This dude is from Kansas, seriously? I know what you might be thinking...

Objectives
At the end of this presentation the participant will be able to:
1. Classify the challenges of pediatric trauma resuscitation for the community hospital.
2. Summarize the results from onsite high fidelity simulation based assessments in hospitals in the US and UK for blunt abdominal trauma and head injury care.
3. Recognize potential methods to improve performance through novel methods.

Disclosure
- No conflicts of interest to report

Children’s Mercy
- Regional leader in a large geographic region
- 70,000 main ED visits
- 45,000 suburban ED visits
- 830 doctors, 8200 employees- 6 separate facilities
- Only level 1 pediatric trauma center in a region of 6 million.

Trauma in Childhood
- 22 million children seek medical care annually
- 22,000 die
- Most common cause of death from ages 1-14 years
- World-wide public health issue
Trauma resuscitation ideally

- Waves of resuscitation
  - 1st 5 seconds identify immediate life threatening emergencies
  - Next 2-3 minutes Primary survey- Stabilization
    - Airway/C-spine
    - Breathing & ventilation
    - Circulation & hemorrhage control
    - Dysfunction of the CNS (neurologic assessment)
    - Exposure and environmental control
  - Next 10-15 minutes Secondary survey
  - Definitive care (transfer needed)

Trauma in Childhood:

- 80% of injured children 1st receive care in a community hospital
- To improve care interventions must focus on the community hospital
- Some hospitals are not ready to care for children
  - Equipment
  - Process/protocols
  - Staff ready

Pediatric Trauma Resuscitation Challenges: Ready or not?

- Trauma is not a single disease
- Children grow- so equipment size varies, as does response to injury
- For some hospitals critical pediatric injury is a rare event (1-4 case/yr) on the job training not enough
- Any level of resuscitation = high-pressure, high-stakes emotionally charged, family centered

What does readiness require:

- System ready?
  - Protocols (attempting to plan)
  - Process (team or not)

- Providers ready?
  - Trauma team roles
  - Technical/medical knowledge and skills
  - Decision-making skills

What is available to help?

- System ready
  - Mandates
  - Guidelines

- Providers ready- alphabet soup of certifications
  - ATLS, PALS, APLS, PEPP, ...
    - Little content related to pediatrics or trauma
    - 3% of ATLS focused on children
    - Long time periods between certifications

Who says Kansas is flat
What do we know about community readiness- equipment/protocols

- National Pediatric Readiness Project Numbers 2015
  - US- 68.9% of hospitals ready
  - Virginia – 75% of hospitals ready, minimum score 39%
    - Lower volume less prepared
  - Kansas- 58% of hospitals ready, minimum score 27%
    - Lower volume (the majority of hospitals 95/123) less prepared

Hospitals seem to have trouble caring for injured children

- A 2006 study by Hunt et al\(^2\) used onsite simulation to identify deficiencies in trauma stabilization of children.
- Median number of tasks that needed improvement was 25 (57%).
- Common deficiencies: 1) accurately estimating a child’s weight, 2) vascular access, 3) removing the child’s clothing, 4) offering parental support 5) performing an accurate neurological assessment, and 6) stabilizing the patient’s cervical spine.

What are the quality metrics to define quality pediatric trauma resuscitation?

- No current benchmarks available
- National data does not include the clinical resuscitation parameters
- ACS certification follows time to... intubation and CTs
- No data collected on how we are doing in primary and secondary survey

The way I see it- What is needed

Problem 1. To improve the system and team readiness
   - Better understand provider needs/perceptions
   - Develop a training and evaluation system to test/measure care and identify gaps and feedback to leaders
   - Develop valid and reliable metrics to track progress

Problem 2: To improve the individuals
   - Help with decision making

Problem 3: To improve crisis function
   - Help with the steps in the process

Today discuss 3 readiness solutions

- The FACT - System readiness and systems-based practice training and reporting
- Virtual platform- Gamification
- Pediatric trauma checklist

What we needed- a deeper understanding provider needs

- Providers ready?
  - Conducted focus groups in Kansas
    - Followed spoke and wheel model for Kansas
    - Onsite
  - Conducted surveys
    - Gathered opinions/self assessments of trauma readiness
Results: Focus groups

• 100% of Providers need/wanted help.
  • 2 hours of training at a time
  • Onsite
  • Would try a simulated program
  • Focus on the local needs
    • Critical access hospitals need an initial stabilization program only
    • Higher levels of care need more comprehensive training

Results: Surveys

• Comfort levels - general trends
  • Smaller hospital less comfortable (>50% very uncomfortable with injury categories/equipment)
  • Nearly all (over 80%) said onsite lecture or web-based training
  • Over 70% onsite simulation
  • Over 70% needed help with assessment and decision-making skills (somewhat or very uncomfortable)

What else was needed

• Change the perspective
  Hospitals are complex inter-related organization so change is difficult

  Consider more comprehensive approach to change

Organizational Change Theory - Kurt Lewin

• Explanatory Factors
  Change initiatives need to destabilize the status quo, implement the alternative and re-stabilize the environment.

• Change Strategy -
  A group process of trial and error until an appropriate fit is found

Theoretical framework

<table>
<thead>
<tr>
<th>Phase</th>
<th>Participants</th>
<th>Method</th>
<th>Evaluation</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physicians</td>
<td>Focus Group</td>
<td>Observation</td>
<td>Improvement in knowledge and skills</td>
</tr>
<tr>
<td>2</td>
<td>Nurses</td>
<td>Survey</td>
<td>Analysis</td>
<td>Increased awareness of patient needs</td>
</tr>
</tbody>
</table>

Brainstorming

• Presented needs to the pediatric simulation community
• Formed an international collaboration
• Developed a framework - the Field Assessment Conditioning Tool (FACT)
The FACT- purpose

(1) Assess readiness to receive traumatically injured children
(2) Provide feedback, horizontally (to emergency staff) and vertically (to the hospital governance infrastructure) to improve patient care

FACT Metrics

<table>
<thead>
<tr>
<th>Event</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessments</td>
<td>9:10</td>
</tr>
<tr>
<td>Senior Alert/11 call</td>
<td>1:10</td>
</tr>
<tr>
<td>Decide “Unilateral Blunt Injury”</td>
<td>1:10</td>
</tr>
<tr>
<td>Decide “Both Critical Head Injury”</td>
<td>1:52</td>
</tr>
<tr>
<td>Initiation</td>
<td>1:20</td>
</tr>
<tr>
<td>Notify Transport control</td>
<td>10:10</td>
</tr>
<tr>
<td>Notify Protection</td>
<td></td>
</tr>
<tr>
<td>Head Up</td>
<td></td>
</tr>
<tr>
<td>Oxygen/100%</td>
<td></td>
</tr>
<tr>
<td>Increase MAP</td>
<td></td>
</tr>
<tr>
<td>Decrease blood pressure (track)</td>
<td></td>
</tr>
<tr>
<td>Ventilator</td>
<td></td>
</tr>
</tbody>
</table>

4 Sim cases with Key performance Indicators (KPIs)

- Head Injury
- Blunt abdominal trauma
- Burn
- Multisystem trauma
- Each case has time based critical actions steps associated with care
- Developed by evidence based review and consensus revision

Head Injury KPIs

The British

FACT pilot study UK

- Met with 10 hospitals in the Northwest region of the UK who agreed to participate
- Administrators/quality staff also agreed to review the findings
- Hospitals underwent a equipment/protocol review prior to simulation
- All staff took a web-based pediatric trauma test.
FACT study UK
- Teams working were video-recorded resuscitating 2 standardized cases: serious head injuries and blunt abdominal trauma with major hemorrhage
- Each hospital visited twice- 3 months apart
- All scenarios on site “surprise” events and allowed to continue until 30 minutes had elapsed.
- Team members filled out post self-reflection logs with systems based questions
- Debrief
- Post event scoring with video review by experts

Report example
- Please examine the FACT handout

Lets take a closer look at the UK metrics/results

Primary Survey Score: development
- This scoring tool was devised as outlined by Stufflebeam.6
- Criteria for successful task completion based ETC/ATLS
- Reviewed and revised by an expert group through 3 rounds of survey-based consensus.

Primary Survey Score

Scoring
- Tasks were evaluated on 1st completion. Each task was scored from 0 to 2 points. No points if not completed.
- One point was assigned if the time to completion was > 5 minutes, or was partially performed, 2 points if fully completed.
- The percentage of items completed correctly was calculated as a summary % score.
- The checklist was adjusted for each case
Pilot study

- Piloting sessions used 2 raters scoring independently and recording scores on computer-based forms.
- Data analysis: 1. Primary Survey Score % completion score. 2. Quality composite score. 3. Estimating rater reliability with calculation of intra-class correlation coefficients (SPSS 19 (Armonk, NY: IBM Corp)).

Results (preliminary for 40 scenarios)
Average completion Primary Survey Score= 71% Range 38-92%.

<table>
<thead>
<tr>
<th>Assessment/Action</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Time Min (mean)</th>
<th>Time Min (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Leader</td>
<td>30/29</td>
<td>89.80%</td>
<td>35 seconds</td>
<td>15 seconds</td>
</tr>
<tr>
<td>Pupill Check</td>
<td>30/29</td>
<td>89.80%</td>
<td>3.34</td>
<td>2.6</td>
</tr>
<tr>
<td>Declen/Entrow</td>
<td>30/29</td>
<td>89.80%</td>
<td>3.9</td>
<td>2.4</td>
</tr>
<tr>
<td>Declen/Tim Critical Head Injury</td>
<td>30/29</td>
<td>89.80%</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Initial</td>
<td>30/29</td>
<td>89.80%</td>
<td>37</td>
<td>2.2</td>
</tr>
<tr>
<td>nuclear Protection</td>
<td>30/29</td>
<td>89.80%</td>
<td>3.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Intubation Center</td>
<td>30/29</td>
<td>89.80%</td>
<td>3.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Head Up</td>
<td>3/29</td>
<td>10.00%</td>
<td>3.2</td>
<td>5</td>
</tr>
<tr>
<td>VTAC</td>
<td>0/29</td>
<td>0.00%</td>
<td>14.2</td>
<td>1.3</td>
</tr>
<tr>
<td>3M Nitrile Gavine</td>
<td>0/29</td>
<td>0.00%</td>
<td>14.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Invasive Airway</td>
<td>0/29</td>
<td>0.00%</td>
<td>11.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Decrease Pressure</td>
<td>0/29</td>
<td>0.00%</td>
<td>10.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Ventilator</td>
<td>0/29</td>
<td>0.00%</td>
<td>21</td>
<td>2.3</td>
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</table>

Preliminary reliability

- Intra-class correlation coefficients (ICC) were used as a measure of inter-rater reliability.
- Time Critical Head Injury (TCHI), .940 with a 95% CI from .803 to .982 (F(12,12) = 16.605, p<0.001)
- Major Hemorrhage with shock (MH), .963 with a 95% CI from .880 to .985 (F(12,12) = 27.335, p < 0.001).

Implications

- Teams often omitted steps in the primary survey
- A high degree of agreement was found in the raters’ checklist score for both scenarios.
- The newly developed Primary Survey Score represents a potential means to measure initial pediatric trauma stabilization strengths and areas for targeted training needs.

Head injury care (KPIs)

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Head Injury implications

Onsite head injury care in simulated scenarios observed during FACT implementation demonstrate the need for improvement

Next steps:
Further analysis of the other seven FACT metrics to understand the relative contributions of knowledge, performance, and staff perceptions on team performance.
FACT reports - UK staff recommendations to improve

<table>
<thead>
<tr>
<th>UK staff recommendations to improve</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are you planning to use this feedback?</td>
</tr>
<tr>
<td>How do you plan to implement your ideas?</td>
</tr>
</tbody>
</table>

- Water
  - Attention to patients' needs and feedback on the ward.
  - Improved team communication.
- Home
  - Water damage with the team's ability to manage emergencies.
  - Need for practice in a task.
- Staff
  - Treatment knowledge for others.
  - Communication and feedback.

Changes made by UK teams

- 43 Changes made by UK teams
- 44 FACT lessons so far
- 45 Problem 2: Pediatric trauma clinical decision-making
- 46 Problem 2: Pediatric trauma clinical decision-making
- 47 Problem 2: Pediatric trauma clinical decision-making
- 48 Problem 2: Pediatric trauma clinical decision-making

FACT lessons so far

- Community hospitals need help in caring for critically injured children
- Primary survey steps are often omitted or delayed
- Care decision may be delayed or omitted
- Very willing to improve
- 3 Kansas Hospitals have participated and the results are virtually identical

Understanding complex decision-making

- Sound clinical judgment is a critical for high quality trauma care
- Cognitive psychology - "experts are individuals capable of a variety of advanced skills including constant, rapid, accurate objective diagnosis and solving complex problems"
- Expertise developed by deliberately challenging decision-making skills by increasing the demand and difficulty of tasks accompanied by constant corrective feedback
- On the job practice may not lead to this

Cognitive task analysis (CTA)

- One approach to modeling cognitive systems (such as the initial steps in resuscitating a child hit by a car)
- Assessing and defining steps involved in expert task performance
- Developed in the 1980-90s for military, industrial and transportation sectors
- 50 hours of training = 5 years of advanced job knowledge
- Like learning the "secret to a magic trick"
- Somewhat laborious
Using CTA we can develop a pediatric trauma virtual platform to train decision-making:

- Managing multiple patients at a time, triaging and prioritizing care (determining the level of illness),
- Interpreting physical examination and vital sign changes,
- Choosing the correct procedures and treatments for various traumatic injuries
- Resuscitating and stabilizing a child,
  - how to approach parents and families
  - calling for help
  - preparations for transfer to definitive care.

The intent to create:

- Dynamic and changing health status to reflect the adequacy of the interventions and timing.
- Ability to create engagement and urgency
- Be played continuously could allow for short interjections of immediate positive or negative feedback avoiding detailed/extensive text.
- Learning in this system could happen through reinforcement via
  - accumulation of points
  - feedback after choices and decisions have already been made.

ADEPT: pediatric trauma game

- A video game can:
  - Force providers to make sequential time limited decisions based on trauma assessment and intervention priorities
  - Offers multiple platforms web-based and apps
  - Offers wide availability and advanced analytics to understand decision-making trouble spots
  - Adaptable learning environment
  - Development underway...
  - CTA for blunt trauma completed

ADEPT platform

Problem 3- Dealing with a rare event crisis
Addressing sustainability/complexity

Checklists

- A checklist is a tool that, outlines, organizes and attempts to streamline complex processes.
- An effective aid should function to delineate and categorize items to simplify conceptualization and recall of information.
- Medical and non-medical industries use cognitive aids to guide providers through accurate task completion.
- Demonstrated to be highly effective for crises!
Checklist methods

- Ideally this checklist should contain mainly action items that require a response
- Key in this process is the need to balance the length of the tool with as complete as possible directions and guide for thinking.
- It must be brief easy to read, easy to follow and aligned with the care and possible concerns or "not to miss" items.

Summary

Can improve – process, readiness, quality

- Status Report
  - FACT for readiness improvement (IRB project in KC metro for piloting) 3 hospitals already completed
  - Trauma game for decision-making
  - Funding local grant CTA
  - NIH grant submitted
  - Work underway will need pilot sites/providers 2018
  - Checklist draft ready- ready to move to frontline provider input
  - Need to test decision support
  - Will need pilot sites/providers 2017

How can you help community hospitals

- Need your help to improve
- We have discussed that decision-making and timeliness are challenges
- Consider other methods such as tele-health applications
- Offer earlier communication
- Any training or outreach can help

References
