Reducing CT-Scan Utilization for Pediatric Minor Head Injury in the Emergency Department: A Quality Improvement Initiative


Division of Pediatric Emergency Medicine
Children’s Hospital of Michigan, PTS 2019
Disclosure

Michigan Emergency Department Improvement Collaborative (MEDIC)

- Physician-led, hospital-based Quality Improvement Collaborative
- Funded by Blue Cross Blue Shield of Michigan and Blue Care Network
- www.medicqi.org
Background

- In United States > 640,000 ED visits/year for pediatric minor head injury (MHI)

- Neurosurgical intervention is very uncommon in children with MHI (GCS:14-15)

- CT utilization rates for pediatric MHI - 20% to 50%
PECARN MHI Risk Stratification for Traumatic Brain Injury (TBI)

**LOW RISK**
- CT Not Indicated
- TBI risk – 0.02%

**INTERMEDIATE RISK**
- CT Vs. Observation
- TBI risk – 0.8% to 0.9%

**HIGH RISK**
- CT Indicated
- TBI risk – 4.3 to 4.4%

**Age < 2 years**
- GCS <15
- Palpable skull fracture
- Altered Mental status
- Non-Frontal scalp hematoma
- LOC >5 seconds
- Not acting normal per parent
- Severe mechanism of injury

**Age 2-18 years**
- GCS <15
- Palpable skull fracture
- Altered Mental status
- Vomiting
- LOC
- Severe headache
- Severe mechanism of injury

- YES TO ANY

---

Objective

To achieve **20% reduction** in the CT utilization rates for the Intermediate Risk Group (per PECARN) of Minor head injury patients in our ED from **baseline of 18.6% to 15%** by July, 2019.
Methodology

Type: QI Project

Setting: Tertiary care academic Level 1 trauma Pediatric Emergency Department – 90,000 patients/year

Duration

- Pre-Intervention, Jun 2016-June 2017
- Post-intervention, July 2017-July 2019

Team: Multidisciplinary
Inclusion Criteria

EXCLUSIONS:
- Age > 18 years
- GCS < 14
- Injury > 24 hrs.
- Pregnancy
- Penetrating trauma
- Nonaccidental trauma
- Coagulopathy
- Hx. of Brain tumor
- Hx. of VP shunt
- Focal neurodeficit
- Trauma code activation

Work Of Abstractors

Eligible Intermediate Risk MHI

Exclusion Criteria

Head or Facial Injury ICD 10 Codes

Chief Complaint Head or Facial Injury
# Our Measures

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Reducing in CT utilization rates for the Intermediate Risk MHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balancing Measure</td>
<td>ED length of stay</td>
</tr>
<tr>
<td></td>
<td>Return visit rate within 72 hrs. of Index visit</td>
</tr>
<tr>
<td></td>
<td>*Clinically important traumatic brain injury identified on revisit</td>
</tr>
</tbody>
</table>

*Clinically important TBI as defined by head injury resulting in death, intubation for 24 h, neurosurgical intervention, or >2 nights in the hospital for management of head injury
SMART Aim

Reduce CT head rate for Intermediate Risk MHI by 20% by July 2019

Population
Children < 18 years with MHI

Key Drivers

Provider Decision Support

Provider Education

Provider Self-evaluation & Monitoring

Intervention

EMR integration of PECARN prediction rules

Visual aid: PECARN prediction rules

Lectures; In-person; e-mails

Individual provider feedback on quarterly basis

Discussing overall performance in monthly division meetings
Intervention Timeline

Jun 2016-17
Baseline Data Analysis

Jul 2017
ED Provider Education

Dec 2017
Visual Aids: PECARN Rules

Apr 2018
ED Provider Feedback

Nov 2018
EMR Integration of PECARN Rules
### Characteristic of Study Population

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All risk MHI patients</td>
<td>1996</td>
<td>4476</td>
</tr>
<tr>
<td>Eligible Intermediate Risk MHI patients, (%)</td>
<td>555, (100%)</td>
<td>976, (100%)</td>
</tr>
<tr>
<td>Age 2-17 years, (%)</td>
<td>486, (87%)</td>
<td>812, (83%)</td>
</tr>
<tr>
<td>Male Gender, (%)</td>
<td>369, (66%)</td>
<td>594, (61%)</td>
</tr>
<tr>
<td>ESI Acuity 1 &amp; 2, (%)</td>
<td>158, (29%)</td>
<td>266, (28%)</td>
</tr>
</tbody>
</table>
SPC Chart of CT Head utilization for Intermediate Risk MHI
(Jun 2016-Jul 2019)

- Mean
- Control Limits
- Goal (15%)

CT Head Utilization Rate

- 45%
- 40%
- 35%
- 30%
- 25%
- 20%
- 15%
- 10%
- 5%
- 0%

18.6%
13.8%

Visual Aids
PECARN Decision
Provider Feedback

Provider Education
EMR Integration of PECARN Decision Rules

One focus. One purpose. Your child.
SPC Chart of CT Head utilization for All Risk MHI
(Jun 2016-Jul 2019)

- Mean
- Control Limits

- Visual Aids: PECARN Decision Rule
- Provider Feedback
- Provider Education
- EMR Integration of PECARN Decision Rules

CT-Head Utilization Rate

0% 2% 4% 6% 8% 10% 12% 14% 16% 18% 20%


One focus. One purpose. Your child.
# Balancing Measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Intervention (June 2016 - Jun 2017)</th>
<th>Post-Intervention (Jul 2017 - Jul 2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED LOS Discharged patients</td>
<td>2.9 hrs.</td>
<td>3.04 hrs.</td>
</tr>
<tr>
<td>Rate of return visit</td>
<td>1.8%, (10/555)</td>
<td>2.1%, (21/976)</td>
</tr>
<tr>
<td>Clinically important TBI in return visit</td>
<td>None</td>
<td>1 patient</td>
</tr>
</tbody>
</table>
Conclusion

![Bar chart showing CT-Head Utilization Rate before and after intervention for All Risk MHI and Intermediate Risk MHI.](chart.png)
THANKS

MEDIC COORDINATING CENTER
Michele Nypaver, MD, Co-Director, Pediatrics
Keith Kocher, MD, MPH, Director, MEDIC
Emily White, Sr. Statistician, MS
Andrew Scott, MHSA
Megan Hogikyan, MPH

CHM MEDIC TEAM
Deb Niedbala, MSN, CPHQ
Nancy Radovic, RN
Kristin Watson, RN

ED LEADERSHIP
Curt Stankovic, MD
Ron Ruffing, MD
All ED Faculty and ED Fellows

One focus. One purpose. Your child.
## Return visit with clinically important TBI

<table>
<thead>
<tr>
<th>1(^{st}) Visit</th>
<th>Return visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 yr. old boy fell from his Dad’s shoulder</td>
<td>Presented within 12 hrs. with headache and vomiting</td>
</tr>
<tr>
<td>Height of fall≈5 feet</td>
<td>Normal Neuro exam</td>
</tr>
<tr>
<td>Well appearing Normal Neuro Exam</td>
<td>CT s/o epidural occipital bleed</td>
</tr>
<tr>
<td>Observed &amp; reassessed in ED # 3 hrs.</td>
<td>OR for evacuation</td>
</tr>
<tr>
<td>Discharged home</td>
<td></td>
</tr>
</tbody>
</table>
## CT utilization rate and diagnostic yield for Intermediate Risk MHI

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre Intervention</th>
<th>Post Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT utilization rate</td>
<td>18.5 %, (103/555)</td>
<td>13.8%, (135/976)</td>
</tr>
<tr>
<td>CT positive rate for trauma related findings</td>
<td>4.8%, (5/103)</td>
<td>9.6%, (13/135)</td>
</tr>
<tr>
<td>Clinically important TBI</td>
<td>0</td>
<td>1(Epidural Bleed)</td>
</tr>
</tbody>
</table>
**Pediatric Head Trauma CT Decision Guide (< 2 years old)**

- **GCS < 15**
  - Yes
  - No

- **Signs of Basilar Skull Fracture / Palpable Skull Fracture**
  - Yes
  - No

- **AMS (agitation, somnolence, slow response, repetitive questions)**
  - Yes
  - No

- **LOC ≥ 5 seconds**
  - Yes
  - No

- **Severe mechanism of injury**
  - Yes
  - No

**Examples of Severe mechanism of injury:**
- < 2 years:
  - Fall > 3 feet
  - MVA or ejection, rollover, fatality
  - Pedestrian or bicyclist without helmet struck by motorised vehicle
  - Head struck by high impact object
- Non-frontal scalp hematoma
- Not acting normally per parent

**Ordering Provider Comments:**

---

**PECARN CT Recommendation**

- Low Risk - CT not recommended
- Intermediate Risk - Observation vs. CT based on clinical judgement
- High Risk - CT recommended

---

**Step 1:** If the Head Trauma CT Head/Brain care set is selected, the below form should open to provide PECARN CT recommendation for CT Head/Brain order based on selections. This will fire for patients in the emergency department.

**Step 2:** When Pediatric Head Trauma CT Decision Guide is signed, this alert is to make sure the provider wants to continue based on the recommendation in the form.

Alert already built in Cert.
**PEDIATRIC HEAD TRAUMA CT DECISION GUIDE:**

**UNDER 2 YEARS.**

- GCS <15
- Palpable skull fracture.
- AMS (agitation, somnolence, slow response, repetitive questions)

Yes to any?

CT - Indicated

- HIGH RISK
- 4.4% chance of clinically important TBI - requiring an intervention.

No?

Observation vs. CT

INTERMEDIATE RISK: 0.9% chance of TBI

Other factors may contribute in order to make a decision.

- Multiple injury or isolated injury?
- Worsening of symptoms while in the ED?
- Parent requesting CT?
- Physician Experience?
- Age < 3 months

Yes to any?

No?

CT - Not Indicated

- LOW RISK: < 0.02% chance of TBI
- Discharge

**PEDIATRIC HEAD TRAUMA CT DECISION GUIDE:**

**2 YEARS & OLDER.**

- GCS <15
- Signs of basilar skull fracture.
- AMS (agitation, somnolence, slow response, repetitive questions)

Yes to any?

CT - Indicated

- HIGH RISK
- 4.3% chance of clinically important TBI - requiring an intervention.

No?

Observation vs. CT

INTERMEDIATE RISK: 0.8% chance of TBI

Other factors may contribute in order to make a decision.

- Multiple injury or isolated injury?
- Worsening of symptoms while in the ED?
- Parent requesting CT?
- Physician Experience?
- Age < 3 months

Yes to any?

No?

CT - Not Indicated

- LOW RISK: < 0.05% chance of TBI
- Discharge
PECARN Risk Stratification for Traumatic Brain Injury (TBI)

Age < 2 years

- **LOW RISK**
  - CT Not Indicated
  - TBI risk – 0.02%

- **INTERMEDIATE RISK**
  - CT Vs. Observation
  - TBI risk – 0.9%

- **HIGH RISK**
  - CT Indicated
  - TBI risk – 4.4%

Age 2-18 years

- **LOW RISK**
  - CT Not Indicated
  - TBI risk – 0.05%

- **INTERMEDIATE RISK**
  - CT Vs. Observation
  - TBI risk – 0.8%

- **HIGH RISK**
  - CT Indicated
  - TBI risk – 4.3%
Data Source: MEDIC

**Participating Hospital ED**
- Electronic Health Record data for every ED visit sent via automated data feed
- Additional data is obtained via manual chart abstraction
- Abstracted data drive MEDIC reporting

**ArborMetrix Secure Database**
- Secure Database vendor
- Provides abstraction, web interface & performance reporting

**Coordinating Center**
- Data are audited and then used to:
  - Help develop future quality initiatives
  - Facilitate focused areas of work (e.g. pediatric initiatives)
  - Inform academic pursuits to include publications