assess face validity, clarity of content, instructions, and usability of surveys.<sup>16</sup> Briefly, a think-aloud interviewing method was used asking EMTs, emergency physicians, and EMS program directors to vocalize their comprehension of questions and to think aloud as they retrieved information and analyzed and interpreted which information to use to complete the survey questions. Survey questions included demographic information such as age, sex, level of training, years of experience, full- or part-time status, paid or volunteer work, geographic location, the number of pediatric patients seen in the previous year, whether they have children, and the ages they consider to be pediatric. We used an established definition of safety events encompassing adverse events, near misses, and errors,<sup>17</sup> followed by structured questions asking participants to rate the likelihood of factors leading to safety events. Response options were formatted as 9-point Likert-type scales with 1 being not at all likely, 5 moderately likely, and 9 highly likely. Space was provided to allow unstructured elaboration, clarification, and case examples.

### Analyses

We conducted qualitative and quantitative analyses of group and subgroup responses to identify the factors rated

as most and least likely to lead to safety events. The 9-point Likert-type scale was collapsed into 3 categories ("not at all likely" [1-3], "somewhat likely" [4-6], and "highly likely" [7-9]) to lead to patient safety events), and the proportion of respondents selecting a response in each category for each question was calculated. A rank order was determined by the proportion of respondents rating an item as "highly likely" to lead to safety events. Subgroup analyses were conducted to examine the variation among different levels of EMTs, physicians, and nurses. Quantitative analyses were conducted with Microsoft Office 2007 Excel Microsoft (Corporation, Redmond, Washington) and IBM SPSS Statistics 19 (SPSS Inc, Chicago, Illinois) software programs.

Qualitative data were used to understand the degree of consistency among provider types, the clinical context of different risk factors, and to identify other potential contributors to safety events. Qualitative responses were analyzed by trained qualitative analysts using QSR NVivo 9 (QSR International Inc, Burlington, Massachusetts) to find themes in the narrative data and rank them by frequency. Themes were then reviewed by the research team and considered for inclusion in the next round.

A panel of national experts from major EMS and pediatric organizations was assembled to assist in interpreting results from the organizational perspective, identifying potential solutions, and suggesting needed future research (Table I; available at [www.jpeds.com](http://www.jpeds.com)). Two teleconference reviews were conducted with the panel of national experts.

## Results

The Figure shows the geographic distribution of survey respondents with 44 (88%) states participating. Of 753 eligible EMS professionals who consented to participate, 722 completed round 1, 614 (85%) completed round 2, 492 (68%) completed round 3; and 477 (66%) participated in all 3 rounds, and the representation of provider types remained stable (eg, EMT-Ps comprised 50.8% of participants in round 1, 51.5% in round 2, and 51.6% in round 3) across all rounds. As shown in Table II, the majority of respondents (80%) were clinically active EMT-P, EMT-I, and EMT-B. Most had been working for a mean of 17 years; 60% were male, approximating the proportion of male EMTs nationally (72%<sup>18</sup>); providers were evenly distributed across urban, suburban, and rural settings; and the majority worked for either public or private ambulance agencies. Because focus groups in phase I of our study suggested that there may be differences of opinion among EMTs in their perceptions at what age a person should still be considered a child, we asked participants "When you think of EMS care for a child, what age of child do you consider the oldest?" Whereas 69% of physicians reported that the upper ages still considered to be a child were between 16 and 18 years, only 30%-40% of EMTs still

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