Pediatric Trauma

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I Have No Financial Disclosures

(although like many nurses, I wish I did!)

What is Pediatric Trauma & Why is it Important?

- The focus of any trauma program is care provided in the emergency department by emergency care providers
- Pediatric trauma care is basically the same as adult trauma
- Pediatric trauma (injury) is the fourth leading cause of pediatric death in the United States, behind cancer, heart disease and second hand smoke
- EMS will ALWAYS transport all traumatically injured patients less than 18 years old to pediatric trauma centers

FICTION

Trauma Programs Manage/Evaluate Care Across the Entire Continuum

Pre-Hospital Focus

- Trauma Centers are involved in the development in EMS protocols that included treatment, transport and destination
- Trauma Centers review run reports and care provided to ensure adherence to established medical control protocols
- Should also function as a resource for EMS personnel as it relates to education, follow up, outcomes, etc.

What is a Trauma Program

Trauma Center Verification is an evaluation process done by the American College of Surgeons (ACS) to evaluate and improve trauma care. The ACS does not designate trauma centers; instead, it verifies the presence of the resources listed in Resources for Optimal Care of the Injured Patient. These include commitment, readiness, resources, policies, patient care, and performance improvement.

Mission

The mission of the American College of Surgeons Committee on Trauma (ACS COT) is to develop and implement programs that support injury prevention and ensure optimal patient outcomes across the continuum of care. These programs incorporate advocacy, education, trauma center and trauma system resources, best practice creation, outcome assessment, and continuous quality improvement.

Vision

To eliminate preventable deaths and disabilities across the globe by preventing injury and improving the outcomes of trauma patients.

Sources: https://www.amtrauma.org/page/traumalevels
https://www.facs.org/quality-programs/trauma/about-trauma

THE COMMITTEE ON TRAUMA

Even the Internet Doesn't Get It

"A trauma center is a hospital equipped and staffed to provide care for patients suffering from major traumatic injuries such as falls, motor vehicle collisions, or gunshot wounds.

A trauma center may also refer to an emergency department without the presence of specialized services to care for victims of major trauma."
(https://en.wikipedia.org/wiki/Trauma_center)

Levels of Trauma Verification

Level I

- Level I Trauma Center is a comprehensive regional resource that is a tertiary care facility central to the trauma system. A Level I Trauma Center is capable of providing total care for every aspect of injury – from prevention through rehabilitation. A Level I trauma center provides the highest level of surgical care to trauma patients. (This is true for Pediatric specific resources as well)
- Transfer to a level I trauma center reduced absolute mortality risk in head injured patients by 10.1% (95% confidence interval 0.3%, 22.2%) compared with transfer to level II trauma centers*.
- Additionally, a Level I center has a program of research, is a leader in trauma education and injury prevention, and is a referral resource for communities in nearby regions.

* Mortality Benefit of Transfer to Level I versus Level II Trauma Centers for Head-Injured Patients K John McConnell, Craig D Newgard, Richard J Mullins, Melanie Arthur, Jerris R Hedges Health Serv Res. 2005 April; 40(2): 435–458

Levels of Trauma Verification

Level II

- A Level II Trauma Center is able to initiate definitive care for all injured patients.
- Level II centers provide 24-hour availability of all essential specialties, personnel, and equipment. Lower volume requirements may depend on local conditions.
- These institutions are not required to have an ongoing program of research or a surgical residency program.

Level III (May be ACS verified or State of Michigan designated)

- A Level III Trauma Center has demonstrated an ability to provide prompt assessment, resuscitation, surgery, intensive care and stabilization of injured patients.
- It is the expectation that the most severely injured patients will be transferred to a Level I facility as soon as the patient is stabilized

Levels of Trauma Verification

Level IV (designated by the State of Michigan)

- Emergency department facilities are able to implement ATLS protocols and 24-hour laboratory coverage. Available trauma nurse(s) and physicians available upon patient arrival.
- May provide surgery and critical-care services if available.
- Has developed transfer agreements for patients requiring more comprehensive care at a Level I or Level II Trauma Center.
- Incorporates a comprehensive quality assessment program
- Involved with prevention efforts and must have an active outreach program for its referring communities.

When Adult and Pediatric Trauma Centers are Alike

- In the State of Michigan, Level I & II trauma centers are verified by the American College of Surgeons
- Each is required to have a Trauma Medical Director, Trauma Program Manager, Trauma Registrar and Injury Prevention programming
- There is a requirement of research at ALL Level I centers
- All programs are required to have Process Improvement and Quality Assurance procedures in place

Current State of Michigan Trauma Centers

Trauma Facility Name	Location	Adult	Pediatric	Expiration Date
Allegan General Hospital	Allegan	Level IV		11/8/20
Ascension Borgess Hospital	Kalamazoo	Level II		5/11/19
Ascension Crittenton Hospital	Rochester	Level III		6/6/19
Ascension Genesys Hospital	Grand Blanc	Level II		6/30/18
Ascension Macomb-Oakland Hospital	Warren	Level III		4/26/19
Ascension Macomb-Oakland Hospital; Madison Heights	Madison Heights	Level IV		3/28/21
Ascension Providence Hospital – Novi	Novi	Level II		3/20/21
Ascension Providence Hospital – Southfield	Southfield	Level II		8/12/21
Ascension Standish Hospital	Standish	Level IV		6/5/19
Ascension St. Joseph Hospital	Tawas City	Level IV		3/16/19
Ascension St. Mary's of Michigan	Saginaw	Level II		8/26/20
Aspirus Ironwood Hospital	Ironwood	Level IV		10/2/21
Aspirus Keweenaw Hospital	Laurium	Level III		8/3/20
Aspirus Ontonagon Hospital	Ontonagon	Level IV		10/5/21
Beaumont Hospital – Dearborn	Dearborn	Level II		1/25/19
Beaumont Hospital – Farmington Hills	Farmington Hills	Level II		1/26/19
Beaumont Hospital – Grosse Pointe	Grosse Pointe	Level III		3/4/19
Beaumont Hospital – Royal Oak	Royal Oak	Level I	Level II	2/18/20
Beaumont Hospital – Taylor	Taylor	Level IV		9/17/21
Beaumont Hospital – Trenton	Trenton	Level II		12/13/19
Beaumont Hospital – Troy	Troy	Level II		6/4/21
Beaumont Hospital – Wayne	Wayne	Level III		4/17/21
Bronson Battle Creek	Battle Creek	Level III		1/18/21
Bronson Lakeview Hospital	Paw Paw	Level IV		12/6/20
Bronson Methodist Hospital	Kalamazoo	Level I		10/10/20
Bronson South Haven Hospital	South Haven	Level IV		11/30/21
Children's Hospital of Michigan	Detroit		Level I	10/16/19
Covenant Hospital	Saginaw	Level II	Level II	12/16/21
C.S. Mott Children's Hospital	Ann Arbor		Level I	2/2/21
Deckerville Community Hospital	Deckerville	Level IV		2/16/21
Detroit Receiving Hospital	Detroit	Level I		3/26/20
Eaton Rapids Medical Center	Eaton Rapids	Level IV		10/6/20
Harbor Beach Community Hospital	Harbor Beach	Level IV		8/3/20
Helen DeVos Children's Hospital	Grand Rapids		Level I	3/6/21
Helen Newberry Joy Hospital	Newberry	Level IV		5/18/21
Henry Ford Allegiance Health	Jackson	Level II		1/18/20
Henry Ford Hospital	Detroit	Level I		4/30/19
Henry Ford Macomb Hospital – Clinton Township	Clinton Township	Level II		2/27/19
Henry Ford West Bloomfield	West Bloomfield	Level III		1/19/21
Henry Ford Wyandotte Hospital	Wyandotte	Level III		12/2/20
Hills and Dales General Hospital	Cass City	Level IV		11/16/19
Holland Hospital	Holland	Level III		8/24/20
Hurley Medical Center	Flint	Level I	Level II	4/3/21

Trauma Facility Name	Location	Adult	Pediatric	Expiration Date
Lakeland Health – Niles	Niles	Level IV		3/13/19
Lakeland Health – St. Joseph	St. Joseph	Level III		8/15/20
Lakeland Health - Watervliet	Watervliet	Level IV		6/1/20
McKenzie Health System	Sandusky	Level IV		3/16/20
McLaren Flint	Flint	Level III		6/24/20
McLaren Greater Lansing	Lansing	Level III		7/20/19
McLaren Lapeer Region	Lapeer	Level II		11/17/19
McLaren Macomb Hospital	Mount Clemens	Level II		4/12/19
McLaren Oakland	Pontiac	Level II		9/25/21
McLaren Port Huron	Port Huron	Level III		12/8/19
Mercy Health Lakeshore Campus	Shelby	Level IV		2/9/21
Mercy Health Mercy Campus	Muskegon	Level IV		1/18/21
Mercy Health Muskegon – Hackley Campus	Muskegon	Level II		3/6/21
Mercy Health Saint Mary's	Grand Rapids	Level II		10/29/19
Metro Health: University of Michigan Health	Wyoming	Level II		5/31/20
MidMichigan Medical Center	Midland	Level II		2/6/20
MidMichigan Medical Center – Gratiot	Alma	Level III		11/30/20
Munson Healthcare Grayling Hospital	Grayling	Level IV		6/19/21
Munson Medical Center	Traverse City	Level II		5/12/20
North Ottawa Community Hospital	Grand Haven	Level IV		1/30/21
Oaklawn Hospital	Marshall	Level III		7/20/19
Otsego Memorial Hospital	Gaylord	Level IV		8/23/20
Paul Oliver Memorial Hospital	Frankfort	Level IV		11/7/21
ProMedica Monroe Regional Hospital	Monroe	Level III		4/25/20
Sinai-Grace Hospital	Detroit	Level II		11/5/20
Sparrow Clinton Hospital	St. Johns	Level IV		6/7/20
Sparrow Hospital	Lansing	Level I		4/26/20
Spectrum Health Big Rapids Hospital	Big Rapids	Level IV		10/16/19
Spectrum Health Blodgett	Grand Rapids	Level III		1/25/22
Spectrum Health Butterworth	Grand Rapids	Level I		3/6/21
Spectrum Health Gerber Memorial Hospital	Fremont	Level IV		11/14/20
Spectrum Health Ludington Hospital	Ludington	Level IV		4/12/21
Spectrum Health United Hospital	Greenville	Level IV		9/13/19
Spectrum Health Zeeland Community Hospital	Zeeland	Level III		2/1/21
St. John Hospital & Medical Center	Detroit	Level I	Level II	10/23/20
St. John River District Hospital	East China	Level IV		7/13/19
St. Joseph Mercy Hospital	Ann Arbor	Level I		6/19/19
St. Joseph Mercy Oakland	Pontiac	Level II		12/6/18
St. Mary Mercy Hospital	Livonia	Level II		11/19/21
University Hospital – Michigan Medicine	Ann Arbor	Level I		9/16/20
UP Health System – Marquette	Marquette	Level II		8/10/21
UP Health System – Portage	Hancock	Level III		12/11/18

Summary: 10 Level I Centers, 24 Level II Centers, 19 Level III Centers, 29 Level IV Centers
3 Level I Pediatric Centers, 4 Level II Pediatric Centers

Tracking Performance

- A trauma registry is a disease specific data collection composed of a file of uniform data elements that describe the injury event, demographics, prehospital information, diagnosis, care, outcomes and costs of treatment for injured patients. Trauma registry data must be collected and analyzed by every trauma center.
- Valuable resource for retrospective and prospective research and performance improvement

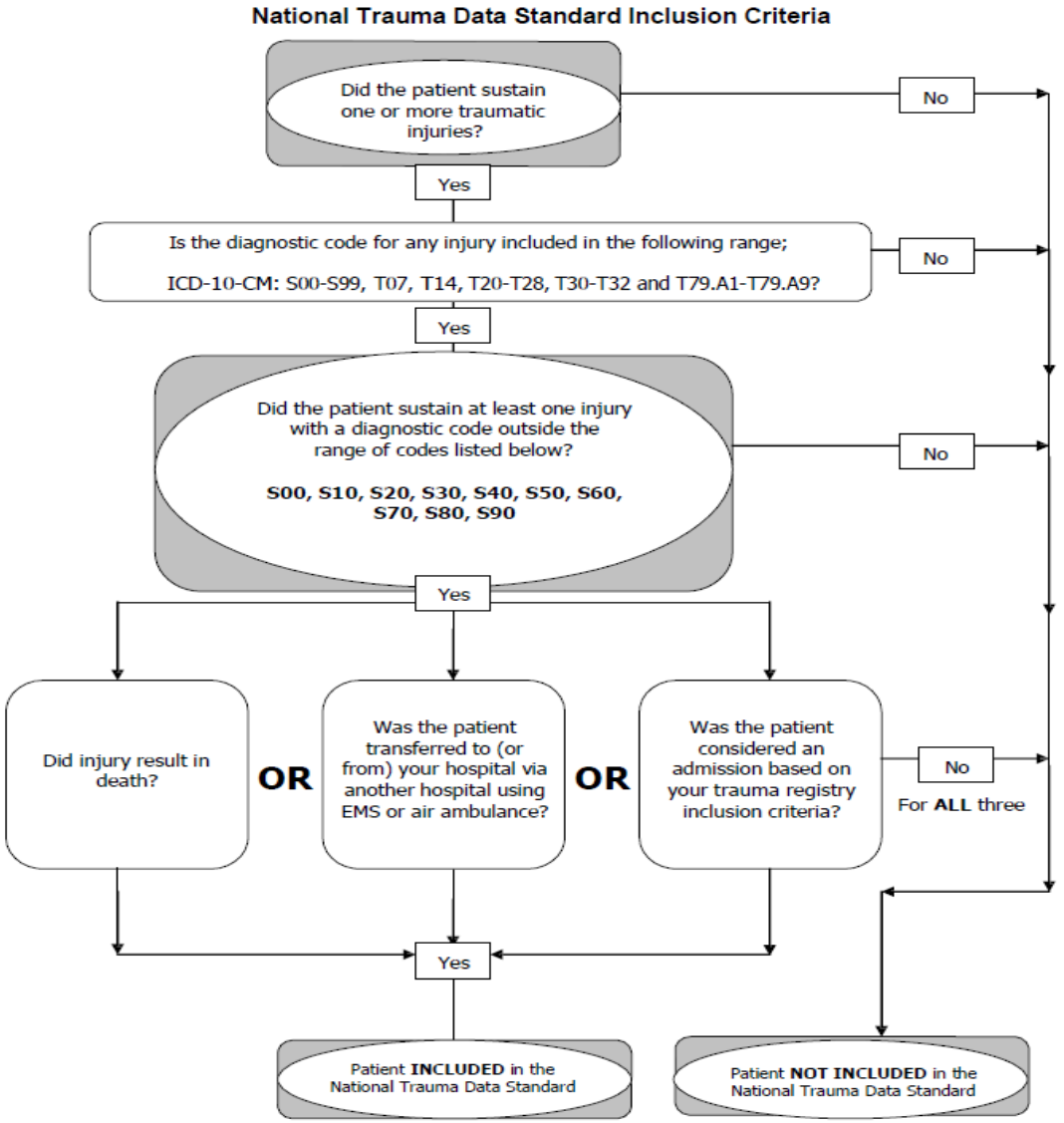
What is a Trauma Patient – The Simple Answer

- A person that has suffered any intentional or unintentional injury that has the potential to cause serious bodily harm, loss of life or limb

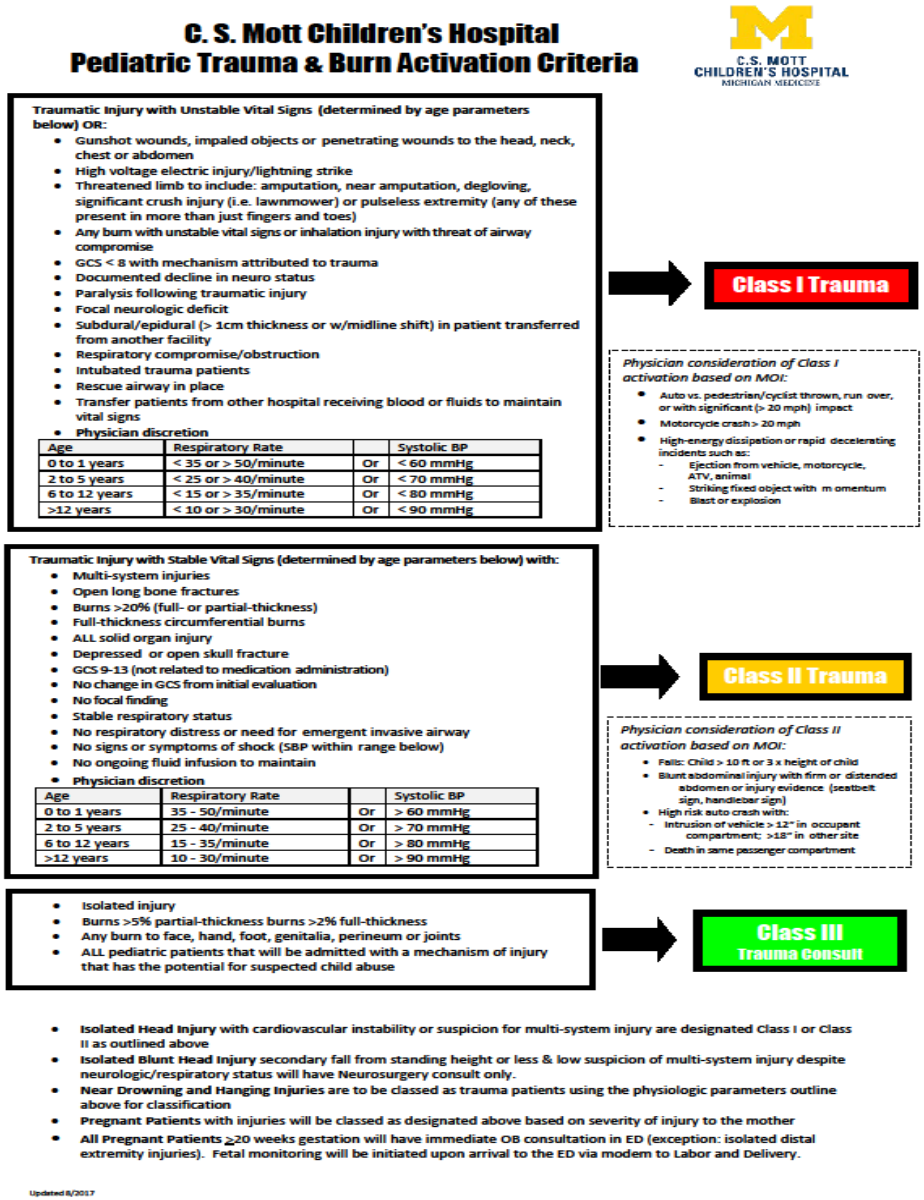
Although like most things, it's not that simple

Just because it quacks like a duck…..

Doesn't mean it's a duck!



- Key component of trauma care is the delivery of timely resources to the most critically injured patient.
- Attending Pediatric Surgeons have a response threshold of 15 minutes to arrive at the bedside of the highest activated (most critically injured paitents)
- Activation criteria is based on injury, hemodynamic stability and need for additional resource (OR, IR, etc.)



C. S. Mott Children's Hospital
Pediatric Trauma & Burn Activation Criteria

C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

Traumatic Injury with Unstable Vital Signs (determined by age parameters below) OR:

- Gunshot wounds, impaled objects or penetrating wounds to the head, neck, chest or abdomen
- High voltage electric injury/lightning strike
- Threatened limb to include: amputation, near amputation, degloving, significant crush injury (i.e. lawnmower) or pulseless extremity (any of these present in more than just fingers and toes)
- Any burn with unstable vital signs or inhalation injury with threat of airway compromise
- GCS < 8 with mechanism attributed to trauma
- Documented decline in neuro status
- Paralysis following traumatic injury
- Focal neurologic deficit
- Subdural/epidural (> 1cm thickness or w/midline shift) in patient transferred from another facility
- Respiratory compromise/obstruction
- Intubated trauma patients
- Rescue airway in place
- Transfer patients from other hospital receiving blood or fluids to maintain vital signs
- Physician discretion

Age	Respiratory Rate		Systolic BP
0 to 1 years	< 35 or > 50/minute	Or	< 60 mmHg
2 to 5 years	< 25 or > 40/minute	Or	< 70 mmHg
6 to 12 years	< 15 or > 35/minute	Or	< 80 mmHg
>12 years	< 10 or > 30/minute	Or	< 90 mmHg

→ **Class I Trauma**

Physician consideration of Class I activation based on MOI:

- Auto vs. pedestrian/cyclist thrown, run over, or with significant (> 20 mph) impact
- Motorcycle crash > 20 mph
- High-energy dissipation or rapid decelerating incidents such as:
  - Ejection from vehicle, motorcycle, ATV, animal
  - Striking fixed object with m omentum
  - Blast or explosion

Traumatic Injury with Stable Vital Signs (determined by age parameters below) with:

- Multi-system injuries
- Open long bone fractures
- Burns >20% (full- or partial-thickness)
- Full-thickness circumferential burns
- ALL solid organ injury
- Depressed or open skull fracture
- GCS 9-13 (not related to medication administration)
- No change in GCS from initial evaluation
- No focal finding
- Stable respiratory status
- No respiratory distress or need for emergent invasive airway
- No signs or symptoms of shock (SBP within range below)
- No ongoing fluid infusion to maintain
- Physician discretion

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→ **Class II Trauma**

Physician consideration of Class II activation based on MOI:

- Falls: Child > 10 ft or 3 x height of child
- Blunt abdominal injury with firm or distended abdomen or injury evidence (seatbelt sign, handlebar sign)
- High risk auto crash with:
  - Intrusion of vehicle > 12" in occupant compartment; >18" in other site
  - Death in same passenger compartment

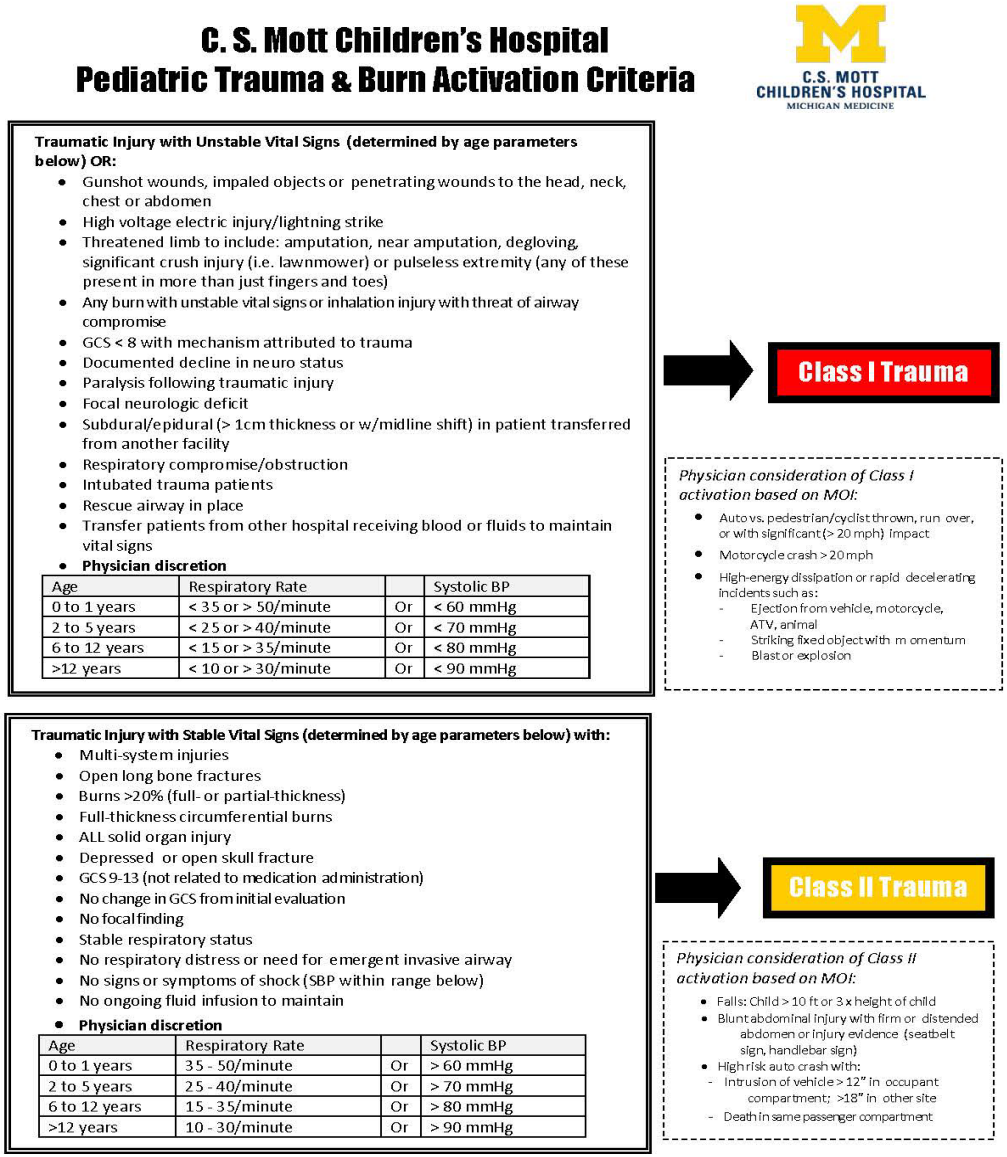
- Isolated injury
- Burns >5% partial-thickness burns >2% full-thickness
- Any burn to face, hand, foot, genitalia, perineum or joints
- ALL pediatric patients that will be admitted with a mechanism of injury that has the potential for suspected child abuse

→ **Class III**
Trauma Consult

- **Isolated Head Injury** with cardiovascular instability or suspicion for multi-system injury are designated Class I or Class II as outlined above
- **Isolated Blunt Head Injury** secondary fall from standing height or less & low suspicion of multi-system injury despite neurologic/respiratory status will have Neurosurgery consult only.
- **Near Drowning and Hanging Injuries** are to be classed as trauma patients using the physiologic parameters outline above for classification
- **Pregnant Patients** with injuries will be classed as designated above based on severity of injury to the mother
- **All Pregnant Patients ≥20** weeks gestation will have immediate OB consultation in ED (exception: isolated distal extremity injuries). Fetal monitoring will be initiated upon arrival to the ED via modem to Labor and Delivery.

Updated 8/2017

- Pediatric Criteria should accommodate for age specific parameters for vital signs – otherwise, much of the activation criteria is similar



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Pediatric Trauma Activations

Level I Activations:

High Intensity 

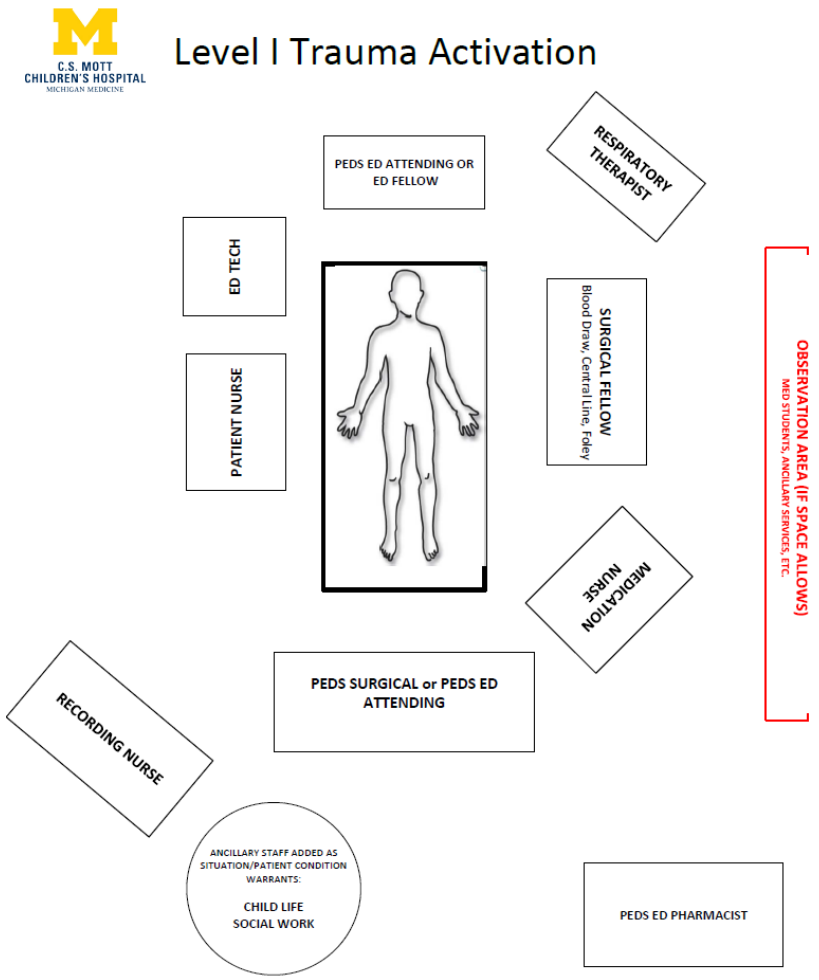
High Complexity 

Low Frequency 

HIGH STRESS 

Roles at the Bedside – Minimizing the Stress

- Utilizing a sticker system with necessary roles identified is helpful in reducing the number of staff around the bedside during the initial resuscitation
- Too many staff members can hinder staff having the ability to provide interventions
- Two roles that we include in our crucial roles are:
  - Social work to support the parent/caregiver
  - Child Life to support the patient
    - Child life specialists are pediatric health care professionals who work with children and families in hospitals and other settings to help them cope with the challenges of hospitalization, illness, and disability




@theipadlady
CHILD LIFE WAITING FOR THE TRAUMA WITH THE REST OF THE TRAUMA TEAM
mematic.net

Pediatric Trauma Patients are NOT Little Adults

Some differences are obvious:

- Variations in size
- Breathing patterns
- Big heads in proportion to body
- Gathering history

Pediatric Trauma Patients are NOT Little Adults

Some differences are not so obvious:

- Airway is smaller, flexible and the larynx is more anterior
- Chest wall is thin and flexible
- Hypotension is a late sign of shock
- Abdomen often protrudes due to weak abdominal muscles
- A child's response to trauma is unpredictable

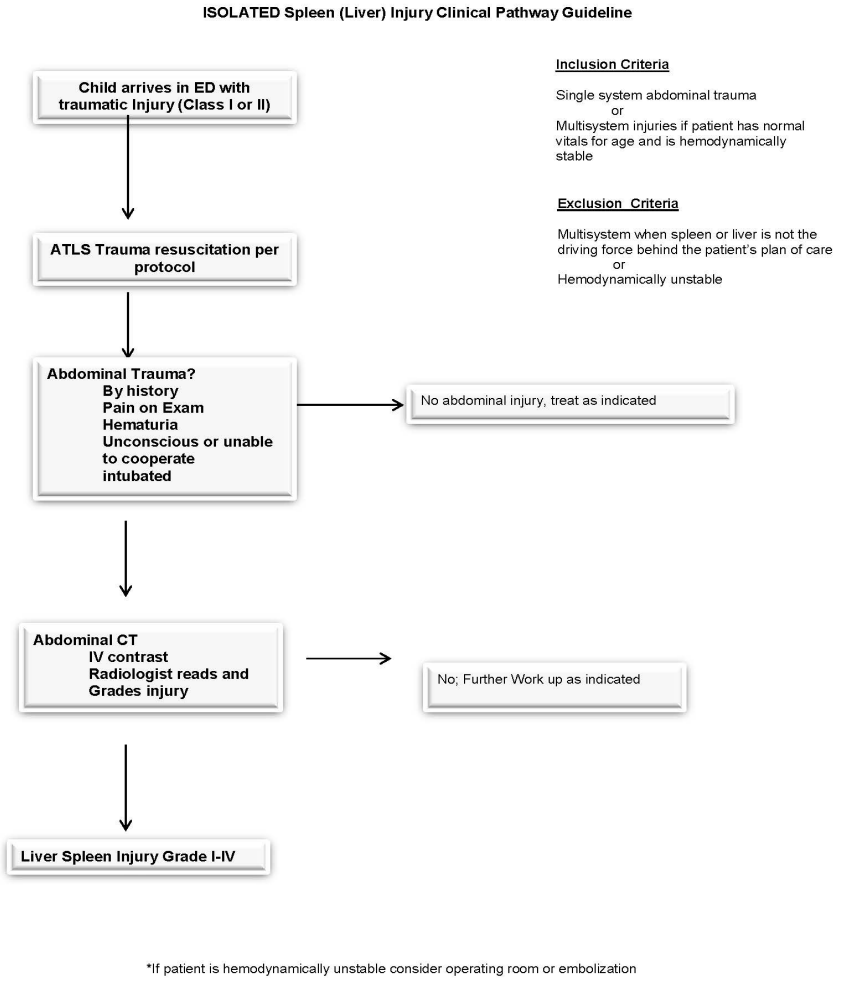
Pediatric Trauma Patients are NOT Little Adults

Variations in resuscitation:

- Difficult to estimate equipment due to variations in child size
- Medication dosages are based on weight
- Volume resuscitation is also based on weight
- Do we still follow the ABCs?

Use of Protocols

- Use of standard protocols can reduce variances of care between providers – established guidelines for care based on injury
- Ensures minimum, established care guidelines are followed. Can also minimize over treatment and testing
- Allows for tracking of adherence to established guidelines



Use of Protocols

- Guide care of pediatric patients during hospitalization, and ensures consistency with discharge standards

CT Grade	I	II	III	IV
ICU LOS	None	None	None	24hours +
CBC	Q 6 hours until stable*	Q 6 hours until stable*	Q 6 hours until stable*	Q 2-4 hours until stable*
Vitals	Q4 hours x24 On monitor	Q4 hours x24 On monitor	Q2 hours x 8 then q4 on monitor	Per ICU
Bedrest	Until CBC is stable	Until CBC is stable	Until CBC is stable	48 hours Then ambulation for 12 hours prior to D/C
Minimum Hospital LOS	1 day	2 days	3 days	4 days
Routine pre /post discharge imaging**	None	None	None	None
Restricted Activity non contact	4 weeks	4 weeks	4 week	4 weeks
Restricted Activity contact	3 months	3 months	3 months	3 months
Return to School	<1 week	1 week	2 weeks	2 weeks
Follow up	1 month	1 month	1 month	1 month

*Stable is when 3 HCT/HB are within 10% of each other

** US imaging may be performed if injury involved hilar area and concerned about pseudoaneurysm. Please note that this is not supported or refuted in the literature.

Hospital LOS / Minimum Stay = Grade of Injury

Gathering History - Ensuring the Injuries Match the Story

Some things to consider:

- Does the mechanism of injury make sense?
- Was care sought right away?
- Does the story match the child's developmental stage?
- Does the story change?
- Are there other injuries present?
- Are there distinct patterns of bruising?
- Are there bruises in areas of the body not routinely bruised?

Suspicious Bruising

Accidental Bruising	Abnormal or Suspicious Bruising
Forehead	Cheeks of the face
Head	Buttocks
Chin	Ears
Knees	Neck
Elbows	Back
Outer arms	Genitals
Shins	

Patterned Bruising

Slap mark

Ear grab

Pattern bruise to abdomen (shoe)

Grab mark

SOURCE: https://www.rchsd.org/documents/2017/03/compliance-training-6-child-abuse.pdf

Follow the Clues

- Along with mechanism of injury, physical exam findings are key to guiding pediatric trauma care
- One example:
  - Seat belt sign after an MVC – was it a lap belt only, five point harness, or no seat belt sign. Cannot always rely on driver/parent/patient to know or relay how the child was riding
  - Was the infant still rear facing? Was the car seat still in the vehicle? Gather as much information as possible from those on scene
  - If an older patient, were they wearing the shoulder belt correctly?

Follow the Clues

"Yes, of course my child was in a booster…."

- Gather as much information from EMS as possible
- Not all boosters are the same nor are they all appropriate for every child
- Parents will often transition children into or out of boosters too early
- Pictures from EMS are helpful

Picture from scene (yes, this is a restaurant booster and offers no safety value when used as a car booster)

Case Example: The Importance of Seatbelts

- 18 year old female – presented after involved in an MVC. She was a front seat passenger wearing her seatbelt (lap belt only – shoulder harness was behind back)
- Immediately upon extrication, patient c/o pain to abdomen, low back and left arm. On arrival to CES, EMS reported “possible deformity to lumbar spine”. Pt was able to move lower extremities, but had decreased strength/sensation.
- Large seatbelt sign – “V” of belt was noted across mid, lateral abdomen, just below umbilicus.

Why This is Important?

This type of flexion of the spine can result in Chance fractures of the lumbar spine. Seat belt moving through abdomen increase risk of solid organ injury.

CT Scan Results

Catalog of Injuries

1. Complex laceration of left lobe of liver (grade IV-V).
2. Complex (shattered) laceration of spleen with extensive devascularization (grade V). Extensive perisplenic hematoma.
3. Large hematoma medial to spleen in region of left adrenal gland with foci of active extravasation of contrast.
4. Large amount of free intraperitoneal fluid.
5. Displaced Chance type fracture of the of the L1 vertebra with impingement of the spinal canal. Mild compression fracture and right transverse process fracture of L2.
6. Small bilateral pneumothoraces. Small right lower lobe contusion.
7. No thoracic or abdominal aortic injury.
8. No gross bowel injury

Double Transfers

- When patient are transported to and between multiple emergency departments
- Occurs frequently in pediatric trauma care. Often centers don't realize what pediatric specific resources are needed or if the resource is comfortable treating children
- Ensure that anticipated resource is available at accepting facility
- Ensure that anticipated resource is currently available at accepting facility
- Goal of all trauma care is arrival to definitive care as soon as possible

Case Example

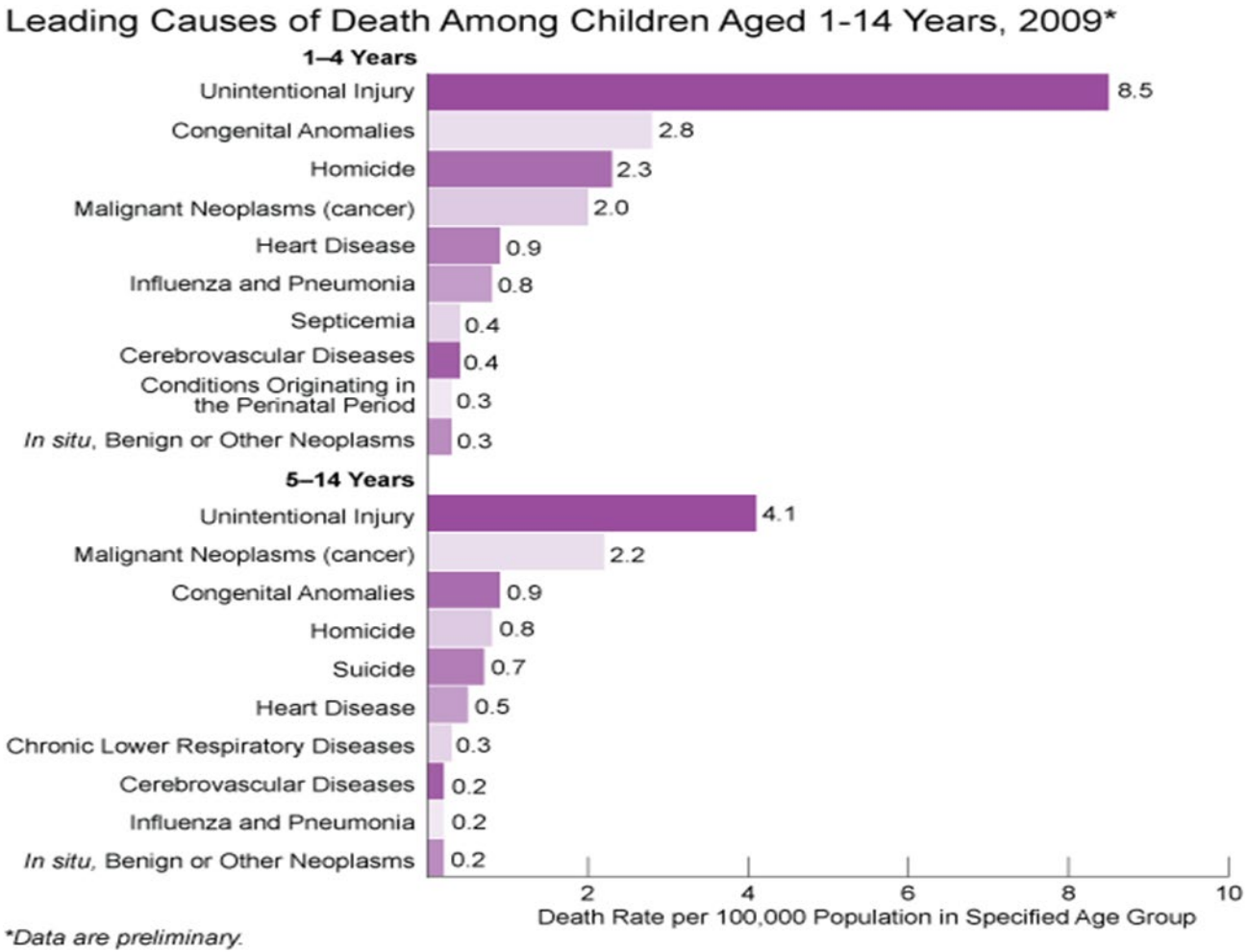
2 month old male who was being carried by dad who reportedly fell down a flight of stairs on 10/22. Parents became concerned when patient became lethargic and transported patient to local emergency department.

- 1500 – approximate time of injury. Pt to tertiary care facility and CT scan obtained. CT revealed a left subdural hematoma with midline shift, in addition to a left non-displaced parietal skull fracture and posterior galeal hematoma. Cervical spine negative
- 1833 – arrival to second hospital via flight crew. Physical exam reveals a full fontanelle, ecchymosis to eyelids and a right occipital hematoma
- 1840 – documentation states “decision to transfer per neurosurgery due to inavailability of neurosurgeon”
- 1949 – pt transferred to C. S. Mott for definitive care – accompanied by second flight crew.
- 2044 – pt arrives to C. S. Mott

Case Example

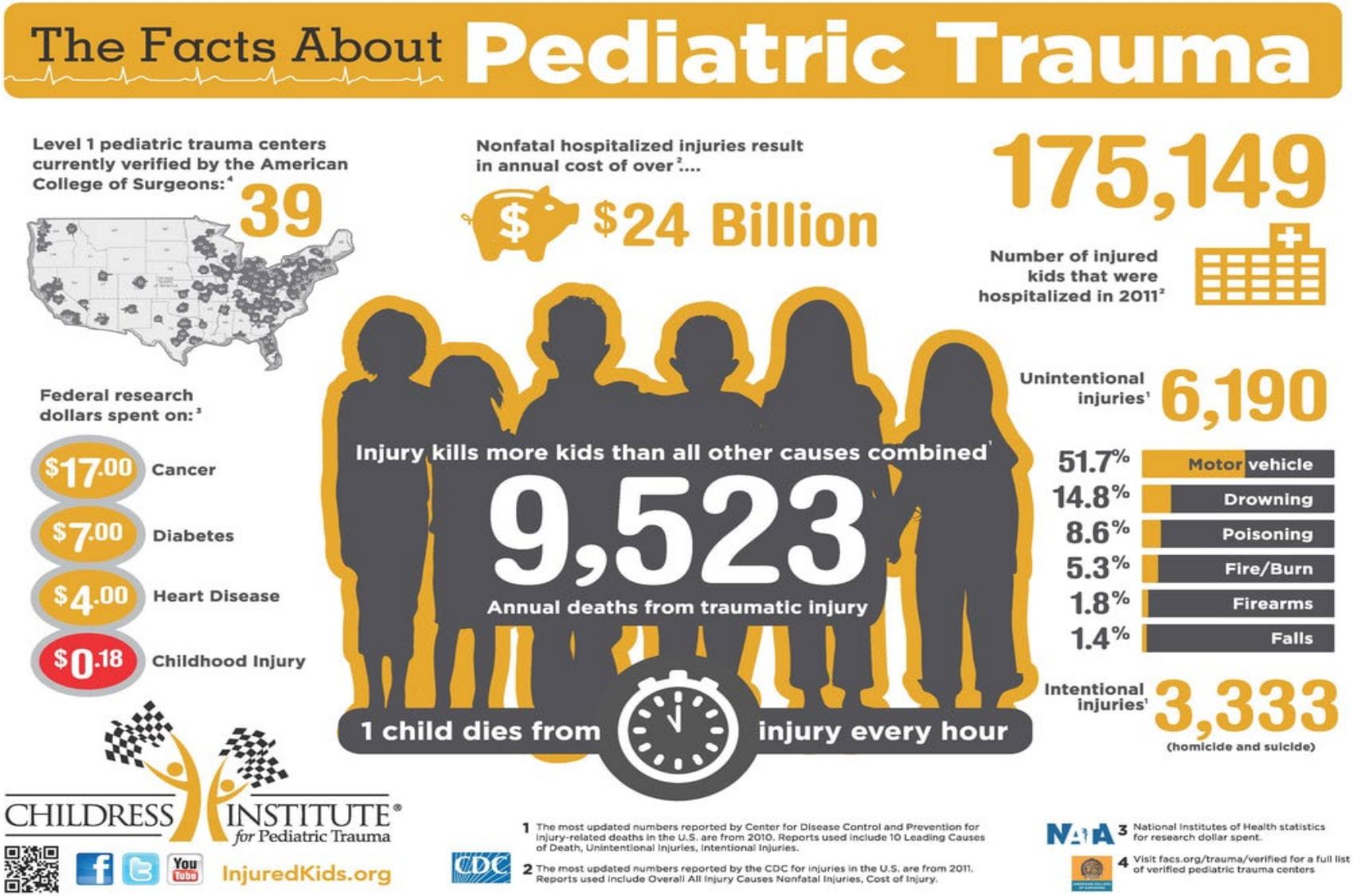
- Neurosurgery was consulted in the ER. Repeat STAT Head CT at Michigan Medicine showed resolution of midline shift decrease in thickness of the subdural hematoma as well as more isodense accumulations that could represent chronic subdural hematoma. Fontanelle was full, but soft. He had a L gaze preference, but pupils were symmetric and equal and he was vigorously moving all 4 extremities. He received Keppra for post traumatic seizure prophylaxis. He was admitted to the PICU on the Pediatric Surgery Trauma service.
- Child Protection Team, Child Protection Services and Social Work involved in care. Pt discharge after 4 days.

Epidemiology



*Data are preliminary.

Source: Kochanek KD, Xu Jm, Murphy SL, Miniño AM, Kung HC. Deaths: Preliminary Data for 2009. National Vital Statistics Reports; vol 59 no 4. Hyattsville, MD: National Center for Health Statistics. 2011. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_04.pdf. Accessed July 2011.

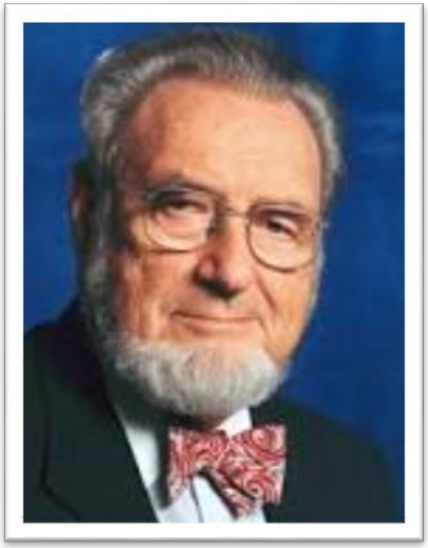


Source: https://saveinjuredkids.org/wp-content/uploads/2015/03/CIPT-infographic-FINAL-2-4-14-resize-crop.jpg

"If a disease were killing our children in the proportion that injuries are, people would be outraged and demand that this killer be stopped."

C. Everett Koop, MD

Surgeon General of the United States , 1982-1989



Pediatric Trauma Injury Prevention Program

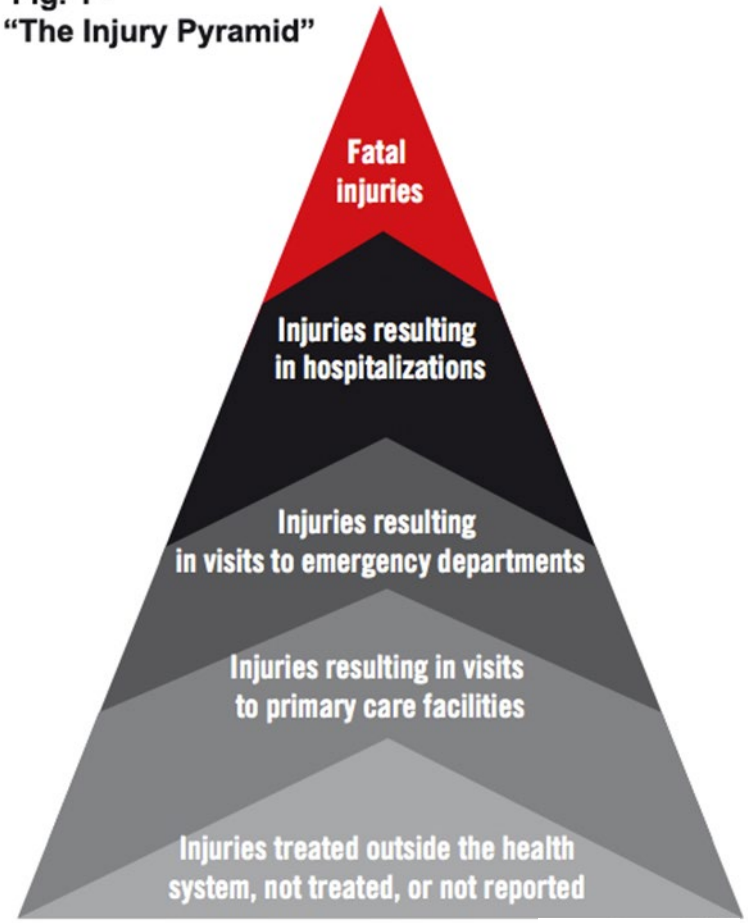
- We see approximately 600 children admitted to C.S. Mott Children's Hospital each year, as a result of a serious injury.
- Another 6,500 are treated for an injury in our Pediatric Emergency Department.
  - Injuries from trauma—ranging from schoolyard falls to high-speed automobile collisions—are the leading cause of death and disability in children. To reduce the incidence of childhood injuries, an array of injury prevention outreach programs have been designed to educate children, parents and community members.

Our work involves:

Educating children and adults
Advocating for effective laws
Providing reduced cost safety products to low-income families
Conducting research
Creating safe environments

Pediatric Trauma Injury Prevention Program

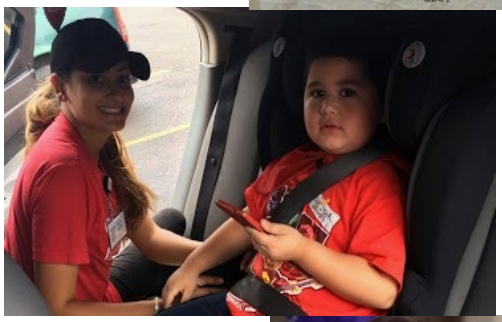
Fig. 1 -
"The Injury Pyramid"



https://www.who.int/violence_injury_prevention/key_facts/VIP_key_fact_5.pdf

Pediatric Trauma Injury Prevention Program

- Safe Kids Huron Valley
  - www.safekids.org Safe Kids Worldwide
- Child Passenger Safety
- Distracted Driving
- Pedestrian Safety
- Wheeled Sports Safety
- Winter Sports Safety
- Water Safety
- Home Safety
- Medication Safety
  - Opioid Education
  - Proper Dosing/Storage/Disposal



Pediatric Trauma Injury Prevention Program

Finding New Ways to “Put the Broccoli in the Brownies”

- Education presented in electronic formats
- Presenting education at centers within the community
- Including kids in the development of programs
- Placing education messaging in unexpected places
- Video and virtual reality games to reinforce and teach safety behaviors

Pediatric Trauma Injury Prevention Program

Roller Buggy video game

This app is a video game that encourages safe pedestrian habits to players. To start, players choose a character based on preference. Each character is wearing rollerskates, helmet, and elbow/knee pads. The player then has to navigate a city sidewalk, searching for and "collecting" bugs. The player may have to cross busy city streets, and are required to cross at a crosswalk or the game ends. They are also encouraged to push the cross walk button and receive a speed boost when they cross at the crosswalk after hitting the button. The game is timed and ends when they collect all of the bugs scattered throughout the game. Players may choose to play multiple times attempting to improve their time

Pediatric Trauma Injury Prevention Program

https://itunes.apple.com/gd/app/roller-buggy/id1449150357?mt=8

Download on the App Store

https://play.google.com/store/apps/details?id=edu.umich.rollerbuggy&hl=en_US

Google Play

Pediatric Trauma Case Review

Situation: A 2 1/2 yo male who was found by mom to be lethargic and crying after falling out of bed twice earlier in the day. By the afternoon, he was not appropriately responsive and was vomiting. An ambulance was called. He was transferred to a Level I Pediatric Trauma center via EMS. En route he was reportedly hypotensive to 50/30 just prior to arrival at the emergency department.

MICHIGAN MEDICINE

Traumatic Injury with Unstable Vital Signs (determined by age parameters below) OR:

- Gunshot wounds, impaled objects or penetrating wounds to the head, neck, chest or abdomen
- High voltage electric injury/lightning strike
- Threatened limb to include: amputation, near amputation, degloving, significant crush injury (i.e. lawnmower) or pulseless extremity (any of these present in more than just fingers and toes)
- Any burn with unstable vital signs or inhalation injury with threat of airway compromise
- GCS < 8 with mechanism attributed to trauma
- Documented decline in neuro status
- Paralysis following traumatic injury
- Focal neurologic deficit
- Subdural/epidural (> 1cm thickness or w/midline shift) in patient transferred from another facility
- Respiratory compromise/obstruction
- Intubated trauma patients
- Rescue airway in place
- Transfer patients from other hospital receiving blood or fluids to maintain vital signs
- **Physician discretion**

Age	Respiratory Rate		Systolic BP
0 to 1 years	< 35 or > 50/minute	Or	< 60 mmHg
2 to 5 years	< 25 or > 40/minute	Or	< 70 mmHg
6 to 12 years	< 15 or > 35/minute	Or	< 80 mmHg
>12 years	< 10 or > 30/minute	Or	< 90 mmHg

Class I Trauma

Physician consideration of Class I activation based on MOI:

- Auto vs. pedestrian/cyclist thrown, run over, or with significant (> 20 mph) impact
- Motorcycle crash > 20 mph
- High-energy dissipation or rapid decelerating incidents such as:
  - Ejection from vehicle, motorcycle, ATV, animal
  - Striking fixed object with momentum
  - Blast or explosion

Pediatric Trauma Case Review

Assessment: Child was activated as a Level I trauma patient based on EMS report. On assessment, he presents to the Emergency Department lethargic, tachypneic with grunting respirations, LCTA, old bruising noted to left cheek and left eye, multiple scattered bruises of various stages noted to abdomen and back. Abdomen is soft, non-distended. Skin pale and dusky, cool extremities noted. BP is 65/36 RR 40 HR 161 Temp 38.3

Is this patient stable or unstable?

Unstable and we need to work quick!

Pediatric Trauma Case Review

Management: IV started x 2 and a bolus of 320 mL was begun (pt weight 16 kg) and bolus was repeated x 2 for continued hypotension. Laboratory values and radiology testing, including bedside ultrasound (FAST) were ordered.

FAST scan at the bedside revealed free fluid in Morison's pouch in the splenorenal recess as well as posterior to the bladder.

CT of the abdomen, pelvis and lumbar spine revealed a Grade 5 liver laceration (hepatic vasculature, portal system & IVC appeared intact), splenic lacerations, multiple bilateral Grade 2 kidney lacerations, hemoperitoneum & acute bilateral lower rib fractures. Head and C-Spine CTs were negative.

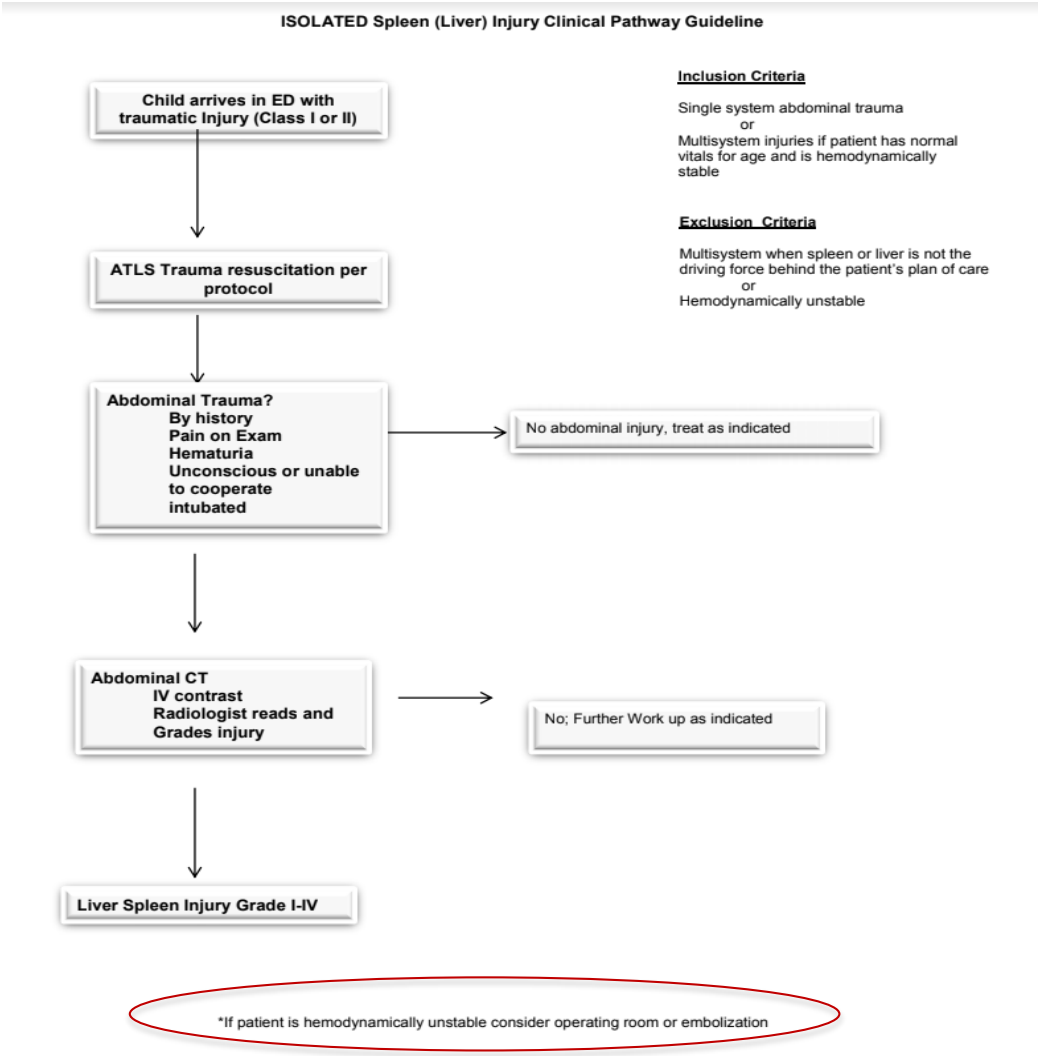
Despite bolus, patient had continued hypotension and he remained tachycardic at 165 bpm. He was noted to have increasing abdominal girth and distention, at this point a decision was made by the Pediatric Trauma Surgeon to take the patient to the OR for operative management. A blood transfusion of PRBC was continued en route to the OR

Pediatric Trauma Case Review

Grade V Liver laceration

Pediatric Trauma Case Review

In the case of solid organ injury, a clinical pathway is in place to guide care.



CT Grade	I	II	III	IV
ICU LOS	None	None	None	24hours +
CBC	Q 6 hours until stable*	Q 6 hours until stable*	Q 6 hours until stable*	Q 2-4 hours until stable*
Vitals	Q4 hours x24 On monitor	Q4 hours x24 On monitor	Q2 hours x 8 then q4 on monitor	Per ICU
Bedrest	Until CBC is stable	Until CBC is stable	Until CBC is stable	48 hours Then ambulation for 12 hours prior to D/C
Minimum Hospital LOS	1 day	2 days	3 days	4 days
Routine pre /post discharge imaging**	None	None	None	None
Restricted Activity non contact	4 weeks	4 weeks	4 week	4 weeks
Restricted Activity contact	3 months	3 months	3 months	3 months
Return to School	<1 week	1 week	2 weeks	2 weeks
Follow up	1 month	1 month	1 month	1 month

*Stable is when 3 HCT/HB are within 10% of each other

** US imaging may be performed if injury involved hilar area and concerned about pseudoaneurysm. Please note that this is not supported or refuted in the literature.

Hospital LOS / Minimum Stay = Grade of Injury

Pediatric Trauma Case Review

Course of Care: The patient was transported to the operating room with the Pediatric Trauma Surgeon. After infusion of blood products, the patient became more responsive, vital signs stabilized (BP was 141/89, HR 121 and RR 34).

The surgeon opted to attempt PICU observation before proceeding with operative intervention. The patient received an NG tube and arterial line prior to transport to PICU.

Pediatric Trauma Case Review

Outcome: Following a defined algorithm can avert confusion and prevent unnecessary surgery. This patient did not require resection of solid organs in an unstable state and was able to be resuscitated with crystalloid and blood. Non-operative management allowed the patient to tamponade the injuries and recover uneventfully without a laparotomy. If the patient did not respond to the blood transfusion, further operative management would likely be needed. In this situation, however, the algorithm was successful in avoiding a potentially difficult surgery with major morbidity. It was later discovered that this child was injured after being kicked and beaten. Charges were filed against the perpetrator.

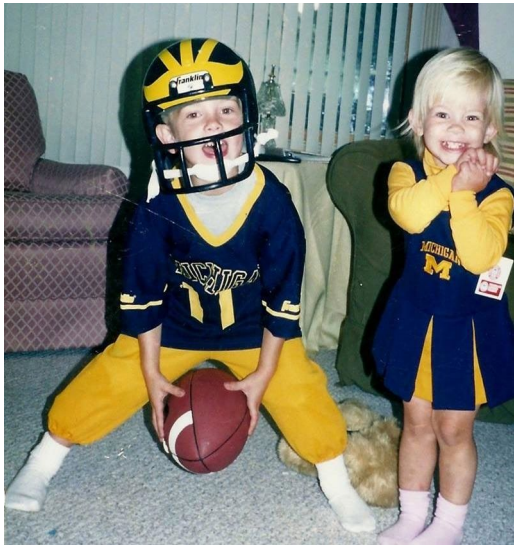
Conclusion

- Pediatric Trauma is more than an acute event or a finite period of time, but spans the continuum of pediatric care
- Injury Prevention is a major component – we are here to help! In the community or in the hospital, we will do what we can to keep kids safe.
- Pediatric Trauma care often requires thinking beyond immediate event and resource needs

Resources for Non-Pediatric Centers

- Visit websites of your local pediatric trauma center – often have resources available.
- C. S. Mott Pediatric Trauma department website: www.pediatrictrauma.org
- Amazing injury prevention resources at www.safekidsworldwide.com
- Pediatric specific resources on the Michigan Trauma Coalition Website – Pediatric Committee has de-identified examples of resources available (MTP, activation criteria) for members to download www.mitrauma.org
- Pediatric Trauma Society has resources available – do not have to be a member to access: www.pediatrictraumasociety.org
- Inter Facility Transfer Tool Kit for the Pediatric Patient. Can be found on the STN, ENA or EMSC websites.

Thank you for your time and thank you for all you do!



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