Tales of a Team
Building a Better Trauma Team

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PURPOSE
- Describe our approach for assessing team performance
- Present results of our studies on team performance
- Describe approaches that we have used for improving team performance

TOPICS
- What determines team size? How can you make it smaller?
- Which members of the team are working hardest? Why?
- How does leadership structure impact patient care?
- What interventions can reduce performance variability?

Performance Improvement Path

Identify problem
Identify contributing factors
Implement solution
Evaluation
Video review

Our Story
APPROACHES USED

• Video analysis of completion/timeliness of tasks
• Ethnographic analysis
• Psychometric surveys
• Real-time behavioral analysis

OUR RESEARCH TEAM

• Pediatric surgeons
• Pediatric emergency medicine physicians
• Critical care physicians
• Psychologists (human factors)
• Computer scientists
• Mathematicians

Who is in the trauma bay? Why are they there?

<table>
<thead>
<tr>
<th>Role</th>
<th>Attending</th>
<th>Stat</th>
<th>Trauma</th>
<th>Shock</th>
<th>Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending surgeon</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical fellow</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical resident</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency medicine physician</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical care physician</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anesthesiologist</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory therapist</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse right</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse left</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication nurse</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing assistant</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiology technician</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social worker</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number</td>
<td>14</td>
<td>12</td>
<td>8</td>
<td></td>
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</tbody>
</table>
TOTAL NUMBER OF PEOPLE IN TRAUMA BAY

No. of people

Count

0 10 20 30 40 50

TOTAL NUMBER OF PEOPLE IN TRAUMA BAY

Average = 22.2

FACTORS INFLUENCING TEAM SIZE

MULTIVARIATE ANALYSIS

Age
Female
Advanced notification
Highest level activation
Transfer
Weekend
Daytime
Penetrating injury

201 resuscitations

NUMBER OF PRIMARY SURVEY TASKS COMPLETED

TASKS COMPLETED IN TWO MINUTES

MULTIVARIATE ANALYSIS

Age
Female
No notification
Highest level activation
Transfer
Weekend
Night
Penetrating injury
High ISS
Team size

EFFECT OF NUMBER OF PEOPLE ON TASK PERFORMANCE AT TWO MINUTES

y = a + bx

y = a + bx

R² = 0.8, y max at x = 7

Average Number of People (Bedside)
POTENTIAL FACTORS INFLUENCING TASK PERFORMANCE IN CROWDS

- Physical crowding
- Social loafing
- “Hiding in the crowd”
- Role confusion
- Ambient noise

Who is working hardest?

66 resuscitations

NASA-TLX

WORKLOAD DISTRIBUTION

WORKLOAD BY ROLE

MULTIVARIATE ANALYSIS

REDISTRIBUTING WORKLOAD

How does leadership structure influence team performance?
PROMOTING SHARED LEADERSHIP

- Acknowledge role expertise
  - Surgeons: surgical care
  - Pediatricians: pediatric care
- One voice
- Make it easy
  - Introductions
  - Stand together

How are our teams doing at performing basic components of ATLS?

What factors influence basic ATLS task performance?

Why Care about ATLS Compliance?

- ATLS compliance and outcome
  - Adoption of the ATLS protocol reduces mortality
  - ATLS compliance is associated with fewer errors, less severe errors
- Up to 50% of preventable trauma deaths related to omissions in the resuscitation phase

Why Care About ATLS Protocol Adherence?

Examples

- Delayed measurement of blood pressure and fluid administration in child with hemorrhagic shock
- Failure to calculate GCS in child with severe head injury
- No oxygen administration in hypoxic child with severe head injury requiring intubation
- No temperature measurement or external warming measurement in profoundly hypothermic child
- No extremity evaluation in severely injured child with a femur fracture
What Can We Do to Increase Protocol Compliance in the Trauma Bay?

- Try harder (M and M, video review)
- Training-simulation (proficiency)
- Get skilled leaders

Checklists

- Used in protocol-driven domains
- Introduced in medical domains
  - WHO Surgical Safety Checklist
  - Infection control procedures
- Increase protocol adherence
- Improve team communication
- Improve outcomes
Spontaneous Behaviors

- Nurse summary
- Team leader direction

RESEARCH QUESTIONS

- What items should be on the checklist?
- Who should administer the checklist?
- Will the checklist be a burden to the team?
- Will the checklist improve the process or outcome of care?

Checklist design

Simulation testing

Pilot implementation

3 months

Testing

4 months

Checklist Development

- Focus groups – items and format
- Included all disciplines

Simulation Testing

- Twelve simulation sessions
- Four scenarios: two with checklist, two without
- Outcomes measured:
  - ATLS task completion (ATLS Performance Score)
  - Compliance with checklist use
  - Workload (NASA TLX) surveys

Primary survey tasks

- Airway assessment
- Breath sounds
- Extremity pulses
- Blood pressure
- Pupil exam
- Temperature

Secondary survey tasks

- Head/Face exam
- Ear exam
- Eye exam
- Neck/cervical spine exam
- Chest exam
- Extremity exams
- Spine exam
ATLS Performance Score (60 points)
- Primary survey: 11 tasks, 32 points
  - 0 points if not completed
  - 1 point if done later than median time
  - 2 points if done between 1st quartile & median time
  - 3 points if done earlier than 1st quartile time
- Secondary survey: 14 tasks, 28 points
  - 0 points if not completed
  - 1 point if done but not stated
  - 2 points if done and stated

Checklist Implementation:
- Three month introduction period
- Presented at Trauma Committee
- Training video for trauma team
- Team leaders oriented at start of rotation

Results of Simulation Testing
- Surgical team leader best as administrator
- ATLS Performance Score improves with checklist use
  Total score: 38.3 vs 42.0 (p<0.001)
- ATLS Performance Score improves with compliance
- No difference between “do list” and “challenge response”
- No change in overall workload of team members

Conclusions
- Checklist improves ATLS performance in simulation
- Safe to implement and evaluate in actual resuscitations

Pre-Post Study
Two 4-month periods
- Pre-implementation: May-August 2011 (n=222)
- Post-implementation: May-August 2012 (n=215)

Video review of all trauma resuscitations

Differences between cohorts calculated
- Cohort characteristics
- Frequency of and mean time to task completion

Cohort Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Pre (n=222)</th>
<th>Post (n=215)</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Activation level</td>
<td></td>
<td></td>
<td>0.24</td>
</tr>
<tr>
<td>Attending</td>
<td>5.6</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>Stat</td>
<td>61.7</td>
<td>61.8</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>30.4</td>
<td>25.7</td>
<td></td>
</tr>
<tr>
<td>Weekend</td>
<td>30.2</td>
<td>32.8</td>
<td>0.59</td>
</tr>
<tr>
<td>No pre-notification</td>
<td>10.4</td>
<td>14.3</td>
<td>0.15</td>
</tr>
<tr>
<td>Team leader (% female)</td>
<td>44.6</td>
<td>49.3</td>
<td>0.39</td>
</tr>
<tr>
<td>Penetrating mechanism</td>
<td>8.1</td>
<td>3.2</td>
<td>0.03</td>
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<tr>
<td>Intubated patient</td>
<td>5.9</td>
<td>7.4</td>
<td>0.51</td>
</tr>
</tbody>
</table>
Table 2. Vital sign task completion pre and post checklist implementation

<table>
<thead>
<tr>
<th></th>
<th>Frequency (%)</th>
<th>Mean time (min)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre</strong></td>
<td><strong>Post</strong></td>
<td><strong>Pre</strong></td>
<td><strong>Post</strong></td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>94.1%</td>
<td>96.3%</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>Heart rate</strong></td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>99.1%</td>
<td>99.5%</td>
<td>0.58</td>
</tr>
<tr>
<td><strong>Oxygen saturation</strong></td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Blood pressure</strong></td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
</tbody>
</table>

No significant reduction in total resuscitation time
26 vs. 24.3 minutes p=0.14

SUMMARY

A checklist for trauma resuscitation:

- Increased compliance with key components of the primary and secondary survey
- Increased the speed of primary survey task and vital sign performance
- Reduced the variability of primary survey task performance

Interesting Discoveries

- Checklist as handoff tool
- The trainee myth
- Fellows: resistors to supporters
- Empowered rotating residents

Does Increased ATLS Compliance Improve Outcome?

Supported by funding from:
Health Resources and Service Administration
Program Emergency Medical Services for Children Targeted issues
grant number H34-MC-13351
CHECKLIST FAQ

Have you thought about an iPad app?

How can I get a copy of your checklist?
http://www.childrensnational.org/files/PDF/EMSC/PubRes/Pediatric_Trauma_Resuscitation_Checklist.zip

How can I see how it is used?

Summary

- Despite individual and team training, ATLS protocol deviations persist during pediatric trauma resuscitation.

- Video analysis can be used to identify patient and resuscitation features that increase the likelihood of protocol deviation.

- A checklist for trauma resuscitation can improve compliance with the ATLS protocol, particularly for teams treating injured patients at high-risk for protocol violations.