The Injurious Burden of Poverty: Analysis of Socio-Economic Disparities in Injury Rates

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Objectives

• Objective 1: Evaluate the spatial distribution of injuries
• Objective 2: Determine the impact of poverty and race/ethnicity on injury rates

Hypotheses

• Injuries concentrate in specific neighborhoods
• Significant injury rate disparities exist among:
  – neighborhoods with concentrated poverty
  – racial/ethnic groups

Background

Poverty affects:
  – Preterm birth rates
  – Infectious diseases
  – Cancer mortality
  – Overall mortality

Methods: Design

A retrospective, population-based cohort study of 748,280 injuries in Massachusetts

Population

All individuals in Massachusetts
Total population: 6,349,097

Methods: Data (1)

Injury Data:
  – Fiscal year 2004
  – Emergency department, observation, and inpatient datasets
  – Comprehensive and non-redundant
  – ICD-9 codes identify injuries,
    E-codes identify injury mechanism
Methods: Data (2)
Zip Code operationalized as the unit of measure for a neighborhood
U.S. Census 2000 population and poverty data at the Zip Code Tabulation Area (ZCTA) level
Patient’s home zip code matched to ZCTA (98.2% match rate)

ZCTAs vs. Zip Codes
- ZCTAs are hierarchically composed of census ‘blocks’
- Massachusetts has 693 zip codes, but only 503 ZCTAs
- Within the DPH dataset, 11,504 / 749,434 injuries (1.5%), are discarded when converting zip codes → ZCTAs

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Total Charges for Injuries in Massachusetts by Zip Code Tabulation Area
Bottom 253 ZCTAs: $211,744,470 (12.5%)
Top 50 ZCTAs: $611,109,411 (36.1%)

Total Number of Injuries in Massachusetts by Zip Code Tabulation Area
Bottom 253 ZCTAs: 101,795 (13.6%)
Top 50 ZCTAs: 263,301 (35.2%)
What type of injuries?
Injury Mechanisms

- Struck by / Against
- Fall
- Cut / Pierce
- Motor Vehicle
- Pedal Cyclist
- Poisoning
- Fire / Burn
- Pedestrian
- Firearm
- Machinery
- Drowning

Number of Injuries vs. Charges

Who is being injured?
Variations in injury patterns by age, gender, and race

Total Injuries: $1,693,038,065

Common Injuries Incident Rate
Eric Fleegler, MD, MPH

**Less Common Injuries Incident Rate**

**Total Injuries Incident Rate by Gender**

**Injury Incident Rate by Race**

**Objectives**

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**Methods: Analysis**

Area-based measure of socioeconomic inequality: Poverty rate

ZCTA poverty rate calculation:

\[
\text{Population below the federal poverty line} \over \text{Total population of ZCTA}
\]

Federal poverty line for a family of four: $17,603

**Methods: Analysis**

Poverty levels:

- (1) 0.0 - 4.9% (Least impoverished)
- (2) 5.0 - 9.9%
- (3) 10.0 - 19.9%
- (4) 20.0 - 100% (Most impoverished)

Areas with poverty rate ≥20% are federally defined “poverty areas”

Methods: Outcome Measures
Incident Rate
  Overall and by poverty level
Incident Rate Ratio
  Compared to least impoverished
Relative Risk
  Compared to White, Non-Hispanic
Population Attributable Fraction
  Injuries that would not have occurred if the risk of injury for all groups equaled that of least impoverished regions

Distribution of Population, by Race/Ethnicity and ZCTA Poverty Level: Massachusetts, 2000

Results: Number of Injuries

<table>
<thead>
<tr>
<th>Population (% Total)</th>
<th>Injuries (% Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>6,349,097 (100)</td>
</tr>
<tr>
<td>White</td>
<td>5,197,124 (82)</td>
</tr>
<tr>
<td>Black</td>
<td>337,157 (5)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>427,340 (7)</td>
</tr>
<tr>
<td>Asian</td>
<td>238,246 (4)</td>
</tr>
</tbody>
</table>

Overall Incident Rate by Poverty Level

Incident Rate / 1,000 by Poverty Level

Children's Hospital Boston
### Results: Incidence Rate Ratio

<table>
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<th>Poverty Level</th>
<th>Incidence Rate Ratio</th>
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<tr>
<td>0-4.9%</td>
<td>101.2</td>
</tr>
<tr>
<td>20-100%</td>
<td>139.6</td>
</tr>
</tbody>
</table>

#### Unadjusted
- Total: 1.38
- White: 1.27
- Black: 1.15
- Hispanic: 1.88
- Asian: 1.11

#### Adjusted for Age & Gender
- Total: 1.38
- White: 1.27
- Black: 1.15
- Hispanic: 1.88
- Asian: 1.11

#### Adjusted for Age, Gender & Poverty
- Total: 1.38
- White: 1.27
- Black: 1.15
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### Results: Relative Risks

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<th>Adjusted for Age, Gender &amp; Poverty</th>
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<tr>
<td>Black:White</td>
<td>1.43</td>
<td>1.29</td>
<td>1.15 (1.12, 1.19)</td>
</tr>
<tr>
<td>Hispanic:White</td>
<td>1.26</td>
<td>0.97</td>
<td>0.87 (0.84, 0.90)</td>
</tr>
<tr>
<td>Asian:White</td>
<td>0.35</td>
<td>0.34</td>
<td>0.31 (0.30, 0.33)</td>
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### Population Attributable Fraction

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<th>Excess Injuries</th>
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<tr>
<td>Total</td>
<td>14.5</td>
<td>108,757</td>
</tr>
<tr>
<td>White</td>
<td>12.3</td>
<td>71,907</td>
</tr>
<tr>
<td>Black</td>
<td>13.3</td>
<td>7,612</td>
</tr>
<tr>
<td>Hispanic</td>
<td>37.7</td>
<td>23,343</td>
</tr>
<tr>
<td>Asian</td>
<td>10.9</td>
<td>1,106</td>
</tr>
</tbody>
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### Impact of Socioeconomic Inequalities on Childhood Injury Mechanisms
Strengths & Limitations
- Population based study
  - Injuries presenting to hospitals
  - Accuracy of zip codes
- ZCTA poverty measure
  - Heterogeneous and relatively large
- Distribution of population by poverty concentration
  - High proportion live in least impoverished regions

Summary
- 748,280 injuries in 2004
- Top 10% of zip codes account for 36% of injury charges
- Higher injury rates among most impoverished ZCTAs
- Variation in injury rates among different race/ethnicities
- Overall, 14.5% Population Attributable Fraction and 108,757 excess injuries

Implications
- Socioeconomic inequalities adversely effect all injuries across a spectrum of mechanisms
- Need to address neighborhood-level poverty as a risk factor for injuries
- Need to monitor socioeconomic inequalities to set health objectives and track progress

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Thank you
Eric Fleegler, MD MPH
Peter Forbes, MA
Lois Lee, MD MPH
Karen Olson, PhD
S.V. Subramanian, PhD
David Mooney, MD MPH
Struck by / Against: Number of Injuries and Injury Rate Ratio

Age Groups

Fall: Number of Injuries and Injury Rate Ratio

Age Groups

Massachusetts vs. Health People 2010

Injury Rates and Incidence Rate Ratio

Charges within top 50 ZCTAs

The Payers

- 2004 State Budget: $22.4 Billion
- 2004 DPH Budget: $389,279,648
- 2004 Medical Budget: $6,363,537,495