Pediatric Trauma: 
Role & Response 
of the US Anesthesiologist

APGB&I meeting 
Aberdeen, Scotland 
James Fehr MD 
Washington University in St. Louis
Where have I learned about trauma?

- University of Michigan Medical School
- Baylor Med-Peds residency
- Johns Hopkins Anesthesiology residency
- Pediatric Anesthesiology & PICU fellowships
- Washington University School of Medicine
- Departments of Anesthesiology & Pediatrics
  - Pediatric Anesthesiology
  - Pediatric Cardiac Anesthesiology
  - Pediatric Intensive Care
  - Pediatric Cardiac Intensive Care
  - Simulation Center Director
Disclosures

None
Hurricane Katrina
Sandy Hook

20 children and 6 teachers massacred in a Connecticut elementary school
I've lived through some terrible things in my life, some of which actually happened.

The Buck stops here.
Washington University in St. Louis
St. Louis Children’s Hospital

- 258 beds
- Founded in 1879
- NICU, PICU, CICU
- 275,000 annual patients
- 58,000 annual ER visits
  - ~1500 injuries evaluated
- 12,000 annual surgical cases
Objectives: Pediatric Trauma Care in the US

• How trauma care for children is organized and paid for in the United States
• Anesthesiology’s role in the initial trauma response in the field and in the ER
• Defining & measuring pediatric trauma outcomes
• Beneficial protocols in pediatric trauma care
• Simulation for trauma team training
Trauma is the major cause of death for children in the US outside of the neonatal period:

- 3000 deaths annually in the US under age 14
- 45% of mortality age 1-14

### 10 Leading Causes of Death by Age Group, United States - 2013

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Congenital Anomalies 4,758</td>
<td>Unintentional Injury 1,316</td>
<td>Unintentional Injury 746</td>
<td>Unintentional Injury 775</td>
<td>Unintentional Injury 11,519</td>
<td>Unintentional Injury 16,209</td>
<td>Unintentional Injury 15,354</td>
<td>Malignant Neoplasms 46,185</td>
<td>Malignant Neoplasms 113,324</td>
<td>Heart Disease 488,156</td>
<td>Heart Disease 611,105</td>
</tr>
<tr>
<td>2</td>
<td>Short Gestation 4,202</td>
<td>Congenital Anomalies 476</td>
<td>Malignant Neoplasms 447</td>
<td>Malignant Neoplasms 448</td>
<td>Suicide 4,878</td>
<td>Suicide 6,348</td>
<td>Malignant Neoplasms 11,349</td>
<td>Heart Disease 35,167</td>
<td>Heart Disease 72,568</td>
<td>Malignant Neoplasms 407,588</td>
<td>Malignant Neoplasms 584,881</td>
</tr>
<tr>
<td>3</td>
<td>Maternal Pregnancy Comp. 1,595</td>
<td>Homicide 337</td>
<td>Congenital Anomalies 170</td>
<td>Suicide 386</td>
<td>Homicide 4,329</td>
<td>Homicide 4,236</td>
<td>Suicide 6,551</td>
<td>Heart Disease 10,341</td>
<td>Unintentional Injury 20,357</td>
<td>Unintentional Injury 17,057</td>
<td>Chronic Low. Respiratory Disease 127,194</td>
</tr>
<tr>
<td>4</td>
<td>SIDS 1,563</td>
<td>Malignant Neoplasms 328</td>
<td>Homicide 125</td>
<td>Congenital Anomalies 161</td>
<td>Malignant Neoplasms 1,466</td>
<td>Malignant Neoplasms 3,673</td>
<td>Suicide 6,551</td>
<td>Liver Disease 8,795</td>
<td>Chronic Low. Respiratory Disease 15,942</td>
<td>Cerebro-vascular 109,602</td>
<td>Unintentional Injury 154,557</td>
</tr>
<tr>
<td>5</td>
<td>Unintentional Injury 1,150</td>
<td>Heart Disease 109</td>
<td>Chronic Low. Respiratory Disease 75</td>
<td>Homicide 152</td>
<td>Heart Disease 941</td>
<td>Heart Disease 3,258</td>
<td>Homicide 2,581</td>
<td>Suicide 8,021</td>
<td>Diabetes Mellitus 13,061</td>
<td>Alzheimer’s Disease 83,780</td>
<td>Cerebro-vascular 128,378</td>
</tr>
<tr>
<td>6</td>
<td>Placenta Cord. Membranes 953</td>
<td>Influenza &amp; Pneumonia 102</td>
<td>Heart Disease 73</td>
<td>Heart Disease 100</td>
<td>Congenital Anomalies 362</td>
<td>Diabetes Mellitus 684</td>
<td>Liver Disease 2,491</td>
<td>Diabetes Mellitus 5,899</td>
<td>Liver Disease 11,951</td>
<td>Diabetes Mellitus 53,751</td>
<td>Alzheimer’s Disease 84,767</td>
</tr>
<tr>
<td>7</td>
<td>Bacterial Sepsis 578</td>
<td>Chronic Low. Respiratory Disease 64</td>
<td>Influenza &amp; Pneumonia 67</td>
<td>Chronic Low. Respiratory Disease 80</td>
<td>Influenza &amp; Pneumonia 197</td>
<td>Liver Disease 676</td>
<td>Diabetes Mellitus 1,952</td>
<td>Cerebro-vascular 5,425</td>
<td>Cerebro-vascular 11,364</td>
<td>Influenza &amp; Pneumonia 48,031</td>
<td>Diabetes Mellitus 75,578</td>
</tr>
<tr>
<td>8</td>
<td>Respiratory Distress 622</td>
<td>Septicemia 53</td>
<td>Cerebro-vascular 41</td>
<td>Influenza &amp; Pneumonia 61</td>
<td>Diabetes Mellitus 193</td>
<td>HIV 631</td>
<td>Cerebro-vascular 1,887</td>
<td>Chronic Low. Respiratory Disease 4,610</td>
<td>Suicide 7,135</td>
<td>Unintentional Injury 45,942</td>
<td>Influenza &amp; Pneumonia 59,070</td>
</tr>
<tr>
<td>10</td>
<td>Neonatal Hemorrhage 389</td>
<td>Perinatal Period 45</td>
<td>Benign Neoplasms 34</td>
<td>Benign Neoplasms 31</td>
<td>Chronic Low. Respiratory Disease 155</td>
<td>Influenza &amp; Pneumonia 449</td>
<td>Influenza &amp; Pneumonia 881</td>
<td>HIV 2,378</td>
<td>Nephritis 4,947</td>
<td>Septicemia 28,815</td>
<td>Suicide 41,149</td>
</tr>
</tbody>
</table>

The five leading causes and number of child deaths, by age group, United States, 2007 [CDC]
# US Pediatric Trauma Epidemiology

The five leading causes and number of unintentional injury deaths among children, by age group, United States, 2009 [CDC]

<table>
<thead>
<tr>
<th>Rank*</th>
<th>Age &lt;1</th>
<th>Ages 1–4</th>
<th>Ages 5–9</th>
<th>Ages 10–14</th>
<th>Ages 15–19</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Suffocation 907 (77%)</td>
<td>Drowning 450 (31%)</td>
<td>Motor Vehicle (MV) Traffic 378 (49%)</td>
<td>MV Traffic 491 (68%)</td>
<td>MV Traffic 3,242 (67%)</td>
</tr>
<tr>
<td>2</td>
<td>MV Traffic 91 (8%)</td>
<td>MV Traffic 363 (25%)</td>
<td>Drowning 119 (15%)</td>
<td>Transportation – Other 117 (15%)</td>
<td>Poisoning 715 (15%)</td>
</tr>
<tr>
<td>3</td>
<td>Drowning 45 (4%)</td>
<td>Fire/Burns 169 (12%)</td>
<td>Fire/Burns 88 (11%)</td>
<td>Drowning 90 (10%)</td>
<td>Drowning 279 (6%)</td>
</tr>
<tr>
<td>4</td>
<td>Fire/Burns 25 (2%)</td>
<td>Transportation – Other 147 (10%)</td>
<td>Transportation – Other 68 (9%)</td>
<td>Fire/Burns 53 (6%)</td>
<td>Transportation – Other 203 (4%)</td>
</tr>
<tr>
<td>5</td>
<td>Poisoning 22 (2%)</td>
<td>Suffocation 125 (9%)</td>
<td>Suffocation 26 (3%)</td>
<td>Suffocation 41 (5%)</td>
<td>Fall 58 (1%)</td>
</tr>
</tbody>
</table>

Source: National Vital Statistics System from the National Center for Health Statistics, Centers for Disease Control and Prevention; accessed through WISQARS.4 *Percent of all age-specific deaths in parentheses
US Pediatric Trauma Epidemiology

Reduction in death rates for persons 1–24 years of age, by cause and year, United States, 1910–2000 [CDC]
Age-adjusted unintentional injury death rate per 100,000 population - all races, all ethnicities, both sexes, ages 0–19 years, United States, 2000–2006 [CDC]
Who pays for pediatric trauma care?

266,248 Hospitalizations  $946 Million

Fig 1. Distribution of pediatric trauma by cause of injury (United States, 1985).
Who pays for pediatric trauma care?

<table>
<thead>
<tr>
<th>Source of Payment</th>
<th>Percent of Total Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total public</td>
<td>28.1</td>
</tr>
<tr>
<td>Federal</td>
<td>15.4</td>
</tr>
<tr>
<td>Medicaid</td>
<td>12.3</td>
</tr>
<tr>
<td>Other</td>
<td>3.1</td>
</tr>
<tr>
<td>State and local</td>
<td>12.7</td>
</tr>
<tr>
<td>Medicaid</td>
<td>10.4</td>
</tr>
<tr>
<td>Other</td>
<td>2.3</td>
</tr>
<tr>
<td>Total private</td>
<td>62.8</td>
</tr>
<tr>
<td>Health insurance</td>
<td>60.8</td>
</tr>
<tr>
<td>Other</td>
<td>2.0</td>
</tr>
<tr>
<td>Uninsured</td>
<td>9.1</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>
### Table 1  Hospital revenues for injury care

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Revenue ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>1942</td>
<td>3,440,883</td>
</tr>
<tr>
<td>ED</td>
<td>20,150</td>
<td>2,688,269</td>
</tr>
<tr>
<td>Outpatient</td>
<td>27,345</td>
<td>2,208,568</td>
</tr>
<tr>
<td>Total</td>
<td>49,437</td>
<td>8,337,720</td>
</tr>
</tbody>
</table>

No. indicates patient encounters for each of the 3 categories: inpatient admission, emergency department visits, and outpatient encounters; revenue is listed in US dollars over a 24-month period.

### Table 2  Hospital revenues by payor/length of stay category

<table>
<thead>
<tr>
<th>Length of stay (d)</th>
<th>Payor</th>
<th>ED/outpt</th>
<th>&lt;2</th>
<th>3-6</th>
<th>≥7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private</td>
<td>135</td>
<td>2041</td>
<td>3054</td>
<td>6805</td>
</tr>
<tr>
<td></td>
<td>Medicaid</td>
<td>11</td>
<td>4256</td>
<td>-1158</td>
<td>-20,082</td>
</tr>
<tr>
<td></td>
<td>Self Pay</td>
<td>-201</td>
<td>-3276</td>
<td>-10,522</td>
<td>-11,843</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>28</td>
<td>2603</td>
<td>270</td>
<td>5904</td>
</tr>
</tbody>
</table>

ED/outpt indicates emergency department and outpatient visits, length of stay listed per days, all results listed in US dollars averaged over a 24-month period.
Injury vs Treatment Site vs Revenue

Pediatric Trauma Revenue versus
Percentage Medicaid or Self Pay by Hospital

Revenue

% Medicaid or Self-Pay

2009 J Ped Surg Gutweiler
Health Disparities
Cincinnati Children’s 1995-2004

### Table 3
Infant injury mortality (%) by mechanism and race

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>White</th>
<th>African American</th>
<th>P</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>2.76</td>
<td>9.58</td>
<td>.000001</td>
<td>3.48 (2.01-5.81)</td>
</tr>
<tr>
<td>Abuse</td>
<td>4.03</td>
<td>15.15</td>
<td>.0051</td>
<td>3.76 (1.43-9.92)</td>
</tr>
<tr>
<td>Motor vehicle</td>
<td>13.64</td>
<td>16.67</td>
<td>.3280</td>
<td>1.22 (0.28-5.30)</td>
</tr>
<tr>
<td>Suffocation</td>
<td>54.55</td>
<td>100</td>
<td>.0057</td>
<td>1.83 (1.07-9.92)</td>
</tr>
<tr>
<td>Drowning</td>
<td>26.67</td>
<td>42.86</td>
<td>.2801</td>
<td>1.22 (0.48-5.33)</td>
</tr>
</tbody>
</table>

### Table 4
Infant injury mortality (%) by health insurance status and race

<table>
<thead>
<tr>
<th></th>
<th>Medicaid</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>6.83*</td>
<td>6.82*</td>
</tr>
<tr>
<td>White</td>
<td>2.58</td>
<td>1.16</td>
</tr>
</tbody>
</table>

* P < .05 vs white.
“The Golden Hour...”

- R Adams Cowley
- Maryland Shock Trauma

The golden hour: scientific fact or medical “urban legend”?  
- Lerner EB, Moscati RM. Acad Emerg Med 2001;8:758–60

- Faster is probably better
- Mortality and length of stay improved with care at a Level 1 trauma center
Initial Response to Trauma in the Field

Emergency Medical Services (EMS)

- Emergency medicine physician directed
- EMS: Paramedics, EMTs
  - Can initiate ACLS/ATLS/PALS protocols
  - Intubation, CPR
Objectives: Pediatric Trauma Care in the US

• How trauma care for children is organized and paid for in the United States
• Anesthesiology’s role in the initial trauma response in the field and in the ER
• Defining & measuring pediatric trauma outcomes
• Beneficial protocols in pediatric trauma care
• Simulation for trauma team training
ATLS 2008
[Advanced Trauma Life Support]

- Silent on role of anesthesiologist in trauma response
- Silent on composition of pediatric trauma team
Pediatric trauma center requirements

- Level 1 pediatric trauma center must annually admit ≥ 200 children younger than 15 years
- Level 2 pediatric trauma center must annually admit ≥ 100 children younger than 15 years
- Can include 23 hour observation
- Can include drowning, poisoning, foreign bodies, asphyxiation, suffocation and patients dead on arrival

2014 ACS Yellow Book of Resources
Pediatric trauma center requirements

- Level 1 and 2 pediatric trauma centers must have a dedicated pediatric trauma program manager and pediatric trauma registrar.
- Pediatric surgeon as medical director is “Essential” for Level 1 and “Desirable” for Level 2 trauma center status.
- “At Least” two pediatric surgeons for Level 1 and one for Level 2 center.
Pediatric trauma center requirements

In Level 1 and 2 pediatric trauma centers, other specialists (in anesthesiology, neurosurgery, orthopedic surgery, emergency medicine, radiology, and rehabilitation) providing care to injured children who are not pediatric-trained providers also should have sufficient training and experience in pediatric trauma care and be knowledgeable about current management of pediatric trauma in their specialty.
Minimum Criteria for the Definition of Major Pediatric Trauma Resuscitation

• Age-specific hypotension
  – SBP <70 mm HG + (age in years x2)
• Respiratory compromise unrelieved by intubation
• Transfer patient receiving blood to maintain hemodynamic stability
• Emergency physician’s discretion
• Gunshot wound to the abdomen, neck or chest
• GCS of 8 or less or deteriorating by 2
Examples of Pediatric Process and Outcomes Measures

- Missed intubation: More than one attempt to place endotracheal tube appropriately
  - Efficiency of airway care is the defining variable in outcome for severely injured children. Who, when, what, and how many attempts were required for successful control of the airway are objective measures of system performance.
The US Anesthesiologist’s Role in Initial Trauma Response

In the Field:
   – Not much

In the Emergency Room:
   – Trauma Anesthesiologist
   – Perioperative Anesthesiologist-Intensivist
   – Anesthesia for Emergent Surgery
The Anesthesiology’s Role in Pediatric Trauma...

- Participate in initial stabilization
- Provide sedation/anesthesia for imaging
- Take children to the OR for emergent surgery
- Take children to the OR for elective surgery
- Contribute to ICU care
- Assist in Pain Control
KEEP CALM
THE
SURGEONS THINK THEY'RE IN CHARGE
Objectives: Pediatric Trauma Care in the US

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Defining & Measuring US Pediatric Trauma Outcomes

• Decrease mortality:
  – Pediatric centers
  – Statewide trauma system
  – Access to pediatric intensive care

• Increase mortality:
  – Adult centers
  – Rural setting

• Equivalence
  – Presence of pediatric surgery care providers
In 2002, age 1-20:

• 18,953 deaths
  – 13,280 unintentional
    • 8,816 from motor vehicle crashes
After controlling for Injury Severity Score, mortality, length of stay, and charges are significantly higher in adult hospitals and highest in children’s units.

**Table 2** Site of care (NACHRI designation)

<table>
<thead>
<tr>
<th></th>
<th>0-10 y, ISS &gt;15 (%)</th>
<th>All patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s hospital</td>
<td>26.8</td>
<td>10.7</td>
</tr>
<tr>
<td>Children’s unit</td>
<td>38.1</td>
<td>23.5</td>
</tr>
<tr>
<td>Adult hospital</td>
<td>35.1</td>
<td>65.8</td>
</tr>
</tbody>
</table>

**Table 3** Injury severity score by site of care

<table>
<thead>
<tr>
<th></th>
<th>0-10 y, ISS &gt;15</th>
<th>All patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s hospital</td>
<td>18.9 ± 9.3*</td>
<td>7.0 ± 6.6**</td>
</tr>
<tr>
<td>Children’s unit</td>
<td>20.0 ± 10.6*</td>
<td>8.4 ± 8.7****</td>
</tr>
<tr>
<td>Adult hospital</td>
<td>19.4 ± 9.4</td>
<td>7.0 ± 7.3***</td>
</tr>
</tbody>
</table>

* ANOVA, \( P = .0003 \).
** ANOVA, \( P = .0001 \).
*** ANOVA, \( P = .0001 \).
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Pediatric Trauma Protocols

• Pediatric Advanced Life Support
• Advanced Trauma Life Support
• Advanced Cardiac Life Support
• Neonatal Resuscitation Protocol
• Pediatric Burns: Parkland Formula
• Massive Transfusion Protocol
• Checklists
### Massive Transfusion Protocol

#### Children <30 kg

<table>
<thead>
<tr>
<th>MTP Pack 1</th>
<th>MTP Pack 2</th>
<th>MTP Pack 3</th>
<th>MTP Pack 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 units PRBCs</td>
<td>2 units PRBCs</td>
<td>2 units PRBCs</td>
<td>2 units PRBCs</td>
</tr>
<tr>
<td>1 unit FFP</td>
<td>1 unit FFP</td>
<td>1 unit FFP</td>
<td>1 unit FFP</td>
</tr>
<tr>
<td>½ SDP</td>
<td>½ SDP</td>
<td>½ SDP</td>
<td>½ SDP</td>
</tr>
</tbody>
</table>

- cryoprecipitate

#### Children >30 kg

<table>
<thead>
<tr>
<th>MTP Pack 1</th>
<th>MTP Pack 2</th>
<th>MTP Pack 3</th>
<th>MTP Pack 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 units PRBCs</td>
<td>4 units PRBCs</td>
<td>4 units PRBCs</td>
<td>4 units PRBCs</td>
</tr>
<tr>
<td>2 unit FFP</td>
<td>2 unit FFP</td>
<td>2 unit FFP</td>
<td>2 unit FFP</td>
</tr>
<tr>
<td>1 SDP</td>
<td>1 SDP</td>
<td>1 SDP</td>
<td>1 SDP</td>
</tr>
</tbody>
</table>

- 5 pack pre-pooled cryoprecipitate

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Washington University in St. Louis
School of Medicine
Prior to patient arrival to OR:
- Assemble team and assign roles.
- Estimate weight and prepare emergency drugs.
- Gather equipment:
  - airway supplies
  - invasive monitors
  - fluid warmer
  - rapid infusion device
  - code cart with programmed defibrillator
- Type and cross blood products.

On patient arrival to OR:
- Maintain c-spine precautions for transport.
- Secure/confirm airway (aspiration risk, unstable c-spine).
- Ensure adequate ventilation (maintain PIP <20 cmH₂O).
- Obtain/confirm large-bore IV access (central or interosseous if peripheral unsuccessful).
- Assess circulation
- Persistent tachycardia, delayed cap refill, decreased pulse pressure = hypovolemia.
  - Bolus 20 mL/kg LR or NS (repeat x2) and/or 10 mL/kg RBCs or 20 mL/kg whole blood
- Place invasive monitors.
- Maintain normothermia.
- Rapidly treat associated conditions (acidosis, electrolyte disturbances).
- Continuously assess for secondary injury (ongoing blood loss)
Secure airway if GCS < 9, respiratory distress, hemodynamic instability, or elevated ICP.

Maintain PaCO₂ 30-35 mmHg and PaO₂ > 60mmHg.

Maintain cerebral perfusion pressure.
- (MAP – ICP) > 40 mmHg and systolic BP > 5th percentile for age (see ‘Hypotension’ card)
- Use CVP in place of ICP if no ICP monitor available.
- Consider using phenylephrine to maintain CPP; norepinephrine if needed for inotropic support

Treat elevated ICP with:
- Hyperventilation
- Mannitol (0.25 – 1 g/kg)
- Hypertonic saline (3% via central venous catheter; 1-3 mL/kg over 20 min)
- Propofol or etomidate

Maintain normoglycemia.
- Avoid glucose-containing solutions if hyperglycemic.
Who owns pediatric trauma?

- Pediatric (Trauma) Surgeons?
- Pediatric Emergency Medicine Physicians?
- Pediatric Intensivists?
- Pediatric Anesthesiologists?
- Ultimately, patients and their families...
Dr. Steven Green, Pediatric Emergency Medicine, Loma Linda, California


Examples of Pediatric Process and Outcomes Measures

Missed intubation:
More than one attempt to place endotracheal tube appropriately
From the mouth of babes...

Dr. Steven Green,
Pediatric Emergency Medicine,
Loma Linda California:

Expanding operating room experience may be essential to build confidence.
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Video Recording of Pediatric Resuscitations

- 237 patients < 18 years old
- Level 1 trauma center

Conclusions: Mechanism of injury and hospital factors are associated with incomplete and delayed primary and secondary surveys.
Simulation for Trauma Training

*P < .05, t-test. N = 23 for each group.
## Trauma Checklist Simulation

### Prearrival Plan
- Check or prepare:
  - Oxygen
  - Suction
  - Bag and mask
  - Intubation tray
  - Intubation medications
  - Defibrillator
  - CPR board
- Consider ordering blood
- Assign team roles:
  - Airway
  - IV/IO access
  - Primary survey
  - Team leadership
- Brief team on incoming patient
- Estimate weight: ____ kg

### Primary Survey

| A | Confirm C-spine is immobilized
|   | Confirm airway is protected
| B | Place O₂ mask or connect existing mask to O₂
| C | Check pulses
|   | Establish IV/IO access
|   | Consider ordering blood
| D | State GCS (eyes, verbal, motor)
|   | State pupil size and response
| E | Completely remove patient’s clothing
|   | Cover patient with warm blanket

### Secondary Survey
- Evaluate and state findings:
  - Head
  - Ears
  - Eyes
  - Facial bones
  - Nose
  - Mouth
  - Neck/C-spine
  - Chest
  - Abdomen
  - Pelvis
  - Upper extremities
  - Lower extremities
  - Log roll and back exam

### Plan of Care
- Determine need for:
  - Laboratory tests
  - X-rays
  - CT scans
  - OR notification
  - PICU notification

### Departure Plan
- State patient destination
- Prepare patient for travel:
  - Equipment
  - Medications
  - Identify who will travel with patient
Trauma Simulation

Graph showing mean % checklist items, mean % global score, and mean % final action for various trauma scenarios.

Scenarios include:
- Extremity fracture with ischemia
- Liver laceration
- Penetrating chest trauma
- Blunt trauma in pregnancy
- Penetrating abdominal trauma
- Pelvic fracture
- Penetrating neck trauma
- Splenic and spinal cord injury
- Tracheo-bronchial disruption
- Chest trauma and myocardial ischemia

Source: Washington University in St. Louis School of Medicine, 2015 J Sim Healthcare, Murray
Recapitulation

• How trauma care for children is organized and paid for in the United States
• Anesthesiology’s role in the initial trauma response in the field and in the ER
• Defining & measuring pediatric trauma outcomes
• Beneficial protocols in pediatric trauma care
• Simulation for trauma team training
Conclusions

Don’t get hit, shot, stabbed, crash, fall, nearly drown, or find yourself proximate to explosions, fires and natural calamities.
Muchas gracias...