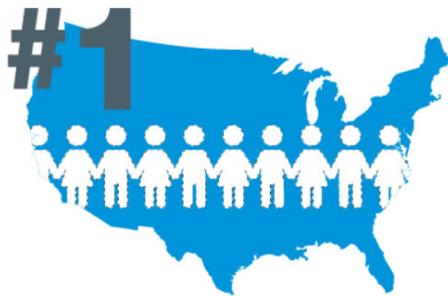


Childhood Injury Guidelines for Care 2018

Utah Trauma Network Conference

Kris Hansen



PREVENTABLE INJURIES ARE THE #1 KILLER OF KIDS IN THE U.S.

Every year, 8,000 families lose a child because of a preventable injury. When a child dies, the lives of families are changed forever.

30% decrease in death rates 2005-2015

www.childrenshospitals.org/issues-and-advocacy/population-health/injury-prevention/fact-sheets/injury-prevention-facts-and-trendsrtng-point-number-3.2

<https://www.safekids.org/why-it-matters>



Prevention

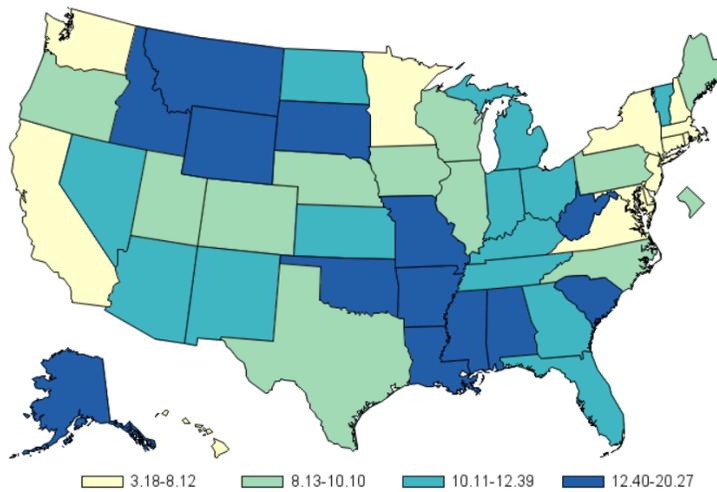


“Memories Are Made of These”

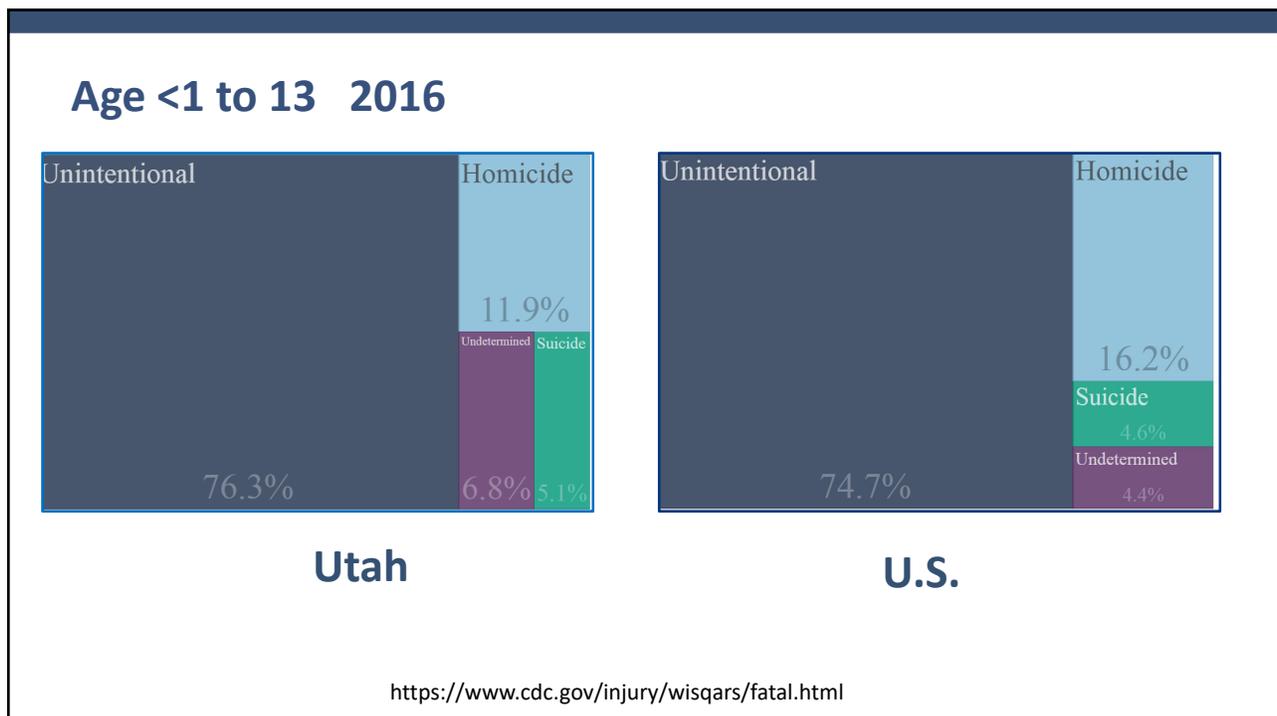
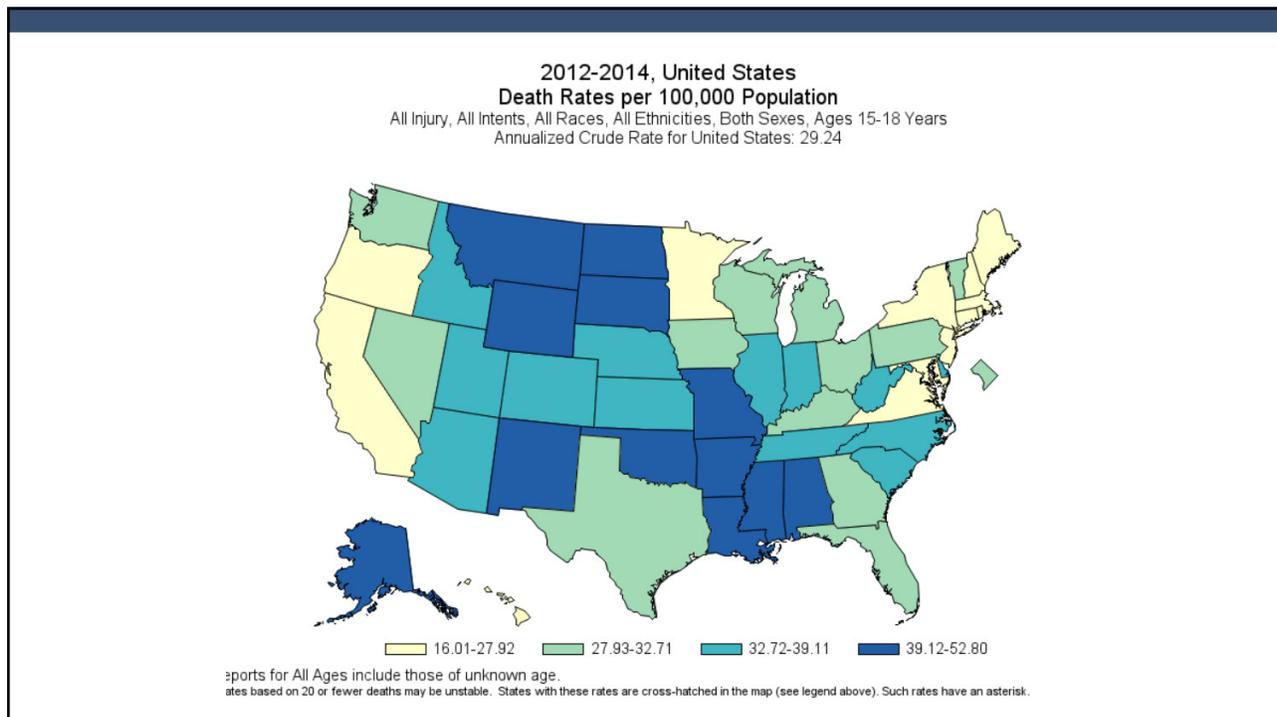
“What's that? Big people have all the fun? Not true.”

- <http://www.yamaha-motor.com/products>

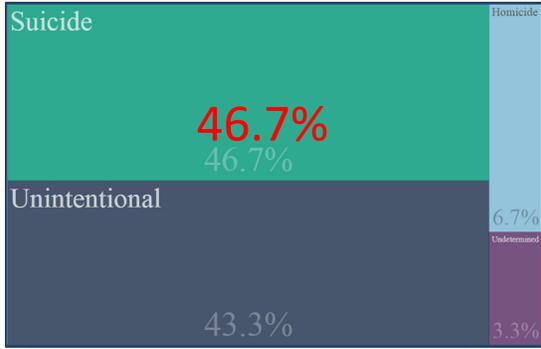
**2012-2014, United States
Death Rates per 100,000 Population**
All Injury, All Intents, All Races, All Ethnicities, Both Sexes, Ages 0-15 Years
Annualized Crude Rate for United States: 9.40



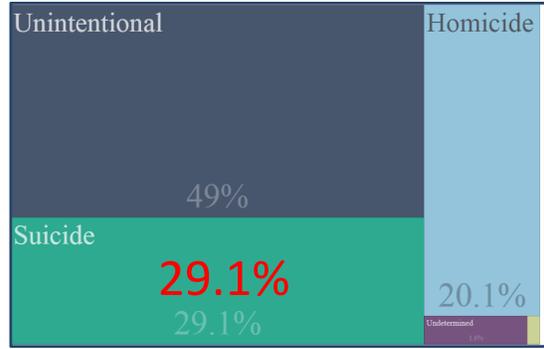
Reports for All Ages include those of unknown age.
* Rates based on 20 or fewer deaths may be unstable. States with these rates are cross-hatched in the map (see legend above). Such rates have an asterisk.



Age 13 – 18 2016



Utah

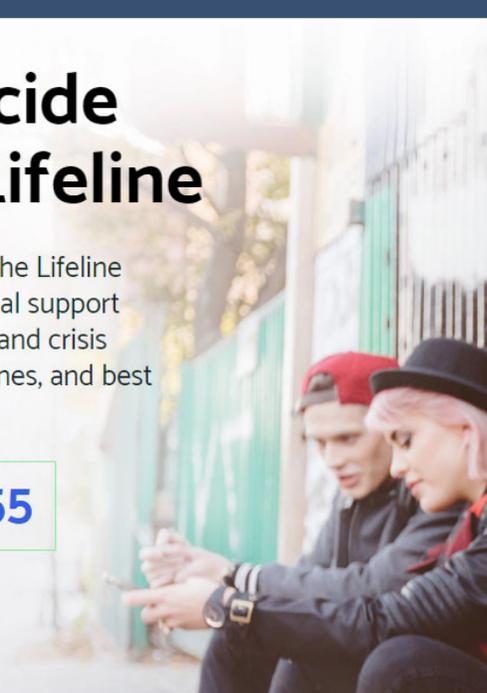


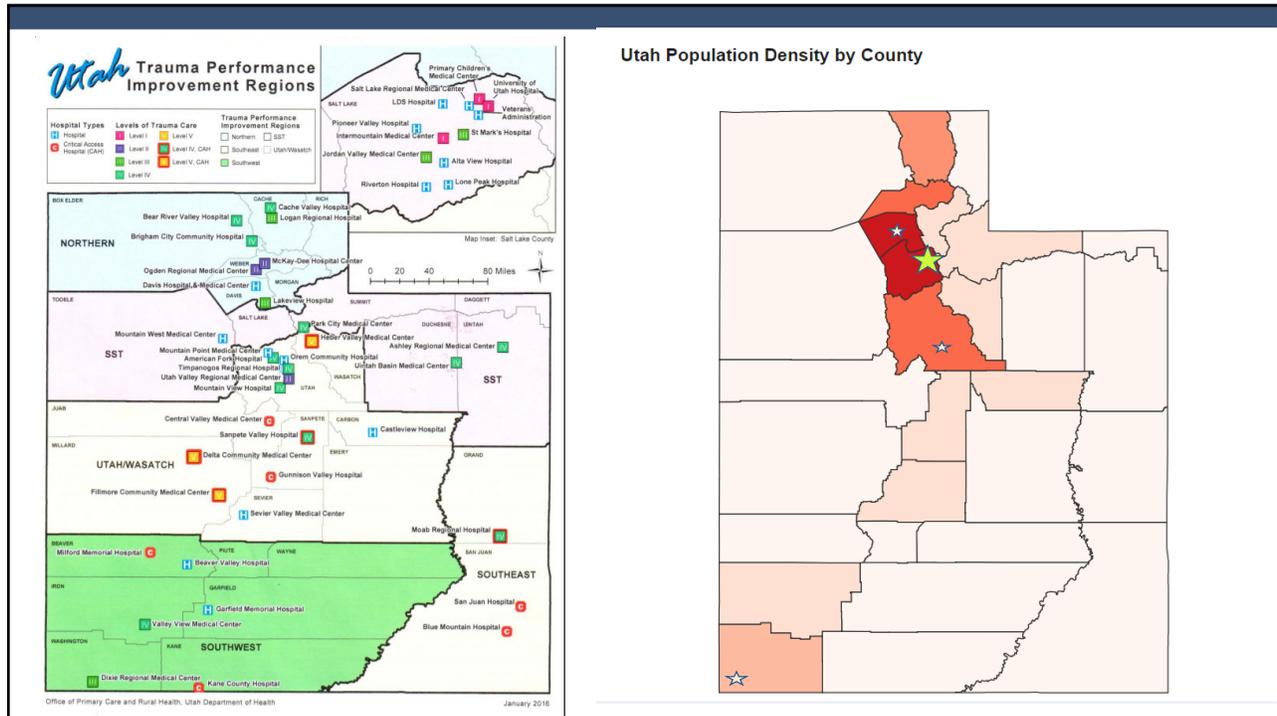
U.S.

<https://www.cdc.gov/injury/wisqars/fatal.html>

National Suicide Prevention Lifeline

We can all help prevent suicide. The Lifeline provides 24/7, free and confidential support for people in distress, prevention and crisis resources for you or your loved ones, and best practices for professionals.





Trauma System

J Trauma Acute Care Surg. 2017 Oct;83(4):662-667. doi: 10.1097/TA.0000000000001560.

Consequences of pediatric undertriage and overtriage in a statewide trauma system.

Hewes HA¹, Christensen M, Taillac PP, Mann NC, Jacobsen KK, Fenton SJ.

Under-triage: transfer of $\leq 85\%$ of patients with an Injury Severity Score (ISS) of ≥ 16

Over-triage: transfer of $\geq 75\%$ of patients with ISS of ≤ 15



Pediatrics in a Trauma System



The strongest predictor of patient transfer was the **Hospital's transfer practice NOT** patient injury, severity of injury, or distance from PTC

Wide variation in pediatric transfer policy was found across the state

Undertriage (12 hospitals, 3,594 patients) – **significantly increased risk of death** (OR 2.44)

Overtriage (26 hospitals, 2,964 patients) – **significantly increased number of preventable transfers**
>60% transferred patients were discharged within **24 hours**

Preventable Transfers

Preventable transfers in pediatric trauma: A 10-year experience at a level I pediatric trauma center[☆]



Stephen J. Fenton^{a,*}, Justin H. Lee^a, Austin M. Stevens^a, Kyle C. Kimbal^b, Chong Zhang^c, Angela P. Presson^c, Ryan R. Metzger^a, Eric R. Scaife^a

^a Division of Pediatric Surgery, University of Utah School of Medicine, Primary, Children's Hospital, Salt Lake City, UT, United States

^b University of Utah School of Medicine, Salt Lake City, UT, United States

^c Division of Epidemiology, University of Utah School of Medicine, Salt Lake City, UT, United States

- 27%** - Preventable transfers (2003 – 2013)
- Median distance 31 miles (0.1 – 491 miles)
- 21.5%** fixed wing or helicopter
- 29% discharge from the ED
- 87% admitted < 24 hours



J Pediatr Surg 2016, vol. 51:645-648

“Right Size” Pediatric Trauma Care

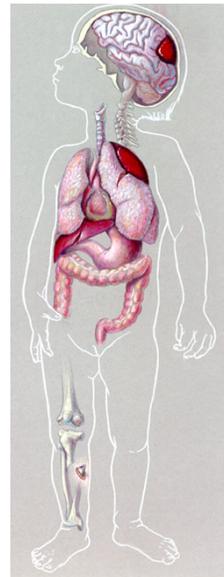


“Right patient to the right place at the right time.”

Right care guidelines
Right system guidelines
Right outcome measurement

Requirements to “Right Size”

- Provide expedited access to trauma care close to home
- Extend pediatric subspecialty care as needed to injured children
- Ensure highest standard of care with optimized outcomes
- Limit unnecessary transfers and the overutilization of resources





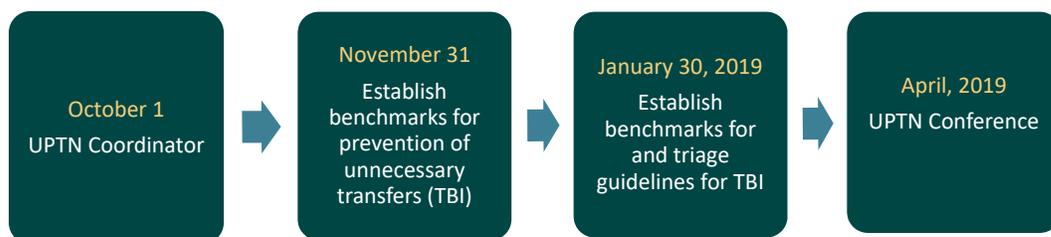
UPTN Structure



The Utah Pediatric Trauma Network will develop, refine, and recommend *methodology, standards and guidelines* to reduce morbidity, mortality and the cost of injury and illness to injured pediatric patients in Utah.



SFY 2019

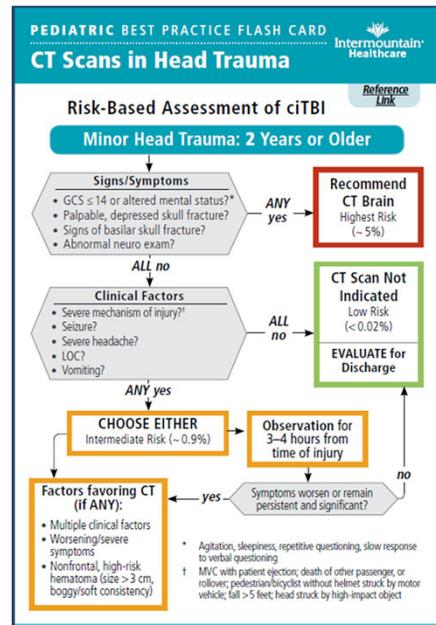
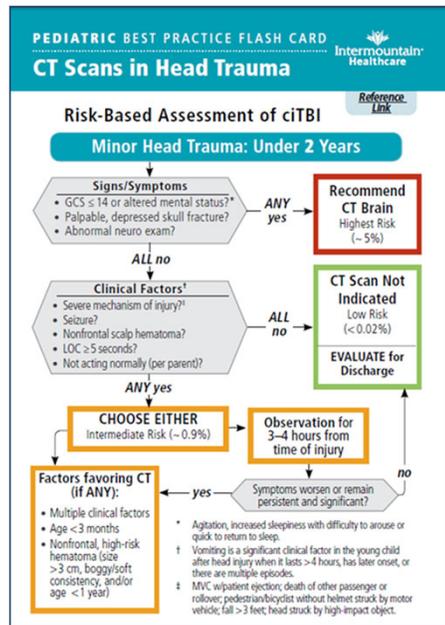


Lessons Learned – Mild Traumatic Brain Injury

Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study

Nathan Koppermann, James F Holmes, Peter S Dayan, John D Hoyle, Jr, Shireen M Atabaki, Richard Hukubkov, Frances M Nasif, David Monroe, Rachel M Stankey, Dominik A Borgidli, Mohamed K Badawy, Jeff E Schank, Kimberly S Quayle, Prashant Mahajan, Richard Lichenstein, Kathleen A Lillis, Michael C Tunik, Elizabeth S Jacobs, James M Callahan, Marc H Gorelick, Todd F Glass, Lois K Lee, Michael C Bachman, Arthur Cooper, Elizabeth C Powell, Michael J Gerardi, Craig A Melville, J Paul Mulrefear, David H Wisner, Sally Jo Zurspan, J Michael Dean, Sandra L Wootton-Gorges, for the Pediatric Emergency Care Applied Research Network (PECARN)*

Summary
 Lancet 2009; 374: 1160-70
 Published Online
 Background CT imaging of head-injured children has risks of radiation-induced malignancy. Our aim was to identify children at very low risk of clinically-important traumatic brain injuries (ctTBI) for whom CT might be unnecessary.



CDC PEDIATRIC mTBI GUIDELINE

Checklist



CDC HEADS UP
SAFE BRAIN. STRONGER FUTURE.

For healthcare providers treating children 18 years of age and younger

HEALTHCARE PROVIDERS SHOULD:

ASSESS.

Conduct a physical examination to identify findings that:

- Suggest more severe TBI (e.g., hemotympanum, pupillary asymmetry).
- May impact management of mTBI (e.g., concurrent injuries or baseline deficits, oculomotor dysfunction).
- Suggest other contributions to symptoms (e.g., dehydration, cervical tenderness, scalp hematoma).

Do not image routinely (including CT & MRI).

- Use validated clinical decision rules predicting risk for more severe injury to determine need.

Assess symptoms using validated scales. Consider cognitive and balance testing.

Conduct a history to identify risk factors for poor prognosis using validated prediction rules.

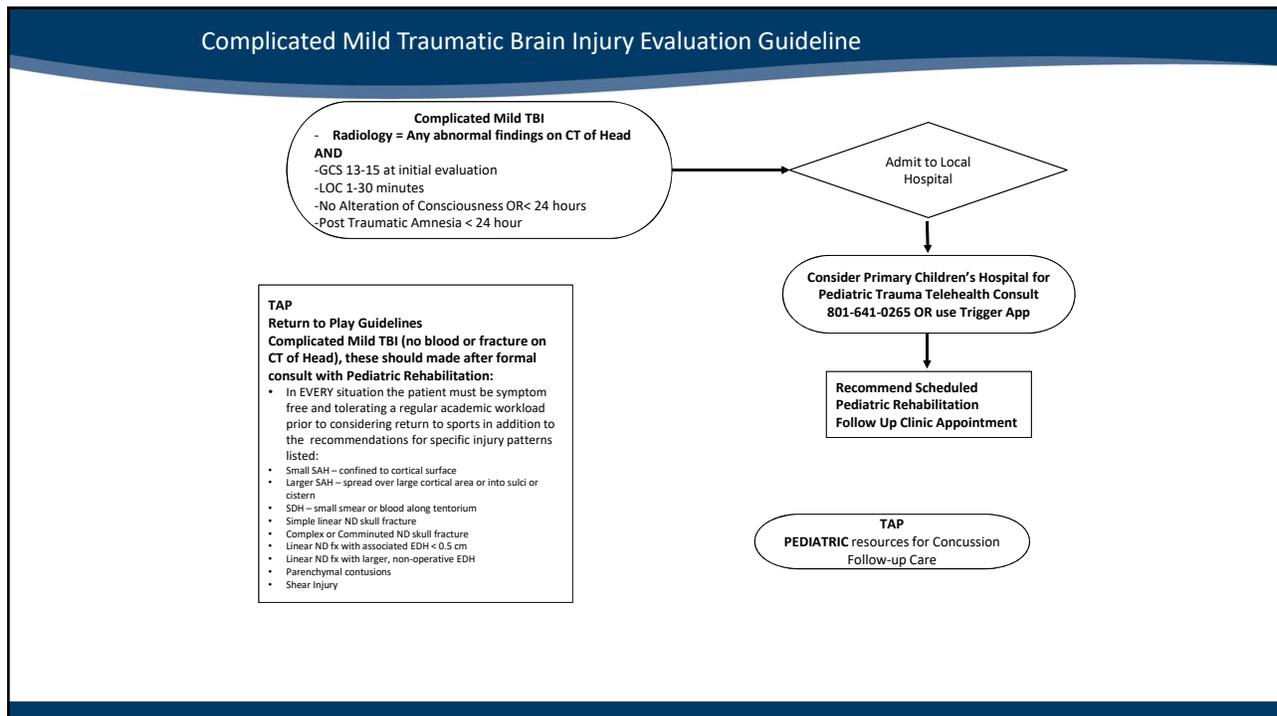
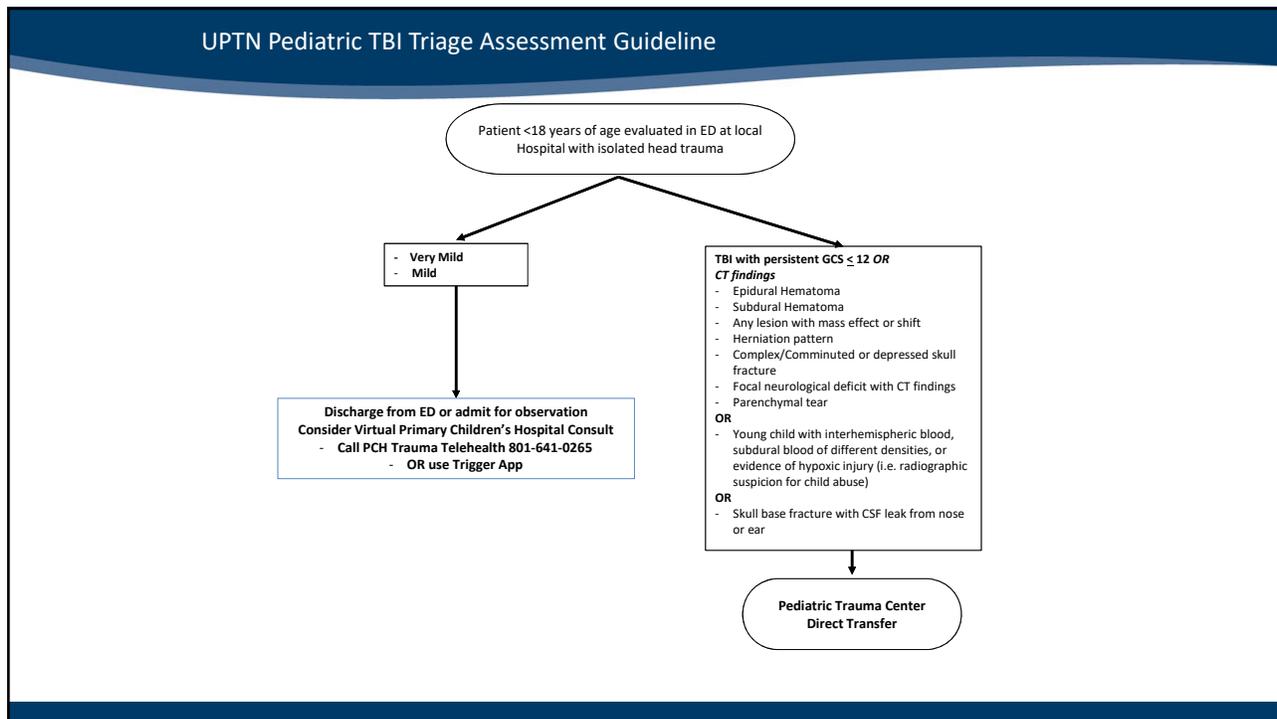
A combination of risk factors that may indicate need for neuroimaging include:

- Age < 2 years old
- Recurrent vomiting
- Loss of consciousness
- Severe mechanism of injury
- Severe or worsening headache
- Amnesia
- Non-frontal scalp hematoma
- Glasgow Coma Score < 15
- Clinical suspicion for skull fracture

Examples of validated scales include, but aren't limited to:

- Post-Concussion Symptom Scale
- Health and Behavior Inventory
- Post-Concussion Symptom Inventory
- Acute Concussion Evaluation

TBI SEVERITY	GLASGOW COMA SCALE (GCS)	LOSS OF CONSCIOUSNESS (LOC)	ALTERATION OF CONSCIOUSNESS (AOC) §	POST TRAUMATIC AMNESIA (PTA)	RADIOLOGY	WHEN TO RETURN TO PLAY
If a patient meets criteria in more than one category of severity, the higher severity level is assigned.						
Very Mild*	15 (at time of presentation)	None or < 1 min	None (at time of presentation)	None or < 1 hour	Normal	** 1 week
Mild*	13-15	None or < 30 min	None or < 24 hours	None or < 24 hours	Normal	** 2 weeks
Complicated Mild	13-15	None or < 30 min	None or < 24 hours	None or < 24 hours	Abnormal	**SAH = 2-3mo **SDH = 3 mo **FX = 2-3 mo **EDH = 2-3 mo **CONT = 2-3 mo **DAI = 3 mo **Minimum 6 months
Moderate	9-12	31 min – 24 hours	> 24 hours. Severity based on other criteria	1-7 days	Normal or Abnormal	**Minimum 6 months
Severe	3-8	> 24 hours	> 24 hours. Severity based on other criteria	> 7 days	Normal or Abnormal	**Minimum 12 months
* determination may be based on other factors such as previous concussions						
** once symptom free, has resumed regular academics, and gradual return to play protocol is followed						



Lessons Learned – Epidural Hematoma

[J Pediatr Surg](#), 2017 Feb;52(2):334-339. doi: 10.1016/j.jpedsurg.2016.09.005. Epub 2016 Sep 15.

Pediatric patients with traumatic epidural hematoma at low risk for deterioration and need for surgical treatment.

Flaherty BE¹, Moore HE², Riva-Cambrin J³, Bratton SL⁴

[Author information](#)

Abstract

BACKGROUND: Although some pediatric patients with small traumatic epidural hematoma (EDH) are observed without surgical drainage, clinical practice remains variable.

OBJECTIVES: Create a prediction rule to identify patients with EDH unlikely to fail hospital observation.

[Pediatrics](#), 2018 Sep;142(3): pii: e20180385. doi: 10.1542/peds.2018-0385.

Repeat Head CT for Expectant Management of Traumatic Epidural Hematoma.

Flaherty BE¹, Moore HE², Riva-Cambrin J³, Bratton SL⁴.

[Author information](#)

Abstract

BACKGROUND AND OBJECTIVES: Guidelines regarding the role of repeated head computed tomography (CT) imaging in the nonoperative management of traumatic epidural hematomas (EDHs) do not exist. Consequently, some children may be exposed to unnecessary additional ionizing radiation. We describe the frequency, timing, and utility of reimaging of EDHs to identify patients who might avoid reimaging.

Lessons Learned – Critical Care Admissions

[J Pediatr Surg](#), 2016 Oct;51(10):1688-92. doi: 10.1016/j.jpedsurg.2016.05.022. Epub 2016 Jun 7.

Preventable pediatric intensive care unit admissions over a 13-year period at a level 1 pediatric trauma center.

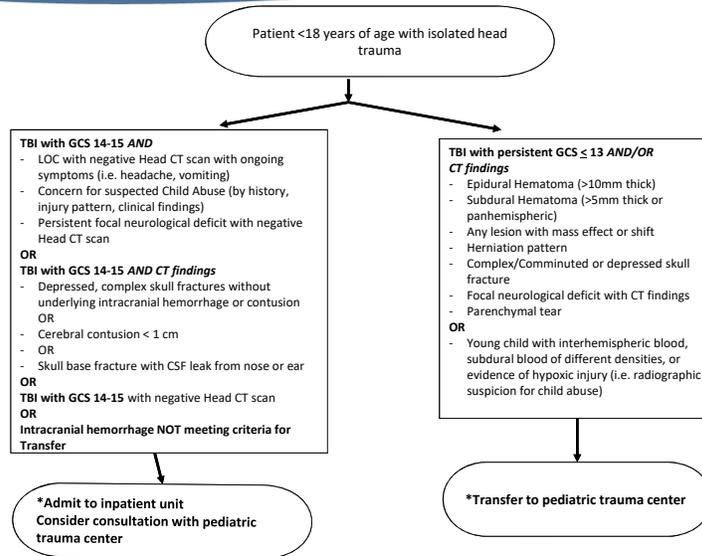
Fenton SJ¹, Campbell SJ², Stevens AM³, Zhang C⁴, Presson AP⁵, Lee JH⁶.

[Author information](#)

Abstract

BACKGROUND: No formal criteria exist to determine the need for admission of injured children to the pediatric intensive care unit. Our objective was to analyze trauma patient admissions to the PICU at a level 1 pediatric trauma center.

Pediatric TBI Clinical Guidelines



Lessons Learned – Skull Fracture

J Pediatr Surg. 2011 Jul;46(7):1342-6. doi: 10.1016/j.jpedsurg.2010.12.019.

Neurologically intact children with an isolated skull fracture may be safely discharged after brief observation.

Rollins MD¹, Barnhart DC, Greenberg BA, Scaife ER, Holsli M, Meyers RL, Mundorf MB, Metzger RR

Impact of newly adopted guidelines for management of children with isolated skull fracture

Ryan R. Metzger^{a,*}, Julia Smith^b, Matthew Wells^c, Lesley Eldridge^c, Maija Holsti^d, Eric R. Scaife
Douglas C. Barnhart^a, Michael D. Rollins^a

^a Division of Pediatric Surgery, Primary Children's Hospital, University of Utah, Salt Lake City, Utah

^b Trauma Service, Primary Children's Hospital, Salt Lake City, Utah

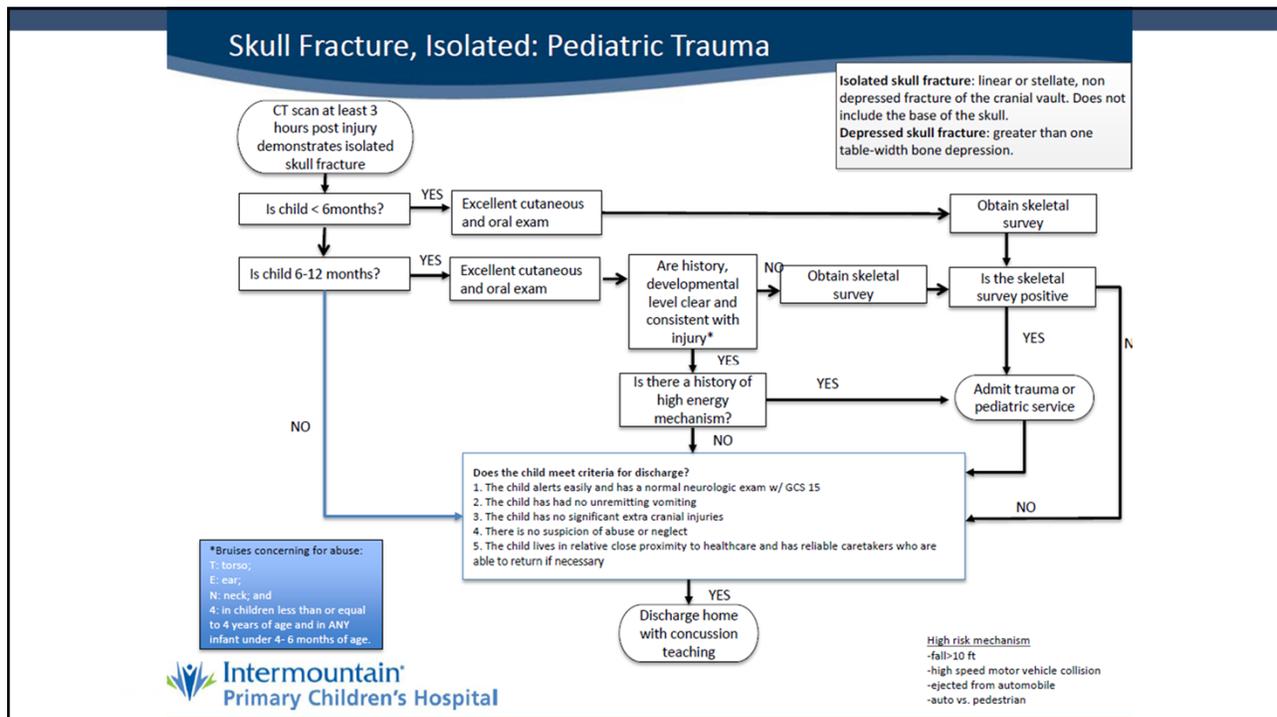
^c University of Utah School of Medicine, Salt Lake City, Utah

^d Division of Pediatric Emergency Medicine, Primary Children's Hospital, University of Utah, Salt Lake City, Utah

Ann Emerg Med. 2016 Oct;68(4):431-440.e1. doi: 10.1016/j.annemergmed.2016.04.058. Epub 2016 Jul 25.

Clinical Presentations and Outcomes of Children With Basilar Skull Fractures After Blunt Head Trauma.

Tunik MG¹, Powell EC², Mahajan P³, Schunk JE⁴, Jacobs E⁵, Miskin M⁶, Zupan S⁶, Wootton-Gorges S⁷, Atabaki SM⁸, Hoyle JD Jr⁹, Holmes JF Jr¹⁰, Dayan PS¹¹, Kuppermann N¹², Pediatric Emergency Care Applied Research Network (PECARN).



Lessons Learned – Emergency Medical Services

Prehosp Emerg Care. 2018 Mar-Apr;22(2):189-197. doi: 10.1080/10903127.2017.1367444. Epub 2017 Sep 28.

Prehospital Pain Management: Disparity By Age and Race.

Hewes HA, Dai M, Mann NC, Baca T, Taillac P.

CONCLUSIONS: Documentation of pain as a symptom and pain treatment continue to be infrequent in the prehospital setting in all age groups, especially young children. There appears to be a racial disparity with Black patients less often treated with analgesics. The broad incorporation of national NEMSIS data suggests that these inadequacies are a widespread challenge deserving further attention.

J Pediatr Surg. 2016 Feb;51(2):329-32. doi: 10.1016/j.jpedsurg.2015.10.001. Epub 2015 Oct 22.

Documentation of pediatric vital signs by EMS providers over time.

Hewes H¹, Hunsaker S², Christensen M², Whitney J³, Dalrymple T⁴, Taillac P⁵.



Lessons Learned – Low Grade Blunt Solid Organ Injury

J Trauma Acute Care Surg. 2018 Apr;84(4):606-612. doi: 10.1097/TA.0000000000001777.

Transfer and nontransfer patients in isolated low-grade blunt pediatric solid organ injury: Implications for regionalized trauma systems.

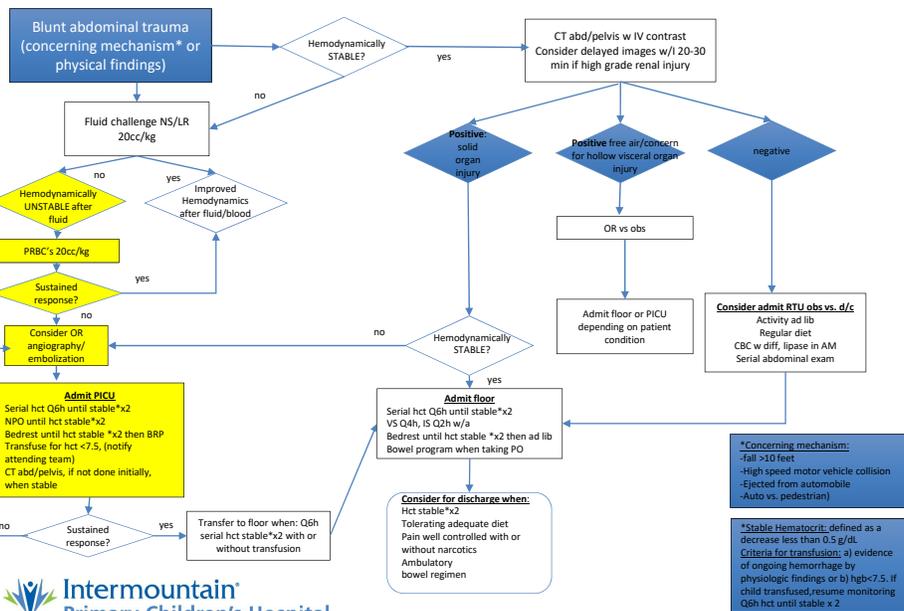
Tessler RA¹, Lyons VH, Hagedorn JC, Vavilala MS, Goldin A, Arbabi S, Rivara FP.

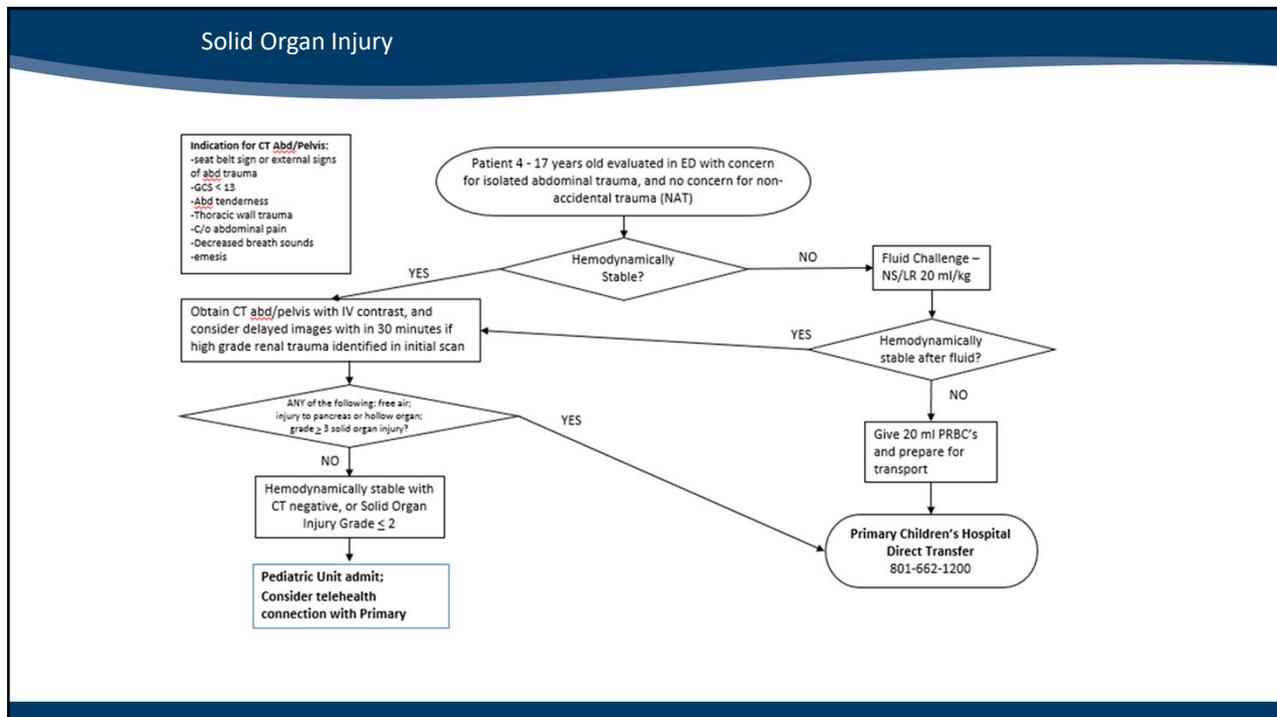
CLINICAL DECISION RULES/ORIGINAL RESEARCH

Identifying Children at Very Low Risk of Clinically Important Blunt Abdominal Injuries

James F. Holmes, MD, MPH; Kathleen Lillis, MD; David Monroe, MD; Dominic Borgianni, DO, MPH; Benjamin T. Kerrey, MD; Prashant Mahajan, MD, MPH; Kathleen Adelgais, MD, MPH; Angela M. Ellison, MD, MSc; Kenneth Yen, MD, MS; Shireen Atabaki, MD, MPH; Jay Menaker, MD; Bema Bonus, MD; Kimberly S. Quayle, MD; Madelyn Garcia, MD; Alexander Rogers, MD; Stephen Blumberg, MD; Lois Lee, MD, MPH; Michael Tunik, MD; Joshua Kooistra, DO; Maria Kwok, MD; Lawrence J. Cook, PhD; J. Michael Dean, MD, MBA; Peter E. Sokolove, MD; David H. Wisner, MD; Peter Ehrlich, MD; Arthur Cooper, MD, MS; Peter S. Dayan, MD, MSc; Sandra Wootton-Gorges, MD; Nathan Kuppermann, MD, MPH; for the Pediatric Emergency Care Applied Research Network (PECARN)*

Study objective: We derive a prediction rule to identify children at very low risk for intra-abdominal injuries undergoing acute intervention and for whom computed tomography (CT) could be obviated.





	Hemodynamically stable on admission	Hemodynamically unstable on admission
Return to school	No restrictions	2 weeks post discharge
Activity Restrictions	No full contact physical activities or sports for 4 weeks	No full contact physical activities or sports for 8 weeks
Follow up	Telephone contact in 4 weeks	Telephone contact in 4 weeks



Lessons Learned – Cervical Spine Imaging

[Pediatr Emerg Care](#), 2015 Apr;31(4):243-9. doi: 10.1097/PEC.0000000000000395.

Cervical spine imaging in hospitalized children with traumatic brain injury.

Bennett TD¹, Bratton SL, Riva-Cambrin J, Scaife ER, Nance ML, Prince JS, Wilkes J, Keenan HT.

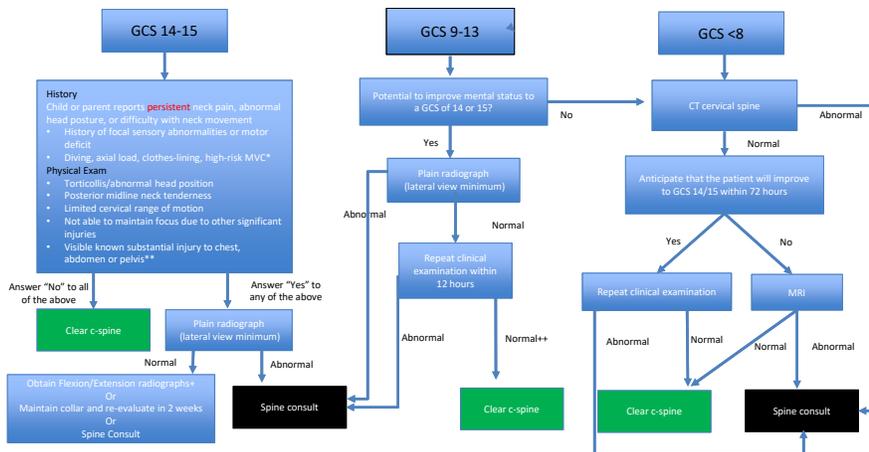
[J Pediatr Surg](#), 2004 Dec;39(12):1877-81.

CT scan and the pediatric trauma patient--are we overdoing it?

Fenton SJ¹, Hansen KW, Meyers RL, Vargo DJ, White KS, Firth SD, Scaife ER.



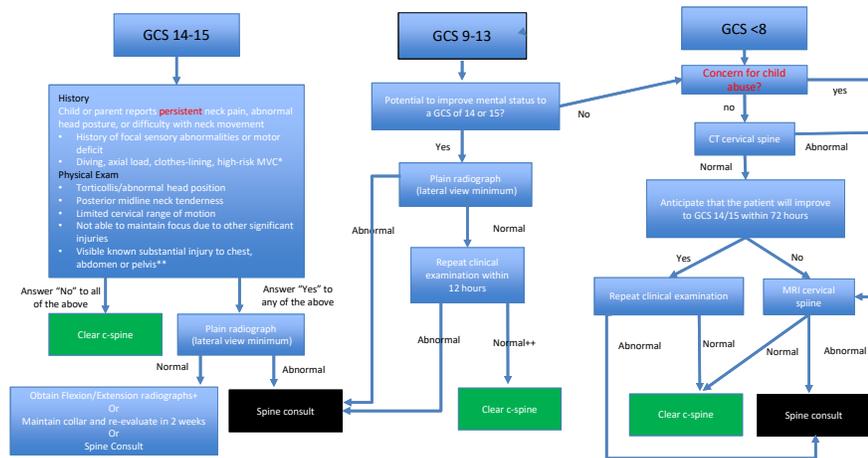
Cervical Spine Clearance: pediatric Algorithm > 3 years of age



*High-risk MVC is defined as a head-on collision, rollover, ejected from the vehicle, death in the same crash, or speed >55mph.
 **Substantial injury is defined as an observable injury that is life-threatening, warrants surgical intervention, or warrants inpatient observation.
 +Adequate Flexion/Extension is defined as >30 degrees of flexion and >30 degrees of extension
 ++ Patient has achieved GCS 14-15 and no longer presents with abnormal head posture, persistent neck pain, or difficulty in neck movement



Cervical Spine Clearance: pediatric algorithm ≤ 3 years of age



*High-risk MVC is defined as a head-on collision, rollover, ejected from the vehicle, death in the same crash, or speed >55mph.
 **Substantial injury is defined as an observable injury that is life-threatening, warrants surgical intervention, or warrants inpatient observation.
 +Adequate Flexion/Extension is defined as >30 degrees of flexion and >30 degrees of extension
 ++ Patient has achieved GCS 14-15 and no longer presents with abnormal head posture, persistent neck pain, or difficulty in neck movement

 Intermountain
Primary Children's Hospital

4/2018

Pediatric Trauma 2018

- Mortality from injury in children is decreasing
- Mature the regionalization of pediatric care, including trauma
- Establish pediatric networks across regions and the state
- Integrate pediatric trauma into the framework of the existing trauma system
- Continually develop, study and propagate best practices

Be the change you want to see in the world....

