“ORANGE IS THE NEW GREEN”: TRAUMA PI AND RESOURCES FOR OPTIMAL CARE OF THE INJURED PATIENT: 2014

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18TH ANNUAL CONFERENCE
SOCIETY OF TRAUMA NURSES
JACKSONVILLE, FL
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Delaware’s Inclusive Trauma System

• Hospital Care
  • 9 acute care hospitals in the state
  • Wilmington Hospital “designated” Level I Trauma Center in 1984
  • No coordination of services for the injured or differentiation of clinical capabilities
  • Injured routinely taken to “nearest” hospital
Delaware’s Inclusive Trauma System

Rate of Unintentional Injury-related Mortality
(per 100,000 population)
Annual Averages by County

U.S.
Kent Cty
New Castle Cty
Sussex Cty

HB 433 - “Delaware’s Trauma System Legislation” 7/8/96

Amended Chapter 97, Title 16 of Delaware Code
“Emergency Medical Services Systems”
Delaware’s Inclusive Trauma System

- All Trauma Centers verified by ACS COT VRC and designated by the DE Division of Public Health
- “Fully Inclusive” Trauma System inaugurated 1/2000
Delaware’s Inclusive Trauma System: Impact on Mortality

Glen H. Tinkoff, MD, James F. Reed, III, PhD, Ross Megargel, MD, Edward L. Alexander, III, MD, Steven Murphy, MD, and Mary Sue Jones, RN

The Journal of TRAUMA® Injury, Infection, and Critical Care • Volume 69, Number 2, August 2010

- Delaware Trauma Data (1998 – 2007): Mortality by ISS category by year
- National Trauma Data Bank (1998 – 2007): Mortality by ISS category by year
National Trauma Data Bank vs Delaware Trauma Data (ISS > 24)

3%/ yr decrease in mortality
Objectives

• Outline the development and current vision of the American College of Surgeons Committee on Trauma (ACS COT) PI efforts
• Discuss fundamental structure and processes required for an effective trauma PI program.
• Review changes to the PI chapter (chapter 16) in the revised edition of the “Resources for Optimal Care of the Injured Patient”
PERFORMANCE IMPROVEMENT
PROBLEM SOLVING FLOWSHEET

Does the stupid thing work?

Don’t mess with it

Did you mess with it?

Does anyone know?

You Idiot!!

Will you get in trouble?

Hide it

You poor guy!

Can you blame someone else?

Throw it away

NO PROBLEM
Trauma Center Standards
Basic Principles of Trauma Center Performance Improvement (PI)

A trauma center should provide care to the injured patient that is:
- Efficient (functioning in the best possible manner with the least waste of time and effort)
- Effective (able to produce the desired result)
- Safe (free from mishap or danger)
Basis for Trauma Center PI
Theory and Practice

Earnest A. Codman MD (1869-1940)

- “End Results Idea”
  
  • “The common sense notion that every hospital should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire, ‘If not, why not?’ with a view to preventing similar failures in the future”


  • Basis for the hospital standardization movement founded by the American College of Surgeons, and the precursor to the Joint Commission on Accreditation of Hospitals formed in 1951
Basis for Trauma Center PI
Theory and Practice

William Edwards Deming (1900 - 93)

• Total Quality Management (TQM)
  • Customer-focused
  • Total employee involvement
  • Process–centered
  • Integrated system-based
  • Continual improvement
  • Fact-based decision-making
  • Effective communication

• Plan/ Do/ Study (Check)/ Act
Basis for Trauma Center PI Theory and Practice

Avedis Donabedian MD, MPH (1919-2000)

- “Evaluation” of Health Care
- Structure + Process = Outcomes
  - Outcome measures performance, which are conditional on structure and process (which can be manipulated)
  - System redesigns and other inputs correct deficiencies, improving quality of care
  - Continued performance monitoring keeps quality of care high
Basis for Trauma Center PI
Theory and Practice

Assuring Quality in a Trauma System—The Medical Audit Committee: Composition, Cost, and Results


J Trauma 1987; 27(8); 866-75.

Medical audit process consisting of:

- Systematic medical record review
- Precise definitions of preventability
- Utilization of risk-adjusted probability of survival (TRISS)
- Multidisciplinary review for determination of preventability
A Medical Culture Paradox

Do No Harm
&
To Err is Human
The Patient Safety Crisis

- 44,000 to 98,000 deaths per year
- $37.6B in costs per year
- Preventable mistakes cost $17 to $29 billion/yr
- Medical errors consume 10-15% of a hospital’s annual operating budget

Medical Errors are a Leading Cause of Death
The Patient Safety Crisis

“The American health care delivery system is in need of fundamental change. Patients, doctors, nurses, and health care leaders are concerned that the care delivered is not the care we should receive. Yet the problems remain. Health care today harms too frequently and routinely fails to deliver its potential benefits.”
Basis for Trauma Center PI
Theory and Practice

James Reason Ph.D.

• Human factors engineer
• Risk and human error analysis
• “Swiss Cheese” model of accident causation
Reason’s “Swiss cheese” model of accident causation

Some holes due to active failures

Hazards

Other holes due to latent conditions

Losses

Successive layers of defences, barriers and safeguards

System defences
Reason’s - Defenses

Potential adverse events

Policy writing, training

Standardizing, simplifying

Automation

Improvements to devices, architecture

Patient
Basis for Trauma Center PI
Theory and Practice

PI and Patient Safety (PIPS)

• “Freedom from accidental injury”
• Establishment of operational systems and processes that minimize the likelihood of errors and maximizes the likelihood of intercepting them when they occur
Level of Responsibility for Medical Errors Among Health Care Professionals and Institutions

Among those who have had experiences with medical errors, how much responsibility do they place on each of the following...

<table>
<thead>
<tr>
<th></th>
<th>Among the 42% of the public who have experience with medical errors...</th>
<th>Among the 35% of physicians who have experience with medical errors...</th>
</tr>
</thead>
<tbody>
<tr>
<td>The doctor involved</td>
<td>A lot 81%</td>
<td>A lot 70%</td>
</tr>
<tr>
<td></td>
<td>A little 10%</td>
<td>A little &lt;5%</td>
</tr>
<tr>
<td></td>
<td>None 8%</td>
<td>None 10%</td>
</tr>
<tr>
<td>The nurses involved</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>26%</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>46%</td>
<td>46%</td>
</tr>
<tr>
<td>The institution involved</td>
<td>43%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>36%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>Other health professional</td>
<td>26%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>24%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>48%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Note: Don't know responses not shown.
Basis for Trauma Center PI
Theory and Practice

Value of Care = \textbf{Quality of Process} + \textbf{Quality of Outcome} + \textbf{Cost}
Trauma PI or Peer Review?

Peer Review - process whereby peers evaluate the quality of work performed by their colleagues

- Evidence or consensus based analysis
- Regular intervals
- “Expert” review
- Produce effective corrective strategies
- Used in credentialing/ privileges
- Integrate into hospital-wide PI
- Provide protection from discovery
Trauma PI or Peer Review?

- Efficient
- Fosters standardization
- Self regulatory - “Polices the profession”
- Credentialing
- “Core” of trauma center PI activities
Trauma PIPS Program Structure

- Board of Directors
- Medical Staff

Trauma Medical Director

Trauma Program Manager
Trauma PIPS Program Structure

Administrative Accountability

TMD must be empowered to address multidisciplinary issues

- Determine the qualifications of trauma panel
- Recommend changes to trauma panel based on performance review
Trauma PIPS Program Structure

Scope

Defined the trauma patient population:
- Patients with ICD-9-CM Dx 800.00 - 959.9
- Trauma-related hospital admissions
- Injury-related deaths in ED or after admission
Trauma PIPS Program Structure

Registry

- “Foundation”
- National Trauma Data Standard
Trauma PIPS Program Structure

**Trauma Registry**
- “Foundation”
- National Trauma Data Standard
- Concurrent (80% cases/ 60d of discharge)
- Confidentiality assured
- Monitored for data validity
- Annual NTDB submission
- Risk-stratified benchmarking system to measure performance and outcomes (TQIP)
TQIP – Inclusion Criteria

Center-Level Criteria:
- Level I or II ACS verified or state designated trauma centers in NTDB. The trauma level of center is first determined according to ACS verification then by state designation.
- For trauma centers outside US, level will be determined using the information from the corresponding government/health authority.
- Must have 12 months of data between 1/1/2012 and 9/30/2013.
- Must be full TQIP participant, with signed contract and payment as of January 29th, 2014.

Patient-Level Criteria (must meet all of the following):
- Age 16 years or older.
- At least one valid trauma ICD-9 code in the range of 800–959.9 (excluding late effects (905-909.9), superficial injuries (910-924.9), and foreign bodies (930-939.9).
- Trauma type of blunt or penetrating.
- Injured patients with at least one AIS=3 or greater in body regions 1 through 8 (AIS crosswalk version 98 was used when available; otherwise, the ICD9 map was used to calculate the AIS score).
- ED discharge disposition AND hospital discharge disposition cannot both be unknown.
- Exclude patients with ED discharge disposition of home, home with services, transfer to another hospital, other, or left against medical advice.
- Exclude patients with pre-existing advanced directive to withhold life sustaining interventions.
- Exclude patients with the following combinations of ED vitals:
  - SBP=0, and pulse=0, and GCS motor=1
  - SBP=NK/NR, and pulse=0, and GCS motor=1
  - SBP=0, and pulse=0, and GCS motor=NK/NR
  - SBP=0, and pulse=NK/NR, and GCS motor=1
  - SBP=NK/NR, and pulse=0, and GCS motor=NK/NR
TQIP – Cohort Definitions

All cohorts are selected from patients meeting the above criteria, and exclude isolated hip fractures in the elderly unless otherwise noted. An isolated hip fracture in the elderly related to a fall is defined as:
- Injury mechanism of fall AND
- Age 65 or older AND
- Any of the following AIS codes:
  - 851810.3 Femur, Fracture, Intertrochanteric
  - 851812.3 Femur, Fracture, Neck
  - 851818.3 Femur, Fracture, Subtrochanteric
- AND all other injuries are in AIS body region External (i.e., bruise, abrasion, or laceration)

**Blunt Multisystem Injury**
- Patients must have blunt mechanism only
- AIS=3 or greater in at least 2 of the following body regions: head, face, neck, thorax, abdomen, spine, upper, or lower extremity.

**Penetrating injury**
- Patients must have penetrating mechanism of Cut/pierce or firearm only
- Any injury with AIS=3 or greater in at least one of the following body regions: neck, thorax, or abdomen.

**Shock**
1. Shock
   - Initial ED/Hospital SBP between 0 and 90

2. Hemorrhagic Shock
   - Initial ED/Hospital SBP between 0 and 90
   - Transfusion Blood within 4 Hours >0
TQIP – Cohort Definitions

Elderly Patients
- Age 65 years or older

Elderly Blunt Multisystem
- Patients must meet the cohort criteria for both Elderly Patients and Blunt Multisystem Injury

Elderly Patients with IHF
- Age 65 years or older AND
- Patients must have injury mechanism of fall AND
- Patients must have at least one of the following AIS codes:
  - 851810.3 Femur, Fracture, Intertrochanteric
  - 851812.3 Femur, Fracture, Neck
  - 851818.3 Femur, Fracture, Subtrochanteric
- AND all other injuries are in AIS body region External (i.e., bruise, abrasion, or laceration)

Mid-Shaft Femur Fracture
- Excluding IHF
- Patients must have blunt mechanism only
- Patients must have AIS 98 code of 851814.3 AIS 98 Femoral Shaft Fracture

Open tibial shaft fracture
- Excluding IHF
- Patients must have blunt mechanism only
- Patients must have the following AIS 98 code of 853422.3 AIS 98 Tibial Shaft Fracture Open
TQIP – Cohort Definitions

Splenic injury
1. Blunt Splenic Injury (BSI)
   o Patients must have blunt mechanism only
   o Patients must have at least one of the following spleen injury codes:
     • 544210.2
     • 544212.2
     • 544214.3
     • 544220.2
     • 544222.2
     • 544224.3
     • 544226.4
     • 544299.2
     • 544240.3
     • 544228.5

2. Isolated Blunt Splenic Injury (IBSI)
   o Patients must have blunt mechanism only
   o Patients must have at least one of the spleen injury codes listed above in the BSI cohort
   o Patients must not have any other injuries in AIS body region '5' (abdomen and pelvic contents)
   o Patients must not have any injuries with AIS>1 in body regions 1, 2, 3, 4, 6, 7, or 8
   o Patients must have ED SBP >90 mmHg
TQIP – Variables for Risk-Adjusting

- Age
- Gender
- Race
- Comorbidities:
  - Congestive heart failure
  - History of angina within past 1 month
  - History of myocardial infarction
  - Chemotherapy for cancer within 30 days
  - Disseminated cancer
  - Ascites within 30 days
  - Esophageal varices
  - Cirrhosis
  - Alcoholism
  - CVA/residual neurological deficit
  - Diabetes mellitus
  - Hypertension requiring medication
  - Currently requiring or on dialysis
  - Respiratory disease
  - Functionally dependent health status
  - Bleeding disorder
  - History of revascularization / amputation for PVD
  - Steroid use
  - Major psychiatric illness
  - Current smoker
  - Drug abuse or dependence
  - Dementia
- Transfer Status
- Pre-Hospital Cardiac Arrest
- Initial GCS Motor Score in the ED
- Initial SBP in the ED
- Initial Pulse Rate in the ED
TQIP – Variables for Risk-Adjusting

- Mechanism of Injury, grouped as:
  - Pedestrian Pedal - MVT Pedal cyclist, MVT Pedestrian, Pedal cyclist/other, Pedestrian/other
  - MVT Occupant and others - MVT Occupant, MVT Other, MVT Unspecified
  - Fall
  - Firearm
  - MVT motorcyclist
  - Struck by, against
  - Others - Transport/other, Machinery, or Unspecified.

- Max AIS Severity in:
  - Head
  - Face
  - Neck
  - Chest
  - Abdomen
  - Spine
  - Upper extremity
  - Lower extremity

- Single Worst Injury (SWI) - Mortality models

- Three Worst Injuries (TWI) – Complications models
TQIP – Patient Cohorts and Characteristics

- TQIP population (all patients)
- Blunt multisystem injuries
- Penetrating injuries
- Traumatic brain injuries (TBI)
- Intubated patients with TBI (ITBI)
- Shock patients
- Elderly patients
- Elderly patients with blunt multisystem injuries
- Elderly patients with isolated hip fracture (IHF)
- Splenic injuries
- Fracture fixation (midshaft femur and open tibial shaft)
- Hemorrhagic shock
TQIP – Process Measures

- Pharmacologic VTE Prophylaxis
- Pharmacologic VTE Prophylaxis Type
- ICP Monitoring
- ICP Monitoring Method
- Hemorrhagic Shock Management
- Angiography
- Embolization
- Surgery for Hemorrhage Control
- Withdrawal of Care
TQIP – Outcomes

- Mortality*
- Major Complications (w & w/o death)*
- MOI*
- Resource Utilization
- Co-morbidites
- Complications
- Time to Death
- D/C Disposition

* graphical inter-facility comparison by OR’s and deciles
TQIP – Reports & Inter-facility comparison

- March 2014 report
  - 198 centers
  - 160,560 incidents

Table 2: Risk-Adjusted Mortality

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Observed N</th>
<th>Observed %</th>
<th>Predicted %</th>
<th>Odds Ratio</th>
<th>Lower</th>
<th>Upper</th>
<th>Outlier</th>
<th>Decile</th>
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</thead>
<tbody>
<tr>
<td>All</td>
<td>1,612</td>
<td>68</td>
<td>4.2</td>
<td>4.5</td>
<td>0.64</td>
<td>0.49</td>
<td>0.83</td>
<td>Low</td>
<td>1</td>
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<tr>
<td>Blunt Multisystem</td>
<td>301</td>
<td>25</td>
<td>8.3</td>
<td>9.5</td>
<td>0.74</td>
<td>0.51</td>
<td>1.07</td>
<td>No</td>
<td>1</td>
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<tr>
<td>Penetrating</td>
<td>58</td>
<td>5</td>
<td>8.9</td>
<td>10.4</td>
<td>0.89</td>
<td>0.47</td>
<td>1.68</td>
<td>No</td>
<td>2</td>
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<tr>
<td>Shock</td>
<td>40</td>
<td>7</td>
<td>17.5</td>
<td>18.4</td>
<td>0.99</td>
<td>0.72</td>
<td>1.37</td>
<td>No</td>
<td>4</td>
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<tr>
<td>TBI</td>
<td>358</td>
<td>20</td>
<td>7.8</td>
<td>8.3</td>
<td>0.72</td>
<td>0.48</td>
<td>1.00</td>
<td>No</td>
<td>2</td>
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<tr>
<td>Intubated TBI</td>
<td>78</td>
<td>26</td>
<td>33.3</td>
<td>34.0</td>
<td>0.92</td>
<td>0.56</td>
<td>1.49</td>
<td>No</td>
<td>4</td>
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<tr>
<td>Elderly</td>
<td>667</td>
<td>33</td>
<td>4.9</td>
<td>5.7</td>
<td>0.54</td>
<td>0.39</td>
<td>0.75</td>
<td>Low</td>
<td>1</td>
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<tr>
<td>Elderly Blunt Multisystem</td>
<td>88</td>
<td>12</td>
<td>13.6</td>
<td>14.1</td>
<td>0.94</td>
<td>0.57</td>
<td>1.57</td>
<td>No</td>
<td>4</td>
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<tr>
<td>IHF</td>
<td>119</td>
<td>1</td>
<td>0.8</td>
<td>2.5</td>
<td>0.72</td>
<td>0.36</td>
<td>1.43</td>
<td>No</td>
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</table>
TQIP – Reports & Inter-facility comparison
TQIP – Reports & Inter-facility comparison

Figure 1: Risk-Adjusted Mortality

Odds Ratio (95% CI)

Patient Cohort

All, Blunt Multisystem, Penetrating, Shock, TBI, Intubated TBI, Elderly, Elderly Blunt Multisystem, IHF
TQIP – Model for PTSF?

Michigan Trauma Quality Improvement Program

Program Overview

The objective of M-TQIP is to measure and improve the quality of care administered to trauma patients in Michigan. This is a voluntary collaboration between Level I and II trauma centers in the State of Michigan, funded by Blue Cross Blue Shield of Michigan and Blue Care Network of Michigan. The consortium supports a collaborative quality initiative (CQI) for trauma providers. Hallmarks of the program are complete and accurate data collection, validation, risk-adjusted feedback on outcomes, and implementation of mechanisms to measure and correlate processes of care with outcomes.

MTQIP was created in 2008 as a pilot program involving six trauma centers in Michigan. In 2011, MTQIP became a formal BCBSM supported CQI program. The MTQIP registry currently contains data on over 40,000 patients from 23 adult Level 1 and 2 trauma centers in Michigan. The University of Michigan serves as the coordinating center for MTQIP.

Funding for MTQIP CQI is provided by Blue Cross Blue Shield of Michigan (BCBSM) and Blue Care Network (BCN). BCBSM’s Value Partnerships program provides clinical and executive support for all CQI programs. To learn more about Value Partnerships see: www.valuepartnerships.com
Trauma PIPS Program Structure

Personnel

- PI Coordinator
- Trauma Registrars
- Trauma panel, specialty liaisons, and service representatives
- Physician extenders, Residents, Trauma Nurses
- Hospital administration
- EMS
- Medical Examiner
Trauma PIPS Program Structure

Measures of Performance ("audit filters")

• Process
• Outcome
• Benchmarks
Trauma PIPS Program Structure

Committees

• “Executive” committee
• Operational Process Performance Committee (Systems committee)
• Multidisciplinary Peer Review Committee
Trauma PIPS Program Process

Figure 3: Levels of Trauma Performance Improvement and Patient Safety (PIPS) Review

- Primary Review (TPM)
- Secondary Review (TPM + TMD)
- Tertiary Review
  - Prehospital Trauma PIPS
  - Trauma Morbidity and Mortality
  - Trauma Multidisciplinary Committee
- Adverse Event/Audit Filter Review
- External Peer Review
- Hospital Quality Committee

Actions
- Education
- Counseling
- Track/Trend
- Guideline Development
- PIPS Team Project
# Trauma PIPS Program Process

## LEVELS OF REVIEW

<table>
<thead>
<tr>
<th>Review</th>
<th>Task</th>
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<tbody>
<tr>
<td>1° Review</td>
<td>Identification</td>
</tr>
<tr>
<td>2° Review</td>
<td>Delegation &amp; Distribution</td>
</tr>
<tr>
<td>3° Review</td>
<td>Discussion &amp; Determination</td>
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Categorization of Mortalities

<table>
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<tr>
<th>Old</th>
<th>New</th>
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<tbody>
<tr>
<td>Preventable</td>
<td>Unanticipated mortality with opportunity for improvement</td>
</tr>
<tr>
<td>Non-Preventable</td>
<td>Mortality without opportunity for improvement</td>
</tr>
<tr>
<td>Possibly Preventable</td>
<td>Anticipated mortality with opportunity for improvement</td>
</tr>
</tbody>
</table>
Trauma PIPS Program Process

Corrective Actions

- System-related issues
  - Guidelines & protocols
  - Education
  - Enhanced resources ($)

- Provider-related issues
  - Education & mentoring
  - Counseling
  - Change in privileges
Trauma PIPS Program Process
Problem Resolution = “Closing the Loop”

- Demonstrating a corrective action has the desired effect by continuous monitoring
- Improvement can not always be demonstrated; however, the PIPS process can!
http://www.facs.org/trauma/verification/resources-preview/index.html
Chapter 15: Trauma Registry

- Trauma registry data must be collected and analyzed by every trauma center.
- These data must be collected in compliance with the National Trauma Data Standard (NTDS) and submitted to the National Trauma Data Bank® (NTDB®) every year in a timely fashion so that they can be aggregated and analyzed at the national level.
- The trauma registry is essential to the performance improvement and patient safety (PIPS) program and must be used to support the PIPS process.
- The trauma registry must be used to identify injury prevention priorities that are appropriate for local implementation.
- All trauma centers must use a risk adjusted benchmarking system to measure performance and outcomes.
- Trauma registries should be concurrent. At a minimum, 80 percent of cases must be entered within 60 days of discharge.
Chapter 15: Trauma Registry

• Trauma registrars must attend or have previously attended two courses within 12 months of being hired:
  – ATS’s Trauma Registrar course or equivalent
  – AAAM’s injury scaling course
• The trauma program must ensure that appropriate measures are in place to meet the confidentiality requirements
• One FTE dedicated to the registry must be available to process the data capturing the NTDS data set for each 500–750 admitted patients annually
• Strategies for monitoring data validity are essential
CHAPTER 16
Performance Improvement and Patient Safety

This chapter describes the concept of monitoring, evaluating, and improving the performance of a trauma program. There is no precise prescription for trauma performance improvement and patient safety (PIPS). However, the American College of Surgeons Committee on Trauma (ACS-COT) calls for each trauma program to demonstrate a continuous process of monitoring, assessment, and management directed at improving care. These performance improvement activities are concordant with the Institute of Medicine’s six quality aims for patient care: safe, effective, patient centered, timely, efficient, and equitable.
• “Prescriptive”
• Basic structure & processes remains unchanged
• Comprehensive written PIPS plan required
• Integration with institutional PIPS effort
  - clearly defined reporting structure
  - method for provision of feedback
• Integration with regional/ state trauma system
• No “Core/ non-Core” trauma panel
• All trauma surgeons and liaisons must participate (50% attendance)
• Emphasis on clinical practice guidelines, protocols, and algorithms derived from evidenced-based resources
• Defined process and outcome measures (trauma audit filters)
• Levels of review required
• Identify OFI’s → Corrective actions → Continuous monitoring & evaluation → Problem resolution
• Multidisciplinary trauma peer review - variety of formats
• Must use risk stratified benchmarking system
  - Maintenance of certification and pay for performance.
  - Commitment to improving performance through comparative analysis of outcomes across appropriately risk-stratified populations
• Level I trauma center must meet admission volume requirement (one of the following):
  − Admit at least 1,200 trauma patients yearly
  − Admit at least 240 admissions with an ISS > 15

• Geriatric trauma (older than 65 years)
  − # admitted with MOI = fall from standing height
  − # isolated hip fractures included in registry data
  − Special considerations for geriatric patient
  − Anticoagulation reversal
  − Comfort/palliative care

• Orthopaedic surgery
  − # pelvis and acetabular cases/yr
  − # pelvis and acetabular cases transferred out
  − Time to ORIF for femur fractures.
  − Time to I&D open fractures.
  − Appropriateness and timing of intravenous antibiotics for all open fractures.
• Blood bank.
  − Turnaround time for massive transfusion protocol (MTP) use/times.
  − Turnaround time for use of goal-directed component therapy.

• Burn patients (if not a burn center).
  • # burn patients admitted, transferred in, transferred out.

• Vertebral column injuries.
  − # vertebral column injuries admitted, transferred in, transferred out
  − # with neurologic deficits
<table>
<thead>
<tr>
<th>Mortality Rates</th>
<th>Measures</th>
</tr>
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<tbody>
<tr>
<td>Adjusted trauma center mortality rate</td>
<td>Trauma-related deaths (excluding DOA*) (\div) total trauma admissions</td>
</tr>
<tr>
<td>Adjusted trauma service mortality rate</td>
<td>Trauma service mortalities (excluding DOA*) (\div) trauma service admissions</td>
</tr>
<tr>
<td>ED trauma mortality rate</td>
<td>ED trauma-related mortalities (\div) total trauma-related mortalities</td>
</tr>
<tr>
<td>Autopsy rate</td>
<td>Number of autopsies (\div) number of trauma mortalities</td>
</tr>
<tr>
<td>Mortality with opportunities for improvement</td>
<td>Provides a gross measure of individual or system errors that were evident in individual and aggregate cases.</td>
</tr>
<tr>
<td>Mortality without opportunities for improvement</td>
<td>Provides a gross measure of in which no individual or system errors identified in individual or aggregate cases.</td>
</tr>
<tr>
<td>Morbidity/Complications (see NTDS definitions at <a href="http://www.facs.org/quality-programs/trauma/vrc/resources">www.facs.org/quality-programs/trauma/vrc/resources</a>)</td>
<td>Measures</td>
</tr>
<tr>
<td>Trauma center complication rate</td>
<td>Number of complications (\div) number of trauma admissions</td>
</tr>
<tr>
<td>Trauma service complication rate</td>
<td>Number of complications (\div) number of trauma service admissions</td>
</tr>
<tr>
<td>Specific complication rate*</td>
<td>Number of specific complications (\div) number of trauma admissions</td>
</tr>
<tr>
<td>LOS</td>
<td>Measures</td>
</tr>
<tr>
<td>Total EMS time</td>
<td>EMS hospital arrival time – dispatch time</td>
</tr>
<tr>
<td>Total EMS scene time</td>
<td>EMS hospital arrival time – scene arrival time</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>Hospital discharge date and time – hospital arrival date and time</td>
</tr>
<tr>
<td>ED LOS</td>
<td>ED disposition or discharge time – ED arrival time</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>Total number of days in any ICU (all episodes)</td>
</tr>
<tr>
<td>Ventilator days</td>
<td>Total number of days on mechanical ventilation</td>
</tr>
</tbody>
</table>

DOA indicates dead on arrival; ED, emergency department; EMS, emergency medical services; ICU, intensive care unit; LOS, length of stay; and NTDS, National Trauma Data Bank.

*Adjusted rates include DOAs using surrogate of "no response to resuscitation" (see the Glossary for definition).
A. Mortality review (CD 16–6). All trauma-related mortalities must be systematically reviewed and those mortalities with opportunities for improvement identified for peer review.

1. Total trauma-related mortality rates. Outcome measures for total, pediatric (younger than 15 years), and geriatric (older than 64 years) trauma encounters should be categorized as follows:
   a. DOA (pronounced dead on arrival with no additional resuscitation efforts initiated in the emergency department).
   b. DIED (died in the emergency department despite resuscitation efforts).
   c. In-hospital (including operating room).
### Table 1: Injury Severity Scale (ISS) Summary Table

<table>
<thead>
<tr>
<th>ISS</th>
<th>Number</th>
<th>Number Admitted to Trauma Service</th>
<th>Number of Mortalities</th>
<th>Percentage Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10–15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**B. Trauma surgeon response to the emergency department** (CD 2–9). Trauma surgeon on-call response for the highest level of activation must be continuously monitored and variances documented and reviewed for reason for delay, opportunities for improvement, and corrective actions. The minimum threshold is within 15 minutes of patient arrival for Level I and II trauma centers and within 30 minutes for Level III and IV trauma centers.
C. Trauma team activation (TTA) criteria (CD 5–13). Criteria for all levels of TTA must be defined and reviewed annually. Minimal acceptable criteria for the highest level of activation include the following in Table 2 (additional institutional criteria may also be included):

Table 2: Minimum Criteria for Full Trauma Team Activation

- Confirmed blood pressure less than 90 mm Hg at any time in adults and age-specific hypotension in children;
- Gunshot wounds to the neck, chest, or abdomen or extremities proximal to the elbow/knee;
- Glasgow Coma Scale score less than 9 with mechanism attributed to trauma;
- Transfer patients from other hospitals receiving blood to maintain vital signs;
- Intubated patients transferred from the scene, - OR -
- Patients who have respiratory compromise or are in need of an emergent airway
  - Includes intubated patients who are transferred from another facility with ongoing respiratory compromise (does not include patients intubated at another facility who are now stable from a respiratory standpoint)
- Emergency physician’s discretion
E. Trauma surgeon response time to other levels of TTA, and for backup call response, should be determined and monitored. Variances should be documented and reviewed for reason for delay, opportunities for improvement, and corrective actions (CD 5–16).

F. Response parameters for consultants addressing time-critical injuries (for example, epidural hematoma, open fractures, and hemodynamically unstable pelvic fractures) must be determined and monitored (CD 5–16). Variances should be documented and reviewed for reason for delay, opportunities for improvement, and corrective actions.
### Figure 2: The Matrix Method for the Calculation of Triage Rates

<table>
<thead>
<tr>
<th></th>
<th>Not Major Trauma</th>
<th>Major Trauma</th>
<th>Total</th>
<th>Overtriage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Level TTA</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A/C x 100</td>
</tr>
<tr>
<td>Midlevel TTA</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>Undertriage =</td>
</tr>
<tr>
<td>No TTA</td>
<td>G</td>
<td>H</td>
<td>I</td>
<td>(E+H) / (F+I) x 100</td>
</tr>
</tbody>
</table>
H. Trauma patient admissions (NTDS definition) to a nonsurgical service is higher than 10 percent (Levels I, II, and III: CD 5–18).

Percentage = \frac{\text{Trauma Patient Admissions to Nonsurgical Service}}{\text{Total Trauma Patient Admissions}} \times 100

Trauma centers admitting more than 10 percent of trauma patients to nonsurgical services must assess the following criteria related to these admissions:

1. Number with a trauma consultation _______
2. Number with other surgical service consultation _______
3. Number with mechanism of injury (MOI) = same-height falls _______
4. Number with MOI = drowning, poisoning, or hanging _______
5. Number with ISS 9 or lower (and who do not meet the criteria in 3 and 4) _______

All remaining trauma patients admitted to a nonsurgical service should be subjected to individual case review to determine the rationale for admission to a nonsurgical service, adverse outcomes, and opportunities for improvement.
I. Pediatric (14 years or younger) trauma care.
   1. Trauma centers admitting at least 100 pediatric trauma patients annually require a pediatric-specific trauma PIPS program (CD 10–6).
   2. Trauma centers admitting fewer than 100 pediatric trauma patients annually must review each case for timeliness and appropriateness of care (CD 10–6).

3. Additional pediatric trauma care–related core measures (select one or more):
   - Management of solid organ injury.
   - Outcomes in head injury.
   - Resuscitation approach in children (fluids).
   - Deep vein thrombosis prophylaxis.
   - Child maltreatment assessment.
   - Use of invasive monitoring.
   - Radiation exposure.
   - Pain management.
   - Involvement of pediatricians/pediatric specialists.
J. **Acute transfers out** (CD 9–14). All trauma patients who are diverted (CD 3–4) or transferred (CD 4–3) during the acute phase of hospitalization to another trauma center, acute care hospital, or specialty hospital (for example, a burn center, replantation center, or pediatric trauma center) or patients requiring cardiopulmonary bypass or when specialty personnel are unavailable must be subjected to individual case review to determine the rationale for transfer, appropriateness of care, and opportunities for improvement. Follow-up from the center to which the patient was transferred should be obtained as part of the case review.

K. **Emergency physicians covering in-house emergencies at Level III trauma centers** (CD 7–3). Any instance in which the emergency department is left uncovered must be reviewed for timeliness of response and appropriateness of care for trauma patients in the emergency department at that time.

L. **Trauma center diversion-bypass hours** must be routinely monitored, documented, and reported, including the reason for initiating the diversion policy (CD 3–6), and must not exceed 5 percent.

\[
\text{Percentage} = \frac{\text{Number of Diversion Hours}}{8,670} \times 100
\]

This includes both diversion of patients from the primary catchment area transported by emergency medical services (EMS) and the inability to accept interfacility transfers.
M. Appropriate neurosurgical care at Level III trauma centers (CD 8–9). All cases with neurologic injury must be routinely monitored, and any case not transferred to a higher level of care must be subjected to individual case review for timeliness of response and appropriateness of care.

- All cases requiring backup to be called in or the patient to be diverted or transferred because of unavailability of the neurosurgeon on call must be reviewed.
- Neurotrauma care should be routinely evaluated as to compliance with the Brain Trauma Foundation guidelines (see Chapter 8, Clinical Functions: Neurosurgery).


- Anesthesia service (emergency department, intensive care unit, floor, and postanesthesia care unit) must be available for the care of trauma patients
- Operating room delays involving trauma patients because of lack of anesthesia support services must be identified and reviewed to determine the reason for delay, adverse outcomes, and opportunities for improvement.

O. Delay in operating room availability (CD 11–16, CD 11–18) must be routinely monitored. Any case that is associated with a significant delay or adverse outcome must be reviewed for reasons for delay and opportunities for improvement.
P. Response times of operating room and postanesthesia care unit personnel when responding from outside the trauma center (CD 11-16, CD 11-18, CD 11-25) must be routinely monitored. Any case that exceeds the institutionally agreed upon response time and/or is associated with an adverse outcome must be reviewed for reasons for the delay and opportunities for improvement.

Q. Rate of change in interpretation of radiologic studies (CD 11-32, CD 11-37) should be categorized by RADPEER or similar criteria (describe the process/scoring metric used).

\[
\text{Percentage} = \frac{\text{Imaging Studies With Change in Interpretation}}{\text{All Imaging Studies}} \times 100
\]

The rate of change in interpretation of radiologic studies must be routinely monitored and reviewed with the radiology department. Identified cases should be reviewed to determine the reason for misinterpretation, adverse outcomes, and opportunities for improvement.

R. Response times of computed tomography technologist (30 minutes)/magnetic resonance imaging technologist (60 minutes)/interventional radiology team (30 minutes) when responding from outside the trauma center (CD 11-29, CD 11-30, CD 11-31, CD 11-32, CD 11-33, CD 11-34, CD 11-35, CD 11-36, CD 11-37, CD 11-46). These times must be routinely monitored, and any case that exceeds the institutionally agreed upon response time or is associated with a significant delay or an adverse outcome must be reviewed for reasons for delay and opportunities for improvement.
S. Transfers to a higher level of care within the institution (CD 16–8). These transfers must be routinely monitored, and cases identified must be reviewed to determine the rationale for transfer, adverse outcomes, and opportunities for improvement.

T. Solid organ donation rate (CD 16–9). This rate must be routinely monitored and reviewed annually. All trauma patients determined brain dead according to the institution's policy should be referred to the local/regional organ procurement agency.

\[
\text{Percentage} = \frac{\text{Organ Donors}}{\text{Referrals}} \times 100
\]
“The methods, language, and concepts of PIPS are evolving. Trauma program staff who are interested in developing and further refining their trauma performance improvement processes should attend the Trauma Outcomes and Performance Improvement Course (TOPIC) offered by the Society of Trauma Nurses (see www.traumanurses.org).”
Transforming Trauma Center PIPS: From QA to a “Culture of Safety”

• “What’s Next?”
  – Shift the emphasis on “error” and “preventability” to “outcomes”, “system re-design” and “behavioral change”
  – Adopt uniform patient safety taxonomy
  – Apply CRM and AHRQ’s TeamSTEPPS® measures
  – Implement “Just Culture” methodology for peer review
  – Aspire to be a High Reliability Organizations
Summary

- Foundational Principles
  - Codman
  - Deming
  - Donebidian
  - Reasons
  - “Resources Document” – Shackford/ Tepas/ Rhodes/ Metzger/ Cryer

- Trauma “PIPS” premise
  - “Optimal” Structure + Processes = “Optimal” Outcomes

- The “Orange Book”
  - Prescriptive Structure & Processes
  - Well-defined audit filters
  - Risk-adjusted Outcomes (TQIP)