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**AMERICAN ACADEMY OF PEDIATRICS**  
Committee on Pediatric Emergency Medicine; Council on Injury, Violence and Poison Prevention; Section on Critical Care; Section on Orthopaedics; Section on Surgery; Section on Transport Medicine

**PEDIATRIC ORTHOPAEDIC SOCIETY OF NORTH AMERICA**  
**PEDIATRIC TRAUMA SOCIETY**  
**SOCIETY OF TRAUMA NURSES**

**POLICY STATEMENT**  
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

**Management of Pediatric Trauma**

**ABSTRACT. Injury is still the number one killer of children ages 1 to 18 in the United States (<http://www.cdc.gov/nchs/fastats/children.htm>). The burden to society of children who survive childhood injury with disability continues to be an enormous financial drain on our economy. The families of children who survive childhood injury with disability face years of emotional and financial hardship, along with significant societal burden. The entire process of managing childhood injury is enormously complex and varies by region. Only the comprehensive cooperation of a broadly diverse group of people will have a significant impact on improving the care of our injured children.**

*Key words: child, death, disability, emergency department, injury, mortality, nurse, pediatrician, trauma, surgeon, PICU, Pre-hospital.*

## 29 **INTRODUCTION**

30

31 Unintentional injury and homicide causes more deaths in children and adolescents ages 1 to 19  
32 than all other causes combined (1). Deaths caused by injuries, intentional or unintentional,  
33 account for more years of potential life lost under the age of 18 than SIDS, cancer, and infectious  
34 diseases combined. It is estimated that 1 in 4 children sustain an unintentional injury requiring  
35 medical care each year (2). The direct cost of childhood injury is more than 50 billion dollars  
36 annually (3). Survivors of childhood trauma may suffer lifelong disability, and require long term  
37 skilled care. Improving outcomes for the injured child requires an approach that recognizes  
38 childhood injury as a significant public health problem. Efforts should be made to improve injury  
39 prevention programs, emergency medical care, and trauma systems for pediatric patients.

40 Additional topics related to the injured child can be found in other AAP publications (4-10).

41 These publications complement and enhance our understanding of managing pediatric trauma.

42

### 43 **Trauma Systems**

44 The pediatric trauma system functions best as a part of the inclusive emergency medical services  
45 (EMS), trauma system and disaster response system at the local, regional, state and national  
46 level. The inclusive trauma system is defined as one where all EMS providers, physicians, other  
47 care givers, and hospitals participate in the care of injured patients. The regional adult trauma  
48 center(s) and the regional pediatric trauma center(s) are the central components of such a system.

49 These systems allow for prompt communication, earlier recognition of critical injuries, and

50 continuing education for trauma providers. An inclusive trauma system ranges from those

51 hospitals capable of stabilization to those that provide comprehensive trauma care. As was noted

52 in the Institute of Medicine report Emergency Care for Children: Growing Pains (11), within any

53 given EMS or trauma system, it is likely that not all hospitals will be completely equipped with  
54 appropriate pediatric resuscitation equipment or medications (11, 12). There may also be  
55 significant variability in pediatric training and experience among physicians and nurses working  
56 in hospital emergency departments (13, 14). About 80% of the US children live within 50 miles  
57 of a level 1 or 2 trauma center. However, in many less populated states the percentage of  
58 children living within 50 miles of a trauma center is much lower. Furthermore, only about 50%  
59 of children live within 50 miles of a pediatric trauma center (15, 16). When the trauma system  
60 extends over a large geographic area, the outlying hospitals of the system must be able to  
61 undertake the stabilization and initial management of the injured child or children that present to  
62 the hospital. Optimally, each trauma system will also define the age range of the pediatric  
63 patient, based upon specific hospital and trauma team resources that are available.

64  
65 An estimated 17.4 million children do not have access to a pediatric trauma center within 60  
66 minutes (17, 18). When a regional pediatric referral center is available within the trauma system,  
67 the most severely injured children may be transported to a facility with Level I pediatric trauma  
68 designation (17). Trauma system administrators are key stakeholders to ensure that all hospitals  
69 with emergency departments may be required to evaluate and resuscitate injured children (4, 6,  
70 8, 11). A mass casualty event such as a tornado strike on one hospital in a system highlights the  
71 need for such readiness. At the very least, a physician and nurse coordinator for pediatric  
72 emergency care should be identified in each facility, with established pediatric specific policies,  
73 procedures, equipment, and guidelines for care established (8, 11). These guidelines are outlined  
74 in the AAP/ACEP/ENA Joint Policy Statement: Guidelines for Care of Children in the ED (8).  
75 In addition, the EMSC performance measures that assess a state's operational capacity to provide  
76 pediatric emergency care are important adjuncts to managing a trauma system (18).

77

78 Protocols for field and hospital triage, treatment and transfer of victims of pediatric trauma are an  
79 important part of any trauma system (19). Transfer guidelines and toolkits are available from  
80 many states and regional systems as well as national organizations (20, 21). The quality of care  
81 that is provided within the system should be continuously evaluated by the trauma system  
82 administration through performance improvement processes. Benchmarking care using risk  
83 adjusted data is important for the ongoing improvement in pediatric care and system delivery  
84 models. The outcomes for pediatric trauma patients should be compared to available benchmarks  
85 such as the National Trauma Data Bank (22), and information shared with specific providers so  
86 that an optimal environment for quality improvement in pediatric trauma care is promoted. The  
87 American College of Surgeons has initiated a Pediatric Trauma Quality Improvement Project  
88 (TQIP) that will provide participating hospitals with additional pediatric specific benchmarking  
89 data (23).

90

### 91 **Pediatric Disaster Preparedness and Surge**

92 Disaster preparedness in the US has improved significantly in the years since Hurricane Katrina.  
93 Hospital accreditation programs such as the JCAHO have strengthened their disaster  
94 preparedness requirements. Children have unique needs for care in mass casualty incidents,  
95 especially if chemical, biologic, or nuclear events occur. Along with physiologic considerations,  
96 triage, identification, decontamination, tracking, and reunification are all issues that must be  
97 considered during mass casualty events. A process for recruiting pediatric health care  
98 professionals when a surge response is needed should be included in any plan. In addition,  
99 attending to the psychological needs of injured children should be considered in any such event.

100 While we can anticipate the needs of children in disasters, the capability of a trauma system to

101 meet these needs will remain in question until the nation achieves an optimal level of emergency  
102 readiness for children on a daily basis (24).

103

#### 104 **Pre-hospital Pediatric Trauma Care**

105 Pre-hospital providers may not be as familiar with effective pediatric emergency care as they are  
106 with the care provided to adults (25). This is due to infrequent exposure of most pre-hospital  
107 providers to critically ill or injured children. This issue is typically addressed by continuing  
108 education efforts for EMS providers through established courses supported by the AAP and the  
109 National Association of Emergency Medical Technicians or practical experience in a children's  
110 hospital. Online training may be an effective and reasonable alternative in largely rural states  
111 (26). State and national certifying and licensing bodies should ensure adequate continuing  
112 education units are obtained in pediatric trauma management by pre-hospital providers to  
113 maintain proficiency. No matter how continuing education is accomplished, mechanisms for  
114 knowledge and skill retention and continuous evaluation of performance are crucial for pre-  
115 hospital personnel. The method for maintaining skills may include continuous evaluation of  
116 performance or collaboration with a pediatric healthcare system that provides opportunities to  
117 maintain and expand upon pediatric acute care knowledge and skills. New projects using  
118 simulation demonstrate promising results (27). Direct feedback to field providers is an essential  
119 component for continual improvement in any trauma system to improve outcomes for injured  
120 children. This feedback can be provided by the receiving facility using real-time reviews, case  
121 review presentations, or feedback to the referring pre-hospital agency.

122

123 There is a relative lack of data supporting the best practices for pediatric resuscitation in the  
124 field, including fluid administration, cervical spine stabilization, and airway management of

125 children. The Broselow system does provide useful guidelines for early resuscitation and there  
126 are new recommendations for termination of resuscitation in the field (28). Comprehensive  
127 support for research in this area needs to come from regional, state, and national organizations.  
128 Examples of this include the federally funded Emergency Medical Services for Children program  
129 (29), the Pediatric Emergency Care Applied Research Network (30), the Pediatric Emergency  
130 Research Network (31), and the American Pediatric Surgical Association Outcomes and Clinical  
131 Trials Center (32).

132

### 133 **Trauma Centers**

134 It has been shown that younger and more seriously injured children have improved outcomes at a  
135 trauma center within a children's hospital or at a trauma center that integrates pediatric and adult  
136 trauma services (15, 33-36). There is data to suggest that the presence of a pediatric trauma  
137 center within a state was associated with lower pediatric injury mortality rates (37). The ability  
138 to provide a broad range of pediatric services, including the presence of physicians trained in  
139 pediatric emergency medicine, pediatric surgical specialties, pediatric anesthesiologists, pediatric  
140 critical care, traumatic stress and substance abuse counseling, pediatric rehabilitation and other  
141 specialized trauma care is important. Nurses with demonstrated competency in the care of  
142 pediatric trauma patients are an important aspect of care as well.

143

144 Management of the injured child requires special considerations. Issues that are unique to  
145 children include reducing diagnostic radiation exposure, age related peculiarities to examination,  
146 family presence during resuscitation (38), treatment protocols, fluid and electrolyte management  
147 and blood transfusions to name a few. Careful consideration of radiation for trauma evaluation  
148 should always be of primary importance due to the radiation dose that is often delivered (39).

149 Pediatric protocols for imaging and diagnostic testing (40), and a child and family centered  
150 environment for care for injured individuals and in mass casualty events (41,42) are important  
151 resources to proactively have in place at all hospitals including pediatric and non-children's  
152 hospital trauma centers. Specific family presence guidelines for implementing and facilitating  
153 family presence during pediatric trauma care are useful to ensure safety and efficacy of family  
154 presence within a hospital (42). Specific pain management protocols would allow the injured  
155 child timely control of pain. Competency and ability to provide a full range of pediatric pain  
156 strategies for children including systemic analgesics, regional and local pain control options, and  
157 distraction techniques are essential components for pediatric trauma care (43). Pain management  
158 is important from the time of injury and throughout the care continuum, including rehabilitation.

159

160 Continuing trauma education for hospital providers and trauma nurses is important and can be  
161 accomplished by current certification in the American College of Surgeons Advanced Trauma  
162 Life Support® course for providers and courses in trauma nursing supported by the Society of  
163 Trauma Nurses and the Emergency Nurses Association (44). Some trauma centers may not have  
164 the resources to care for all of the injured children within their referral region at any given time,  
165 especially in less populated states. Thus, the most seriously injured children may need to be  
166 stabilized in regional referral centers and transported to tertiary facilities with these resources.  
167 Pediatric critical care transport teams are often the best resource for such transfers (45).

168 Hospitals that seek regional or state designation or verification as a pediatric trauma center  
169 through the American College of Surgeons verification process or similar state trauma  
170 designation processes are examples of facilities that have made an extraordinary effort to provide  
171 resources to care for injured children.

172

173 A well-equipped and staffed pediatric intensive care unit (PICU) is another essential component  
174 of a pediatric trauma center. Pediatric intensive care units offer a setting with the necessary  
175 monitoring devices, equipment, medications and technology to support physiologic function, and  
176 are staffed with professionals with the expertise to apply them to the pediatric patient. There are  
177 data which demonstrate that the availability of PICU beds within a region may improve survival  
178 in pediatric trauma (46). Pediatric critical care physicians, surgeons, and pediatric  
179 anesthesiologists trained in the care of injured children working together are needed for optimal  
180 care of severely injured and unstable patients in the ICU setting. In addition to critically injured  
181 children, stable patients with the potential for deterioration may also require the specialized  
182 services of a PICU. Pediatric trauma care specialists, especially those with critical care training,  
183 are in short supply and are distributed irregularly in the population, thus endangering the  
184 nationwide delivery of pediatric trauma care (47). Furthermore, the presence of experienced  
185 PICU nursing and allied healthcare personnel support the environment necessary for frequent  
186 monitoring and assessment of injured children. Moreover, pediatric trauma care continues on the  
187 in-patient floors. Once the child is stable and the possibility of rapid deterioration is decreased,  
188 the rehabilitation process generally begins while still in the inpatient setting.

189  
190 It is the goal of a comprehensive trauma system to reintegrate the child into their community.  
191 The availability of rehabilitation resources for pediatric patients is a vital component of pediatric  
192 trauma care. Returning the child to full, age appropriate function, with the ability to reach his or  
193 her maximum adult potential is the ultimate goal after injury. Early rehabilitation is especially  
194 crucial for those children suffering neurologic injuries. Physical, occupational, cognitive, speech,  
195 and play therapy, as well as psychological support are all essential elements of a comprehensive  
196 rehabilitation effort for the injured child and their family. Care should be taken to address acute



197 stress and post-traumatic stress reactions in trauma patients (48). In particular, crisis intervention  
198 and ongoing support should be offered to youth who are injured through interpersonal violence,  
199 because they are especially at risk for repeat, violent injuries and psychosocial trauma. One  
200 example of this is the National Network of Hospital-based Violence Intervention Programs  
201 ([www.nnhvip.org](http://www.nnhvip.org)) and the National Child Traumatic Stress Network ([www.nctsn.org](http://www.nctsn.org)).

202  
203 Active and effective performance improvement committees, with issues focused toward  
204 pediatrics is an essential component for trauma centers. In any trauma center these activities also  
205 include attention to patient safety. Periodic review of trauma care by the providers of that care is  
206 the process that is most likely to improve patient outcomes in any hospital. Trauma care review  
207 is facilitated by a comprehensive trauma registry that has ties with national databases so that  
208 outcomes can be benchmarked for improved quality of care. Mandatory systematic child death  
209 review processes should be in place to identify emerging trends and higher level risk factors for  
210 which interventions can be developed and evaluated.

211  
212 Another unique aspect related to pediatric trauma care is the need for increased awareness for  
213 evidence of potential child abuse (49). Pediatric trauma center personnel should be aware of  
214 state reporting requirements within their jurisdiction and remain vigilant to facilitate early  
215 detection of abuse and neglect. This is best accomplished by using a protocol or screening to  
216 detect child abuse in the ED that cares for children. It is the responsibility of all pediatric  
217 providers to be educated regarding the early detection, diagnosis and management of inflicted  
218 injuries. Community hospitals should be aware of the resources for specialized child protection  
219 teams in their regional referral areas. Cooperation and collaboration with hospital-based child  
220 protection teams are essential for management of cases of suspected abuse and neglect.

221  
222 Injury prevention is the cornerstone to any discussion concerning pediatric trauma. Injury  
223 prevention initiatives do work (50). For example, the Safe Kids program has been instrumental in  
224 decreasing deaths to trauma. However, these initiatives are not promoted equally across the  
225 United States, often due to limited resources. There are methods to identify and refine the  
226 approach to injury prevention initiatives that are specific for individual regions (51). Trauma  
227 programs should utilize data from the trauma registry to identify high risk injury prevention  
228 needs. Activities should be identified by using local data and may focus on such things as fall  
229 prevention, alcohol and drug abuse recognition and intervention, child passenger safety, bike  
230 safety, water safety, and other regionally appropriate activities as endorsed by the Injury Free  
231 Coalition for Kids ([www.injuryfree.org](http://www.injuryfree.org)). Emergency medical services providers, hospitals,  
232 emergency departments and trauma centers should have injury prevention content and  
233 information, as well as activities incorporated into patient and staff education and as part of  
234 community-based injury prevention programs.

235

## 236 **RECOMMENDATIONS**

- 237 • The unique needs of injured children need to be integrated specifically into trauma systems  
238 and disaster planning at the local, state, regional and national level.
- 239
- 240 • Evaluation and management of the injured child should begin with the providers at the  
241 bedside who have basic competency in pediatric trauma care.
- 242
- 243 • Pediatric injury management should include an integrated public health approach from  
244 prevention through pre-hospital care, and emergency and acute hospital care, to rehabilitation

- 245 and long term follow up as indicated for stress reactions associated with the injury.
- 246
- 247 • All potential providers of pediatric emergency and trauma care should be familiar with their
- 248 regional pediatric trauma system and be able to evaluate, stabilize and transfer acutely
- 249 injured children.
- 250
- 251 • Qualified pediatric critical care transport teams should be utilized when available in the
- 252 interfacility transport of critically injured children.
- 253
- 254 • Interfacility transfer agreements should be in place to facilitate rapid acceptance and
- 255 transport of critically injured children to the appropriate level of care.
- 256
- 257 • National organizations with a special interest in pediatric trauma such as the American
- 258 Academy of Pediatrics (AAP), American College of Surgeons (ACS), American College of
- 259 Emergency Physicians (ACEP), Emergency Nurses Association (ENA), Pediatric Trauma
- 260 Society (PTS), American Pediatric Surgery Association (APSA), Pediatric Orthopaedic
- 261 Society of North America (POSNA), American Pediatric Surgical Nurses Association
- 262 (APSNA) and the Society of Trauma Nurses (STN), should collaborate to advocate for a
- 263 higher quality of care across the nation.
- 264
- 265 • Evidence based protocols for management of the injured child should be developed for
- 266 essential aspects of care, including pre-hospital, acute resuscitation and post discharge
- 267 through rehabilitation.
- 268
- 269 • Research including data collection for best practices in isolated trauma and mass casualty
- 270 events specifically addressing the needs of children should be supported.

- 271  
272 • State and Federal financial support for research and trauma system development and  
273 maintenance must be provided.
- 274  
275 • Every state should identify appropriate facilities with the resources to care for injured  
276 children and establish continuous monitoring processes for care delivered to injured children.  
277 This is especially important for the youngest and most severely injured children.
- 278
- 279 • Steps should be taken to increase the number of trainees in specialties that care for injured  
280 children to address key subspecialty service shortages in pediatric trauma care. Strategies  
281 should include increased funding for graduate medical education and appropriate  
282 reimbursement for trauma specialists.
- 283
- 284 • Pre-hospital and hospital providers should make every effort to stay current in the emergency  
285 management of injured children. Additionally, providers should actively participate in and  
286 cultivate an injury prevention program within their service area to ultimately reduce the rate  
287 of children injured.
- 288
- 289 • Direct, constructive feedback to field providers and referring hospitals should occur from the  
290 pediatric trauma center, to allow for continued education and improved pediatric care.
- 291  
292
- 293 • All health care providers should be aware that injured children and their families should be  
294 evaluated and referred for stress reactions related to injury.

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