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WEB PAPER

The development of a national pediatric trauma curriculum

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Abstract

Background: Educational programs dedicated to pediatric trauma are either not available or comprehensive. Pediatric trauma is thus managed by a range of specialists with training in a variety of related fields. Post-certification fellowships in pediatric medicine all mandate education in the assessment and management of the injured child. The purpose of this study was to develop a blueprint for a national pediatric trauma training curriculum.

Methods: A team of four experts developed content for a national pediatric trauma curriculum and disseminated it to 11 pediatric trauma sites across Canada. The objectives contained both knowledge and skill sets related to the management of the pediatric trauma patients. A multi-tiered Delphi process was used to develop the final content.

Results: All the 11 pediatric teaching centers across the country participated. A final list, representing a consensus of views, was developed in 10 domains through the iterative process of the Delphi technique. The domains for the curriculum included introduction to pediatric trauma and epidemiology, initial management, pediatric airway, shock, thoracic injuries, abdominal and pelvic injuries, spinal and neurological injuries, pediatric head injuries, burns and electrical injuries, and orthopedic injuries.

Conclusion: The Delphi process is an invaluable tool in developing curricula. The pediatric trauma curriculum can be used in teaching hospitals for house staff education and meeting core competencies. The blueprint can be validated further in the future.

Introduction

Pediatric trauma is a leading cause of morbidity and mortality in children (American Academy of Pediatrics and American Heart Association 2006). Moreover, it not only affects the health of the child but also exerts an emotional and psychological impact on family and community. Improved care can decrease the harm to the patient and mitigate the severity of other outcomes, resulting in a general decrease in the burden of illness. One way to effect such improvement is to ensure that the quality of care is standardized at the highest possible level.

Pediatric trauma centers are central to the management of these patients. In 2001–2002, more than 30,000 children under the age of 20 were hospitalized in Canada for trauma (Canadian Institute for Health Information National Trauma Registry 2004). Of these cases, approximately 1700 were classified as major trauma, and 235 of these patients died. Trauma is certainly not a benign illness and definitely needs to be treated with the best possible care.

Among the major Canadian centers managing pediatric trauma, processes and care patterns vary widely. Some offer emergency department-based care, while in others, there is a preponderance of adult surgery. There are only a few accredited pediatric tertiary trauma centers across the country with an organized trauma team approach.

In contrast, adult trauma is treated with increasing effectiveness and in a uniform fashion. Improved education in

Practice points

- Current programs do not offer enough material related to pediatric trauma.
- Modified Delphi techniques can provide an excellent means of obtaining consensus on curriculum content.
- Future direction would include validating the results using a ranking system.

managing adult trauma is one reason for this. The Advanced Trauma Life Support (ATLS) course (American College of Surgeons Committee on Trauma 2004), developed by the American College of Surgeons, provides training for the initial stabilization of the trauma patient before definitive treatment or transport to a specialized center. This training could be described as a 'cookbook method' of dealing with adult trauma. Only one chapter in the course textbook deals with pediatric trauma.

The Pediatric Advanced Life Support (PALS) course (Anonymous) offered by the American Heart Association is geared toward cardiac respiratory resuscitation. Only a single chapter in the 2002 edition deals with pediatric trauma and was scant on management principles, while the 2006 edition has no mention of pediatric trauma. Finally, the Advanced Pediatric Life Support (APLS) course (Gausche-Hill et al. 2004)

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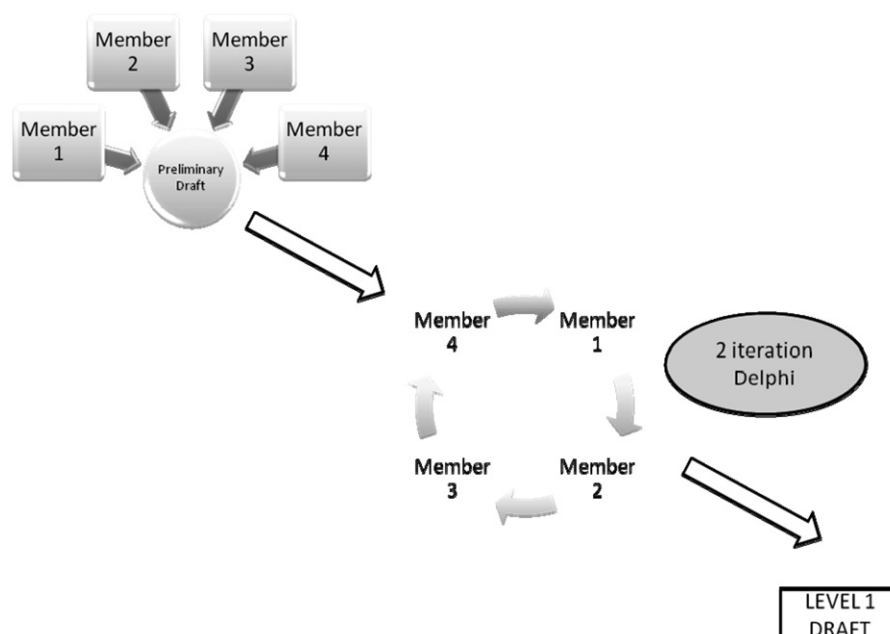


Figure 1. Development of level 1 draft.

also has only a small focus on trauma, most of the text being concentrated on medical management of the very sick child.

What they all lack is either a strong focus on pediatrics or on trauma. None of them elaborates on the need to educate physicians on issues beyond initial assessment and resuscitation. Given that pediatric trauma has a high burden of illness in Canada and around the world, any means to improve and standardize patient care across the country would be beneficial. Creation of a pediatric trauma curriculum could help attain this goal by providing a means to deliver uniform care to children across Canada.

Methods

Current availability of programs

This study consists of the development of a blueprint of a national pediatric trauma curriculum that can help formalize and standardize education in this field. The impetus for the study is the paucity of educational material directly related to pediatric trauma within the Canadian and other medical systems.

Personal communication with every Canadian pediatric trauma center has made it clear that none offers a recognized program or even a course in this field. The purpose of this study was therefore to develop the aims, objectives, and skill sets for a national pediatric trauma curriculum that would bring together many specialties and break down the barriers of the 'silo' approach to education.

A review of the current courses offered in North America found none that dealt exclusively with pediatric trauma. Courses dealing in pediatric life support and general trauma were also reviewed for content and cross-referencing.

Research ethics

The study was approved by the Research Ethics Board of the Hospital for Sick Children, Toronto, Canada. Since the study required no contact with patients and only input and feedback from the experts and site coordinators, a request was made to the Board to grant a waiver for consent requirement. Upon review, the chair of the Board granted this request.

Use of the Delphi technique

The Delphi technique was chosen for this project because it seemed the most promising way to achieve consensus among experts from across the country. The project was designed so that a broad range of opinion could be sampled, with each contributor given equal weighting.

Study design

The study was divided into two macro-Delphi phases. The first was among an expert panel of four members, well versed in trauma education and research. They developed and refined the initial set of aims, objectives, and skills for a national curriculum in pediatric trauma. Consensus was reached after two iterations and the resultant document was labeled the level 1 draft (Figure 1). In the second macro phase, a copy was sent to representatives in all pediatric centers across Canada for their feedback. They reviewed the content with staff in all the sub-specialties involved (Pediatric Emergency Medicine, Pediatric Surgery, and Pediatric Critical Care), in what was termed a single-iteration micro-Delphi process. This micro-Delphi process ensured a cohesive response from each center. The responses from all the site coordinators were then returned as level 2 drafts (Figure 2). These were collated to prepare a final draft.

The site coordinator was responsible for disseminating the objectives and collecting the responses in a timely fashion and

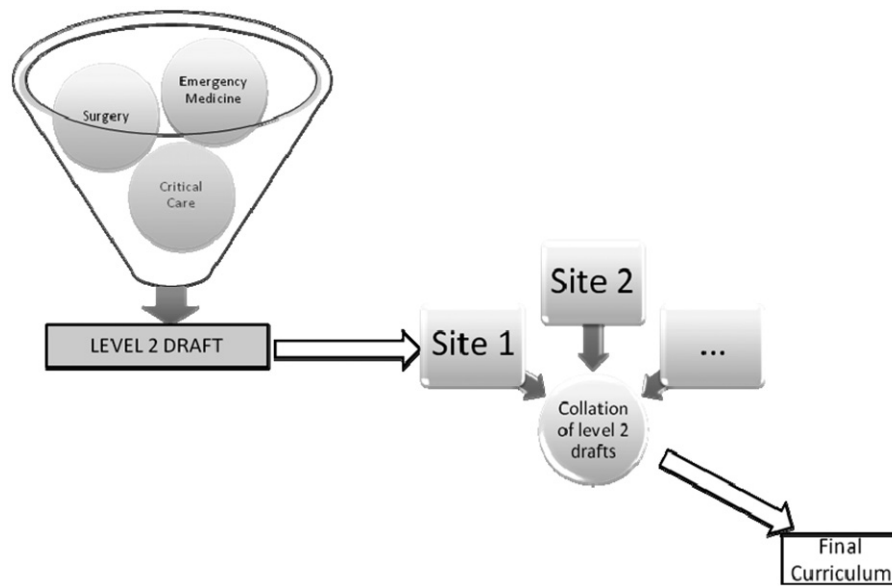


Figure 2. Schematic representation for the development of the level 2 draft.

also instructed to inquire about domains their local team felt should be added to the original list.

Selection of experts. The four principal investigators were selected, through personal contact, on the basis of geographical location, clinical specialty, academic activity, and degree of interest. All of them were actively involved in pediatric trauma and research, and all agreed to participate in this study. Inclusion of representatives from across the country allowed for a geographically and politically balanced view.

Development of level 1 draft. At an initial meeting, the authors identified 10 domains as necessary for a comprehensive curriculum. Each member was allocated two or three domains for which they generated the aim, specific objectives, and skills necessary for them. After each member had completed his or her assignment, the drafts were collated and standardized for grammar and syntax. Two Delphi iterations were necessary for the group to agree on the final level 1 draft (see Figure 1 for an overview of the level 1 draft process).

Selection of site coordinators. Site coordinators were identified through personal contacts in 11 medical centers across Canada. Participants from different specialties – Pediatric Emergency physicians, Pediatric General surgeons, and Pediatric Critical Care specialists – were selected to provide a wide range of views of patient care. All were contacted to gauge their interest in the study. Each coordinator was directly involved in the care of pediatric trauma patients at the sites. In addition, some coordinators were medical directors of a regional pediatric trauma center.

Development of level 2 draft. The site coordinators were contacted electronically to provide them with a synopsis of the study and to emphasize the importance of their input. A package was then sent out to all coordinators that included information on the process, on what the study was trying to

Table 1. Domains for the pediatric trauma curriculum.

Domains selected by initial four expert panels

Introduction to pediatric trauma, epidemiology, burden of illness, and trauma prevention
 Assessment and initial management of pediatric trauma patient
 Assessment and management of pediatric airway
 Assessment and management of shock
 Assessment and management of thoracic injuries
 Assessment and management of abdominal and pelvic injuries
 Assessment and management of spinal and neurological injuries
 Assessment and management of pediatric head injuries
 Assessment and management of pediatric burns and electrical injuries
 Assessment and management of pediatric orthopedic injuries

achieve, and to whom they were to circulate the objectives. A CD copy of the objectives was included in the package. The coordinators were unaware of each other, thus allowing for anonymity. Feedback was sent to a single source and received equal weighting (Figure 2).

Development of final draft. All level 2 drafts were reviewed and given equal weighting. The final draft incorporated all the information provided by each site coordinator. The goal was to return a second set to the coordinators for review and endorsement. However, since only a few suggestions were made with much support, this second iteration was skipped.

Results

The initial development of the aims, objectives, and skill sets was carried out by four experts. Two iterations of the Delphi process were used to come up with a working draft that could be disseminated to the site coordinators. The 10 domains proposed by the expert panel are listed in Table 1.

Each of the 11 site coordinators selected from across the country represented a major pediatric center. No coordinator approached to be a part of this study refused to participate. Several raised concerns about the time commitment. However,

Table 2. Summary of feedback from the site coordinators.**Overall**

- It was valuable to include general trauma objectives.
- Consider further objectives in the future – eye trauma, facial trauma, and penetrating neck trauma.
- When developing a course based on this, consider having different ages (neonates, preschoolers, school-aged children, and adolescents) as part of the cases to show the age-related differences.
- Consider changing the format to CanMEDS.
- Consider having ATLS as a prerequisite if developed into a course.

Objective specific

- Challenge the role of the diagnostic peritoneal lavage.
- Know the indications for the use of contrast when using CT scanning to help identify potential intra-abdominal/pelvic injuries.
- Knowledge of a general joint exam would be a better objective, with emphasis on a few special tests for the knee and shoulder examination.
- Is it important to distinguish the difference between spinal and neurogenic shock?
- Is there a need to differentiate the need for cuffed and uncuffed endotracheal tubes for airway management?
- Unsure of the detail needed for pediatric orthopedics and the dislocation reductions.
- The change in scoring system—in Quebec, minor head injury is 13–15.
- There is a lack of evidence for the second impact syndrome.
- Important to be aware of published guidelines for severe head injury, but recognize that they are guidelines.
- Appreciate that spinal cord injury without radiological abnormality (SCIWORA) may be delayed.
- Unsure of the detail required for all the fracture types.

an information package fully explaining the coordinators' responsibilities provided them with a better understanding of their roles and responsibilities and allayed their concerns.

A response rate of 100% was obtained from both sites and specialties. Two sites lacked representation from Pediatric General Surgery, chiefly because the members were carrying a heavy clinical load and felt they could not make a meaningful contribution to the study.

Each site coordinator attested to the comprehensiveness of the aims and objectives provided in the level 1 draft. One contributor suggested that the format be changed to the CanMEDS format (Anonymous) in future if there is a possibility of submitting the list to the Royal College. A few suggestions dealt with the specific content of the curriculum. Some items were challenged on their relevance to the curriculum, and some information was considered too detailed. For example, one site commented that the objectives of burns were more relevant to a plastic surgery fellow than to a trauma fellow. The role of diagnostic peritoneal lavage drew the heaviest questioning. Table 2 provides a summary of the responses. A final list of the aims and objectives can be accessed at http://www.emergencymedicine.utoronto.ca/Education/Pediatric_Trauma_Curriculum.htm.

Discussion

Despite the high burden of illness associated with pediatric trauma, no recognized program in this field is currently available for physician training that is comprehensive and that caters specifically to pediatric trauma. This development of a pediatric trauma curriculum, the first of its kind, is the product of a broad-based collaboration among experts from across Canada. Through the application of the Delphi technique, the

project developed a set of aims, objectives, and skills in 10 domains and distributed them to coordinators across the 11 pediatric trauma centers for review, advice, and opinion. The highly positive response rate attests to their importance. The result is a blueprint of developing a comprehensive curriculum in the medical expert domain, and can be further elaborated by adding other areas of CanMEDS.

The utility of diagnostic peritoneal lavage (DPL) was questioned by five sites. This is an area of controversy. Although few centers now proceed with DPL in pediatric trauma, certain circumstances may require it. The purpose of this curriculum was not to establish definitive management guidelines but to serve as a tool that can be tailored to the particular circumstance. The other reason to include it is to maintain the comprehensiveness of the curriculum.

Every pediatric treatment site in Canada was invited to participate, and each site coordinator ensured representation from Pediatric Emergency Medicine, Pediatric General Surgery, and Pediatric Critical Care. The study's 100% return rate is exceptional, considering the lower participation rates reached by past studies. The enthusiasm of the site coordinators was reflected not only in the response rate but also through direct communication with the author. Experts from all over the country, all with relevant clinical and educational backgrounds, attested to the need and usefulness of the proposed new curriculum.

In this study, the participants were not asked to rank items on a scale but rather to review each item for validity and in addition were given the option to add material. Although ranking provides an objective means of validating the items on the list, it was excluded for two reasons: (1) there were too many items on the list and it would have taken the sites much longer to review the content and (2) it may have deterred people from participating as it would have involved too much work.

The Delphi technique is a structured means of facilitating communication among experts to deal with a complex problem or issue so as to arrive at the best possible solution (Mullen 2003). The goal is to reach a consensus among selected experts over multiple iterations, with each successive iteration directing the group to a common solution. Several studies have looked at the development of an entire curriculum based on the Delphi technique. These included areas such as undergraduate medical education in acute care (Perkins et al. 2005), disaster medicine (Hsu et al. 2006), critical care (Boyle et al. 1998, CoBaTriCE Collaboration et al. 2006), dermatology (Clayton et al. 2006), women's health (Philips et al. 2003), and pharmacology (Walley & Webb 1997) to name a few. In addition, practical aspects such as clinical skills (Syme-Grant et al. 2005) and professionalism (Kearney 2005) have also been shown to be amenable to study by this method. For this study, the Delphi technique was best suited because of the geographical spread of the sites, equal weighting of all responders, large content of material to review, and the multi-tiered process.

Although one reason for selecting the Delphi process is to ensure equal representation from as many respondents as possible, this study was limited to pediatric experts who both knew the subject well and dealt with it in practice on a daily

basis. Members from adult trauma programs, other pediatric subspecialties, or other healthcare workers were not invited to participate: the time to develop the material would have been excessive and including others would not give the same weighting as from the experts. In particular, pediatric subspecialties in plastic surgery, neurosurgery, and orthopedics would provide further recommendations on the specific areas. A future study can be expanded to include these groups.

Furthermore, we limited the study to Canadian sites. The main reason for this was to try and develop a blueprint consensus that could then be made available to other geographical locations. To attempt this at an international level at the first attempt would have been formidable. Given the initial template, the curriculum can now be adopted and endorsed by any organization.

Each site provided feedback related either to specific objectives or to the general utility of the curriculum. At first glance, the feedback appears scant. The brevity of response could be attributed to lack of time or to reluctance to scrutinize a lengthy series of aims and objectives. However, the fact that sites were given four months to respond and two of them had an extra two months suggests that the time allotted to review was adequate. Willingness to participate was apparent from the outset: every site coordinator was enthusiastic about being part of this national project and commented on the potential usefulness of the proposed curriculum.

Summary

This is the first attempt at developing a national blueprint for pediatric trauma. The overwhelming success of developing this was due to the high interest in developing this material. Different regions can adopt this based on their resources. Further development of the medical expert variables as adding other competencies based on the CanMEDS format can result in a comprehensive curriculum.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Notes on contributors

RAHIM VALANI is an assistant professor of medicine at the University of Toronto. He is a co-editor of 'The Hospital for Sick Children Handbook of Pediatric Trauma.' He completed his Masters in Medical Education from the University of Dundee. His interests include curriculum development and international health.

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focus on the pediatric components. In addition to extensive lecturing on pediatric trauma care issues, her research interests lie in injury prevention and development of quality indicators for pediatric trauma care.

VINCE GRANT is an assistant professor of pediatrics at the University of Calgary. He is the medical director for pediatric trauma at the Alberta Children's Hospitals which is one of two regional trauma centers in the province. Dr. Grant has a strong interest in medical education and simulation, and is also the medical director for the Human Patient Simulation Program.

BJ HANCOCK is dually certified as a pediatric general surgeon and pediatric critical care intensivist. She is the director of Pediatric Trauma Services at Children's Hospital of Winnipeg and chair of the Pediatric Committee for Major Trauma. She is a member of the Health Sciences Center Trauma Steering Committee. She was the co-director of a pediatric emergency medicine trauma fellowship at Children's Hospital of Winnipeg. Dr. Hancock is the Manitoba Provincial Chair of the Committee on Trauma, American College of Surgeons and is the director of the ATLS® course in Winnipeg.

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