Utilizing the TQIP infrastructure to measure outcomes and implementation

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Medical Director, Trauma Quality Programs, ACS
Objectives

• Scope of Trauma Quality Programs
  • Centers
  • Patients
• TQIP data infrastructure
  • Data description
  • Data flow
  • Data quality
• Modifications of data flow to accommodate research studies
TQIP – Trauma Quality Improvement Program

• Risk-adjusted benchmarking program designed to compare processes of care and outcomes across trauma centers

• Established in 2010

• Over 820 participating trauma centers
  • USA
  • Canada
  • Korea
  • Qatar
American College of Surgeons Trauma Quality Improvement Program

ACS TQIP BENCHMARK REPORT:

OR Ranges:
- Low = 0.35-0.80
- Average = 0.64-1.45
- High = 1.28-2.10

Cohort = All Patients
## Quality Program Participation

<table>
<thead>
<tr>
<th>Type of Center</th>
<th>ACS Verified centers</th>
<th>TQIP Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Level I &amp; II</td>
<td>314</td>
<td>508</td>
</tr>
<tr>
<td>Total Pediatric</td>
<td>110</td>
<td>146</td>
</tr>
<tr>
<td>Adult Level III Centers</td>
<td>108</td>
<td>174</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>532</strong></td>
<td><strong>828</strong></td>
</tr>
</tbody>
</table>
Patients – Adult programs only

<table>
<thead>
<tr>
<th></th>
<th>Count/annum</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>296,184</td>
<td></td>
</tr>
<tr>
<td>Blunt multisystem</td>
<td>43,325</td>
<td>15</td>
</tr>
<tr>
<td>Penetrating</td>
<td>14,466</td>
<td>4.9</td>
</tr>
<tr>
<td>Shock (SBP&lt;90)</td>
<td>12,490</td>
<td>4.2</td>
</tr>
<tr>
<td>Hemorrhagic shock (SBP&lt;90+transfusion within 4 hrs)</td>
<td>7,251</td>
<td>2.4</td>
</tr>
<tr>
<td>Severe TBI (isolated)</td>
<td>12,716</td>
<td>4.3</td>
</tr>
<tr>
<td>Elderly</td>
<td>107,311</td>
<td>36</td>
</tr>
<tr>
<td>Elderly blunt multisystem</td>
<td>10,752</td>
<td>3.6</td>
</tr>
</tbody>
</table>
National Trauma Data Standard

- Consistency across centers
- Specifies
  - inclusion criteria
  - data definitions
  - source hierarchy
  - format to assure interoperability
- Auto calculated fields
- Levels of validation
NTDS fields

- Demographics
- Pre-Existing Conditions
  - Hypertension, anticoagulants, diabetes, etc
- Injury mechanism
- Pre-Hospital Information
  - Mode of transport
  - Scene Vitals, EMS Dates/Times, etc.
  - Poorly populated – NEMSIS integration pending
- ED Information
  - SBP, Pulse, GCS, etc
NTDS fields

• Hospital Procedure Information
  • ICD-10 PCS; Date/Time

• TQIP Measures - Level I & II TQIP centers
  • Time/date, mode of hemorrhage control
  • Cerebral Monitor; Date/Time
  • VTE prophylaxis
  • Blood products in first 4 hours (for those presenting in shock)
  • Ortho trauma measures (time to OR, soft tissue coverage, AbRx prophylaxis)

• Injury and other diagnoses
  • ICD-10-CM
  • AIS codes
NTDS fields

- Hospital Events
  - VAP, DVT, PE, AKI, SSI, return to ICU/OR, etc.
- Withdrawal of life sustaining interventions (date/time)
- Outcome Information
  - ED and hospital discharge disposition
## Venous Thromboembolism - events

### Deep Vein Thrombosis (DVT)

**Definition**
The formation, development, or existence of a blood clot or thrombus within the venous system, which may be coupled with inflammation.

**Element Values**
1. Yes
2. No

**Additional Information**
- Must have occurred during the patient’s initial stay at your hospital.
- The patient must be treated with anticoagulation therapy and/or placement of a vena cava filter or clipping of the vena cava.
- A diagnosis of Deep Vein Thrombosis (DVT) must be documented in the patient’s medical record, which may be confirmed by venogram, ultrasound, or CT.

**Data Source Hierarchy Guide**
1. History & Physical
2. Physician’s Notes
3. Progress Notes
4. Case Management/Social Services
5. Nursing Notes/Flow Sheet
6. Triage/Trauma Flow Sheet
7. Discharge Summary

### Pulmonary Embolism (PE)

**Definition**
A lodging of a blood clot in a pulmonary artery with subsequent obstruction of blood supply to the lung parenchyma. The blood clots usually originate from the deep leg veins or the pelvic venous system.

**Element Values**
1. Yes
2. No

**Additional Information**
- Must have occurred during the patient’s initial stay at your hospital.
- Consider the condition present if the patient has a V-Q scan interpreted as high probability of pulmonary embolism or a positive pulmonary arteriogram or positive CT angiogram and/or a diagnosis of PE is documented in the patient’s medical record.
- Exclude subsegmental PEs.

**Data Source Hierarchy Guide**
1. History & Physical
2. Physician’s Notes
3. Progress Notes
4. Case Management/Social Services
5. Nursing Notes/Flow Sheet
6. Triage/Trauma Flow Sheet
7. Discharge Summary
## Rate of pulmonary embolism

<table>
<thead>
<tr>
<th>Cohort</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>0.6</td>
</tr>
<tr>
<td>Blunt multisystem</td>
<td>1.7</td>
</tr>
<tr>
<td>Shock</td>
<td>2.0</td>
</tr>
<tr>
<td>Severe TBI</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Venous Thromboembolism - prophylaxis

VENOUS THROMBOEMBOLISM PROPHYLAXIS TYPE

**REPORTING CRITERION:** Report on all patients

**DEFINITION**
Type of first dose of venous thromboembolism prophylaxis administered to patient at your hospital.

**ELEMENT VALUES**
1. None
2. Xa Inhibitor (Rivaroxaban, etc.)
3. LMWH (Dabigatran, Enoxaparin, etc.)
4. Other
5. Direct Thrombin Inhibitor (Dabigatran, etc.)
6. Unfractionated Heparin (UH)

**ADDITIONAL INFORMATION**
- *Element Value “5. None” is reported if the first dose of venous thromboembolism prophylaxis is administered post discharge order date/time.*
- *Venous Thromboembolism Prophylaxis Types which were retired greater than 2 years before the current NTDS version are no longer listed under Element Values above, which is why there are numbering gaps. Refer to the NTDS Change Log for a full list of retired Venous Thromboembolism Prophylaxis Types.*
- *Exclude sequential compression devices*
- *Element Value “10. Other” is reported if “Coumadin” and/or “aspirin” are given as venous thromboembolism prophylaxis.

**DATA SOURCE HIERARCHY GUIDE**
1. Medication Summary
2. Nursing Notes/Flow Sheet
3. Pharmacy Record

VENOUS THROMBOEMBOLISM PROPHYLAXIS DATE

**REPORTING CRITERION:** Report on all patients

**DEFINITION**
Date of administration of first dose of venous thromboembolism prophylaxis administered to patient at your hospital.

**ELEMENT VALUES**
- Relevant value for data element

**ADDITIONAL INFORMATION**
- Reported as YYYY-MM-DD.
- Refers to date upon which patient first received the prophylactic agent indicated in *Venous Thromboembolism Prophylaxis Type.*
- The null value “Not Applicable” is reported if *Venous Thromboembolism Prophylaxis Type* is *Element Value “5. None.”*
### IX. Processes of Care: Venous Thromboembolism Prophylaxis

#### Table 24: Pharmacologic VTE Prophylaxis by Cohort

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Group</th>
<th>Patients¹</th>
<th>VTE Prophylaxis</th>
<th>Time to VTE Prophylaxis (days)</th>
<th>Unknown Time to VTE Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N (%)</td>
<td>No Prophylaxis (%)</td>
<td>Median (IQR)</td>
<td>N (%)</td>
</tr>
<tr>
<td>All Patients</td>
<td>All Hospitals</td>
<td>351,275</td>
<td>255,270 (72.7)</td>
<td>27.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>1,103</td>
<td>938 (87.4)</td>
<td>12.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Blunt Multisystem</td>
<td>All Hospitals</td>
<td>50,332</td>
<td>42,391 (84.3)</td>
<td>15.7</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>321</td>
<td>283 (92.5)</td>
<td>7.5</td>
<td>4.7</td>
</tr>
<tr>
<td>Penetrating</td>
<td>All Hospitals</td>
<td>17,661</td>
<td>15,280 (86.6)</td>
<td>13.4</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>115</td>
<td>104 (90.4)</td>
<td>9.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Shock</td>
<td>All Hospitals</td>
<td>13,326</td>
<td>11,156 (83.7)</td>
<td>16.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>43</td>
<td>40 (93.0)</td>
<td>7.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Severe TBI</td>
<td>All Hospitals</td>
<td>20,468</td>
<td>14,395 (70.4)</td>
<td>29.6</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>100</td>
<td>57 (68.7)</td>
<td>31.3</td>
<td>17.0</td>
</tr>
<tr>
<td>Elderly</td>
<td>All Hospitals</td>
<td>128,787</td>
<td>88,491 (68.7)</td>
<td>31.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>313</td>
<td>252 (81.3)</td>
<td>18.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Elderly Blunt Multisystem</td>
<td>All Hospitals</td>
<td>12,734</td>
<td>10,176 (80.0)</td>
<td>20.0</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>88</td>
<td>77 (88.5)</td>
<td>11.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Isolated Hip Fracture</td>
<td>All Hospitals</td>
<td>50,539</td>
<td>44,184 (87.4)</td>
<td>12.6</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>2</td>
<td>2 (100.0)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

¹ Excluding mortalities (1) in the ED, (2) within the first 48 hours of arrival, and/or (3) with unknown time to mortality
Table 25: Pharmacologic VTE Prophylaxis Type by Cohort

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Group</th>
<th>VTE Prophylaxis</th>
<th>Unfractionated Heparin</th>
<th>Low Molecular Weight Heparin</th>
<th>Direct Thrombin or Xa Inhibitor</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>All Patients</td>
<td>All Hospitals</td>
<td>255,270</td>
<td>48,895 (19.2)</td>
<td>195,664 (76.6)</td>
<td>4,486 (1.8)</td>
<td>6,225 (2.4)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>938</td>
<td>13 (1.4)</td>
<td>921 (98.2)</td>
<td>2 (0.2)</td>
<td>2 (0.2)</td>
</tr>
<tr>
<td>Blunt Multisystem</td>
<td>All Hospitals</td>
<td>42,391</td>
<td>8,970 (21.2)</td>
<td>32,469 (76.6)</td>
<td>319 (0.8)</td>
<td>633 (1.5)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>283</td>
<td>3 (1.1)</td>
<td>279 (98.6)</td>
<td>1 (0.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Penetrating</td>
<td>All Hospitals</td>
<td>15,280</td>
<td>1,845 (12.1)</td>
<td>13,282 (86.9)</td>
<td>39 (0.3)</td>
<td>114 (0.7)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>104</td>
<td>1 (1.0)</td>
<td>103 (99.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Shock</td>
<td>All Hospitals</td>
<td>11,156</td>
<td>2,499 (22.4)</td>
<td>8,359 (74.9)</td>
<td>97 (0.9)</td>
<td>201 (1.8)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>40</td>
<td>1 (2.5)</td>
<td>39 (97.5)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Severe TBI</td>
<td>All Hospitals</td>
<td>14,395</td>
<td>4,948 (34.4)</td>
<td>9,171 (63.7)</td>
<td>99 (0.7)</td>
<td>177 (1.2)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>57</td>
<td>1 (1.8)</td>
<td>54 (94.7)</td>
<td>0 (0.0)</td>
<td>2 (3.5)</td>
</tr>
<tr>
<td>Elderly</td>
<td>All Hospitals</td>
<td>88,491</td>
<td>24,472 (27.7)</td>
<td>57,979 (65.5)</td>
<td>2,867 (3.2)</td>
<td>3,173 (3.6)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>252</td>
<td>5 (2.0)</td>
<td>245 (97.2)</td>
<td>2 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Elderly Blunt Multisystem</td>
<td>All Hospitals</td>
<td>10,176</td>
<td>3,017 (29.6)</td>
<td>6,775 (66.6)</td>
<td>149 (1.5)</td>
<td>235 (2.3)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>77</td>
<td>1 (1.3)</td>
<td>75 (97.4)</td>
<td>1 (1.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Isolated Hip Fracture</td>
<td>All Hospitals</td>
<td>44,184</td>
<td>7,362 (16.7)</td>
<td>29,840 (67.5)</td>
<td>3,191 (7.2)</td>
<td>3,791 (8.6)</td>
</tr>
<tr>
<td></td>
<td>Your Hospital</td>
<td>2</td>
<td>0 (0.0)</td>
<td>2 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

1 Excluding mortalities (1) in the ED, (2) within the first 48 hours of arrival, and/or (3) with unknown time to mortality
What’s not in NTDS

- Date/time of hospital complication
- CPT codes
- Costs of care
- Data beyond hospital discharge
  - Late mortality, PROMs
- Additional elements captured in local registries
Inclusion criteria: TQIP vs NTDB

• Inclusion criteria
  • Admitted to, transferred to, died
  • Trauma diagnosis (ICD-10)
TQIP Program Components

- Risk adjusted inter hospital comparisons
- Education/training of registrars
- Enhanced data quality
- Sharing best practices
Data Flow

Hospital trauma registry (ESO, Imagetrend) → Batch Submission → ACS Data Center → Usable data
Implications of Data Flow

• Field mapping might be required to align registry with NTDS
  • If mapping is not optimal, data quality becomes a problem
• Addition of incremental data fields for research requires an additional step
  • Modification of data fields for the entire program ~2 year time horizon
COT Research Initiatives Platform

• Web-based, direct-data-entry platform that is integrated within the TQP Data Center
  • Leverages the ACS data collection infrastructure, including the collection and storage of study data
  • No changes to TQP data submission process and no additional burden of work from registry products (e.g., mapping)
  • 800+ trauma facilities available for recruitment in the study
• Allows collection of new data fields (beyond the NTDS Data Dictionary) that are specific to the research study
• Allows for the collection of new data elements more quickly than adding them to the NTDS Data Collection process
Data flow: Implications for incremental data collection

Hospital registry (trauma registrar) → ACS Data Center → Merged incremental and TQIP datasets

IQVIA web-based platform → Incremental data set → TQIP dataset

Research dataset
COT Research Initiatives Platform

• Platform is customizable to fit the data needs of a specific study
  • New data elements and fields values are gathered using a form-based data collection with real-time data validation
  • Support for many data element types (free text, conditional, multi-select, etc.)
  • Data are aggregated across all participating centers; the data are cleaned and then returned to the investigator for analyses

• Asynchronous
  • Data are entered into the research platform in real time
  • Temporal differences in data submission (real-time vs. quarterly) results in this linkage occurring 1-2 quarters post-discharge
Why?

• Advantages to using an existing data platform
  • Labor costs for data entry are significant
    • ~90% of the costs are covered through existing data collection via your registry
  • No need to think through how to standardize data collection across centers
    • Data definitions
    • Data hierarchy
    • Data quality
Identification of high yield centers for studies

- Queries based on study criteria
- Aggregated patient and facility level data
- If a center is interested in participating, center contact information passed on to investigators
  - Research contacts
Leveraging the Platform for Your Study

• Contact us at traumaquality@facs.org with your research study proposal
• ACS staff will:
  • Determine costs based on scope and statement of work
  • Work with your research team on element design and validation, data dictionary
  • Outline the next steps regarding facility recruitment and enrollment in the study
  • Determine study timelines including data collection, linkage, and delivery of the aggregate dataset
• Incorporate data collection plan in your grant/budget
Summary

• With limited incremental costs, data infrastructure exists to perform clinical trials with high impact

• Good data exists to estimate sample sizes & distribution of cases across centers
Questions?

Contact Avery Nathens:
anathens@facs.org