Association of Social Vulnerability Index with Risk-Adjusted Trauma Outcomes

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Disclosures

• This work was accepted for publication in the Journal of Trauma and Acute Care Surgery on December 13th, 2021

• A version of this talk was given at AAST (American Association for the Surgery of Trauma) on September 7th, 2021
Little is known regarding the mechanisms that drive disparities in trauma outcomes.

Social & Economic Traits
- Insurance status
- Race
- Ethnicity
- Income
- State/Region
- Hospital system

Inequitable Outcomes
- Inpatient mortality
- Inpatient morbidity
- End of life care
- Access to rehab
- Return to work


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Social Determinants of Health as a potential driver of disparities in outcomes

• Social determinants of Health (SDOH) are the **conditions in the places where people live, learn, work, and play**

• **Difficult to measure** and thus little understanding of their impact on Trauma Outcomes

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The Social Vulnerability Index provides a lens into community resilience and SDOH

- Developed and validated by the **CDC** to guide disaster response
- Census tract level → ZIP codes
- Indexed between 0 and 100
  - 0-20 = least vulnerable
  - 20-40
  - 40-60
  - 60-80
  - 80-100 = most vulnerable
Novel application of SVI to Michigan’s state-wide trauma collaborative (MTQIP)

**CHALLENGE**
- Census tract or ZIP code data not available in national trauma registries
- Commercial/federal claims databases may have them, but lack clinical detail

**SOLUTION**
- The Michigan Trauma Quality Improvement Program’s (MTQIP) statewide trauma registry has geographic identifiers, claims-level data, and NTDS clinical detail
Retrospective, observational study to evaluate association between SVI and inpatient outcomes

**STUDY COHORT**
- Ages 18+
- Admitted 2017-20
- Level 1 or 2 center

**PRIMARY PREDICTOR**
- SVI Quintile
  - 0-20 = least vulnerable
  - 80-100 = most vulnerable

**PRIMARY OUTCOME**
- Inpatient mortality
  - Death or hospice

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Three levels of “risk adjustment”

UNADJ. MODEL
• Unadjusted outcomes
• Observed differences
• “The lived experience”

CLAIMS MODEL
• Risk adjustment possible using “Claims data”
• Often used for policy analysis
• SVI quintile
• Age
• Sex
• Race/ethnicity,
• Insurance type
• ISS from ICDPIC
• Mechanism from ICDPIC
• Hospital bed size
• Hospital teaching status

ROBUST CLINICAL MODEL
• Risk adjustment possible using NTDS trauma registry data
• State of the science re: clinical detail
• SVI quintile
• Age
• Sex
• Race/ethnicity,
• Insurance type
• Prior Medications
• Comorbidities
• Six region AIS
• ISS
• Mechanism
• Intent
• Shock index
• GCS-motor
• Blood transfusion
• Pre-hospital CPR
• Mechan ventilation

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# Demographics of study population

<table>
<thead>
<tr>
<th></th>
<th>Entire Study Cohort</th>
<th>Extremes of SVI Quintiles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample (n)</strong></td>
<td>83,607</td>
<td>10,379</td>
</tr>
<tr>
<td><strong>Age (mean, sd)</strong></td>
<td>63 (±21)</td>
<td>70 (±20)</td>
</tr>
<tr>
<td><strong>Male (%)</strong></td>
<td>53</td>
<td>45</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White (%)</td>
<td>83</td>
<td>94</td>
</tr>
<tr>
<td>Non-Hispanic Black (%)</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Hispanic (%)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Non-Hispanic, Other (%)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Insurance Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private (%)</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>Medicare (%)</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Medicaid (%)</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Uninsured (%)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Other (%)</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>
Unadjusted outcomes show “dose-dependent” association between SVI and inpatient mortality

**Unadjusted**

<table>
<thead>
<tr>
<th>Vulnerability</th>
<th>Odds Ratio for Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Vulnerable</td>
<td>1.18x</td>
</tr>
<tr>
<td>2nd</td>
<td>1.26x</td>
</tr>
<tr>
<td>3rd</td>
<td>1.53x</td>
</tr>
<tr>
<td>4th</td>
<td>1.72x</td>
</tr>
<tr>
<td>Most Vulnerable</td>
<td>*</td>
</tr>
</tbody>
</table>

* @PoojaNeiman @DrJohnScott
Key Finding #1

Patients from more vulnerable communities have higher inpatient mortality after trauma admission... in a dose-dependent manner
**Dampened** association between SVI and mortality after “Claims-based” risk adjustment

![Bar chart with odds ratios for mortality across different vulnerability levels.](image)

- **Unadjusted**
- **Claims-based model**
- **MTQIP model**

Odds Ratio for Mortality

- Least Vulnerable
- 2nd
- 3rd
- 4th
- Most Vulnerable

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No risk-adjusted difference in mortality using the robust clinical model
Key Finding #2

Compared to lower SVI, patients from more vulnerable communities have similar risk-adjusted inpatient mortality.
SVI is a dose-dependent risk factor for trauma mortality

Risk-adjusted outcomes do not differ by SVI quintile
How do we improve outcomes for high SVI patients when risk-adjusted outcomes are the same?

SVI is a dose-dependent risk factor for trauma mortality

Risk-adjusted outcomes do not differ by SVI quintile

How to improve this?

In light of this?

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Injury severity and lethality has a similar dose-dependent association with SVI.
Key Implication

Increased mortality among high SVI patients appears to be driven by more lethal injuries, as opposed to worse inpatient care.
Improving disparities in outcomes will require investment in communities and injury prevention.

**ISAVE**: Improving Social Determinants to Attenuate Violence

**MSHIELD**: Michigan Social Health Interventions to Eliminate Disparities

**UNITE**: Understanding the Links between social determinants and firearm violence in California communities

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Eliminating SDOH-linked disparities requires both excellent inpatient care **AND** investing in communities.

SVI associated with “dose-dependent” risk of inpatient mortality

Equivalent “risk-adjusted” outcomes suggests high-quality inpatient care

Must invest “upstream” to reduce community risk of lethal injuries

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