Gunshot injuries treated at hospitals without trauma units

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Hypothesis

1. Gunshot injury occurs
2. Emergency medical services triages patient
3. Personal vehicle transports patient
Hypothesis

1. Non-trauma centers are treating gunshot wounds

2. Non-trauma centers will transfer patients who meet trauma center criteria

3. Gunshot wounds treated at the non-trauma center will have worse outcomes
Background

• Trauma centers
  – Decrease mortality (MacKenzie et al., 2006)
  – Better because of staff experience (Nathens et al., 2001; Haas et al., 2009)
  – Transfers = direct admissions (Rivara et al., 2008; Hill et al. 2011)

• Firearm-related injury research is conducted using Trauma Registry data

• Pre-hospital transport
  – Police transport for penetrating trauma: similar outcomes (Branas et al., 1995; Band et al., 2011)
  – Self transport for trauma: similar outcomes (Cornwell et al., 2000)
  – Self transport for gunshot wounds: 12.6%, decreased mortality (Zafar et al., 2014)

• Non-trauma centers seeing trauma
  – Up to 1/3 of all trauma patients (ISS>15) (Nathens et al., 2004)
  – Under-triage by EMS – 14% of the time for “injury” criteria (Ma et al. 1999), because the trauma center is too far away (Doumouras et al., 2002)
Background
Methods

• Retrospective analysis (2009-2013)
• Illinois Inpatient and Outpatient Hospital Databases
• ALL firearm-related injuries (accidents, suicides, assault, legal intervention, undetermined)
• Split into groups based on site of initial treatment: non-trauma center vs. trauma center
• Linked Dataset
• SAS Enterprise 5.1
  – Table analysis on categorical variables
  – Summary statistics on continuous variables
  – Multivariable Model: ‘Meeting Anatomic Triage Criteria’ to predict in-hospital mortality
• MapUSA GIS software to map by residential zip codes
Results

males : females

<15yo : 15-24yo : 25-34yo : >35yo

black : hispanic : white : other
<table>
<thead>
<tr>
<th>Location</th>
<th>Non-Trauma Center</th>
<th>Trauma Center</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=2842)</td>
<td>(n=7044)</td>
</tr>
<tr>
<td>Head/Neck</td>
<td>414 (14.6%)</td>
<td>1242 (17.6%)</td>
</tr>
<tr>
<td>Back/Spine</td>
<td>57 (2.0%)</td>
<td>480 (6.8%)</td>
</tr>
<tr>
<td>Torso</td>
<td>657 (23.1%)</td>
<td>3354 (47.6%)</td>
</tr>
<tr>
<td>Upper Ext.</td>
<td>801 (28.2%)</td>
<td>1974 (28.0%)</td>
</tr>
<tr>
<td>Lower Ext.</td>
<td>1236 (43.5%)</td>
<td>2994 (42.5%)</td>
</tr>
<tr>
<td>Meet Anatomic Triage Criteria</td>
<td>884 (31.1%)</td>
<td>4055 (57.5%)</td>
</tr>
<tr>
<td>NISS ≥ 16</td>
<td>59 (2.4%)</td>
<td>1551 (22.0%)</td>
</tr>
<tr>
<td>Deaths</td>
<td>91 (3.2%)</td>
<td>701 (10.0%)</td>
</tr>
</tbody>
</table>

*Note: NISS = New Injury Scale Score*
### Results

<table>
<thead>
<tr>
<th></th>
<th>Home</th>
<th>Long-term care</th>
<th>AMA</th>
<th>Hospital</th>
<th>Another institution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-trauma</strong></td>
<td>1984 (69.8%)</td>
<td>35 (1.2%)</td>
<td>55 (1.9%)</td>
<td>519 (18.3%)</td>
<td>88 (3.1%)</td>
</tr>
<tr>
<td>(n=2842)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Trauma</strong></td>
<td>5784 (82.1%)</td>
<td>260 (3.7%)</td>
<td>126 (1.8%)</td>
<td>102 (1.2%)</td>
<td>48 (0.7%)</td>
</tr>
<tr>
<td>(n=7044)</td>
<td></td>
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</tr>
</tbody>
</table>

Of the 519 transfers, could only track 218 to a second hospital in the trauma region (192 to a trauma center)

884 meet triage criteria: 66 died (15 after a day)

1958 did not meet criteria: 15 died (3 after a day)

92 transferred: 7 died

100 transferred: 3 died
Results

Meet triage criteria: # treated at a non-trauma center

Meet triage criteria: proportion treated at a non-trauma center
Discussion

• Gunshot wounds are not studied at non-trauma centers, but they are being treated there
  – 27.8% of all shooting victims
• Most gunshot wounds treated there were minor, but almost a third (31.1%) met triage criteria
  – self transport vs. EMS under triage
• Meeting triage criteria does not mean you will get transferred
  – being “held onto” or “blocked” or neither
• 81 people died from gunshot wounds at the non-trauma center
  – 18 after a day long stay
  – low NISS
Limitations

- Retrospective analysis on billing data (not surveillance data)
- Generalizability
- Outcomes difficult to compare because non-trauma center patients had lower severity
Final Summary

1. Self-transport issue
   – Geography points to a structural issue
   – *Consider* designating a new trauma center

2. Some patients need higher level care
   – Streamline inter-hospital coordination

3. Not just gunshot wounds
   – Need for surveillance of non-trauma centers
Questions?