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Optimizing the assessment of pediatric injury severity in low-resource settings: Consensus generation through a modified Delphi analysis

Etienne St-Louis[a,b,*], Dan Leon Deckelbaum[a], Robert Baird[b], Tarek Razek[a]

[a] Department of General Surgery, McGill University Health Centre, 1650 Cedar Avenue, Montreal, Quebec, H3G 1A4, Canada
[b] Department of Pediatric Surgery, McGill University Health Centre, 1001 Décarie Boulevard, Montreal, Quebec, H4A 3JI, Canada

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ABSTRACT

Introduction: Although a plethora of pediatric injury severity scoring systems is available, many of them present important challenges and limitations in the low resource setting. Our aim is to generate consensus among a group of experts regarding the optimal parameters, outcomes, and methods of estimating injury severity for pediatric trauma patients in low resource settings.
Materials and methods: A systematic review of the literature was conducted to identify and compare existing injury scores used in pediatric patients. Qualitative data was extracted from the systematic review, including scoring parameters, settings and outcomes. In order to establish consensus regarding which of these elements are most adapted to pediatric patients in low-resource settings, they were subjected to a modified Delphi survey for external validation. The Delphi process is a structured communication technique that relies on a panel of experts to develop a systematic, interactive consensus method. We invited a group of 38 experts, including adult and pediatric surgeons, emergency physicians and anesthesiologists trauma team leaders from a level 1 trauma center in Montreal, Canada, and a pediatric referral trauma hospital in Santiago, Chile to participate in two successive rounds of our survey.
Results: Consensus was reached regarding various features of an ideal pediatric trauma score. Specifically, our experts agreed pediatric trauma scoring tool should differ from its adult counterpart, that it can be derived from point of care data available at first assessment, that blood pressure is an important variable to include in a predictive model for pediatric trauma outcomes, that blood pressure is a late but specific marker of shock in pediatric patients, that pulse rate is a more sensitive marker of hemodynamic instability than blood pressure, that an assessment of airway status should be included as a predictive variable for pediatric trauma outcomes, that the AVPU classification of neurologic status is simple and reliable in the acute setting, and more so than GCS at all ages.
Conclusion: Therefore, we conclude that an opportunity exists to develop a new pediatric trauma score, combining the above consensus-generating ideas, that would be best adapted for use in low-resource settings.

Background

Traumatic injury is responsible for a disproportionate amount of mortality and morbidity among young people in Low- and Middle- Income Countries (LMICs) [1,2]. Within these environments, where the demand for skilled practitioners, infrastructure, equipment and specialized training often far exceeds the supply, any decisions made regarding quality improvement initiatives and resource allocation must be grounded in hard data and produce demonstrable effects. However, there is a significant lack of standardized data collection and registry maintenance in LMICs – a problem which has only started to be addressed on a larger scale in the last decade [3,4]. Without the data required, it can be extremely difficult for local stakeholders and health care advocates to demand and organize the implementation of strategies to decrease the significant and often preventable burden of traumatic injury.

As a response to this situation there has been a proliferation of trauma registries in LMICs [5,6]. These registries capture information on large patient cohorts in order to analyze the epidemiology, study the processes and evaluate the quality of patient care in trauma [7]. Trauma registries vary widely in their content, administration, and cost. HIC trauma registry maintenance has been reported to have an estimated direct cost of approximately

* Corresponding author at: General Surgery Resident, McGill University, Canada.
E-mail address: etienne.st-louis@mail.mcgill.ca (E. St-Louis).

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$95 US per patient in 2015 [8]. Despite successful attempts by various researchers to develop and implement sustainable low-cost trauma registries for LMICs, pediatric trauma patients are often lumped together with their adult counterparts. Pediatric trauma patients have unique characteristics in terms of mechanisms, anatomy and physiology. Therefore, the registry and its component tools designed to record the trauma data and allow standardized trauma outcome prediction and benchmarking are not well adapted to this population.

Indeed, most trauma registries include a trauma outcome prediction scores that can be used for benchmarking of trauma care across different institutions or within an institution over time. These can be extremely useful to investigate the cause of differences in trauma outcomes based on a variety of patient, physician, pre-hospital or hospital factor. Moreover, they are critical to monitor the improvements in quality of care following specific interventions designed to respond to various issues arising from the trauma registry data analysis. There is a wide variety of scores which include different anatomic and physiologic variables. However, given the unique characteristics of the pediatric trauma patient and the unique limitations of LMICs, our aim is to develop a new pediatric trauma outcome score that is adapted to the aforementioned specifications. Unfortunately, a lack of sufficient LMIC data hinders our ability to perform direct in situ prediction modeling and therefore different strategies must be used to apply evidence based and consensus-generated boundaries to a predictive model generated from High-Income Country (HIC) data.

Methods

Our study consisted of two parts using a mixed-methods design. In order to investigate the characteristics of various trauma scores used in pediatric patients in LMICs, a systematic review and qualitative analysis was conducted. A questionnaire generated using the findings from this systematic review was subjected to a modified Delphi survey by a panel of independent physicians practicing with exposure to pediatric trauma in a variety of settings. The study protocol was approved by the institutional review board and conforms to the Tri-Council Policy Statement of Ethical Consent. The methodology and results of the systematic review were presented at the European Society of Trauma and Emergency Surgery Annual Clinical Congress on April 25th 2016 and recently published [9].

In order to establish consensus regarding various features generated through systematic review of pediatric trauma scores that could be considered important for inclusion in a new pediatric trauma score designed for low-resource settings, a modified Delphi survey was conducted for external validation. The Delphi process is a structured communication technique that relies on a panel of experts to develop a systematic, interactive consensus method [10–14]. The experts answer a questionnaire in two or more rounds. After the first round, the participants are provided with an anonymous summary of the results. Thus, during the second round, experts are encouraged to revise their earlier answers based on the expert opinion conveyed through an anonymized summary of the previous round's results, while avoiding direct influence from colleagues in the setting of a live discussion or debate [15]. The findings of the systematic review were summarized in a series of statements. Participants were invited to rate their agreement with these statements using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each round of survey was administered online (www.surveymonkey.com, California, United States). Generally, a sample size of 10–15 is adequate for a homogeneous panel of experts undergoing Delphi survey. Thirty-eight trauma physicians, representing a variety of specialties including Pediatric General Surgery, Trauma Surgery, Anesthesia and Emergency Medicine, were invited to answer the questionnaire. We expected a 50% response rate. Subjects were solicited for participation in the survey by e-mail invitation. They were given the opportunity to ask any and all questions regarding the study and provided informed consent prior to completing the survey electronically. Reminder e-mails were sent a 2 and 4 weeks following the initial solicitation, and the survey remained open for a total period of 3 months. A demographic questionnaire was also administered during the first round. Demographic information on the respondents are provided in Tables 1 and 2.

The responses collected for each statement were used to measure the strength of the agreement, which is based on the mean score, and the strength of the consensus, which is based on the standard deviation of the recorded scores. Perfect agreement with a statement was defined as a second round mean score of 5. Conversely, perfect disagreement with a statement was defined as a second round mean score of 0. Perfect consensus was defined as a second round standard deviation of 0.00. High and low scores are defined as second round scores larger or smaller than the mean of all recorded second round scores, respectively. Consensus achievement was defined by decreasing standard deviation in subsequent rounds.

Results

Respondent demographics and background beliefs

Of the 38 physicians invited to participate, 19 (50%) answered the first-round survey and only 14 (37%) answered the second round. Various medical specialties with exposure to trauma were represented, including 1 emergency physician with exposure to both adult and pediatric patients, 5 emergency physicians with

Table 1
Respondent participation and mean standard distribution of responses at each round of Delphi Survey.

Country of Origin	N	Percentage of total invited	Percentage of total at given round	Percentage of previous round total	Mean standard deviation
Invitation					
Canada	29	76%	–	–	–
Chile	9	24%	–	–	–
Total	38	100%	–	–	–
First round					
Canada	14	37%	74%	–	–
Chile	5	13%	26%	–	–
Total	19	50%	100%	–	0.99*
Second round					
Canada	10	26%	71%	52%	–
Chile	4	11%	29%	22%	–
Total	14	37%	100%	74%	0.78*

* Overall an improvement in agreement observed (mean standard deviation decreasing from 0.99 to 0.78) between round one and two, indicating improved consensus.