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Background


• Injury death rates remained steady from 1988-2007

• Factors contributing to the decreased rates of injury hospital discharges are not well understood
What factors influence injury hospital discharges?

1. **Injury**
   - Risk factor for Injury
   - Prevention efforts
   - Injury severity
   - Other?

2. **Medical attention**
   - More severe
   - EMS availability
   - Other?

3. **Non-hospital treatment**
   - More severe

4. **Hospital admission**
   - Injury severity
   - Medical treatment guidelines
   - Other?

5. **Hospital Discharge**
Objectives

- Examine trends in injury hospital discharges for patients aged 25-64 from the past two decades by diagnosis and severity to provide insight into the effects of changes in injury incidence and in health care delivery.
Methods--Data Source

Data source for injury severity

  - HCUP-NIS is an all-payer inpatient care database with data from 5 to 8 million hospital stays from about 1,000 hospitals
  - Data are collected from
    ✓ States participating in HCUP; for 2007, these states comprise 95 percent of the U.S. population
    ✓ The NIS is sampled to approximate a 20-percent stratified sample of U.S. community hospitals.
Methods--Data Source

Data source for trends

- National Hospital Discharge Survey (NHDS): 1988-2007
  - NHDS is a national probability sample survey of inpatient discharge records selected from non-Federal, short-stay hospitals.
  - Data are collected by
    - manual review of medical records (55%), medical abstract form
    - automated system (45%), computerized data files containing machine-readable medical record data
Methods—Injury definition

• Discharges with a *first-listed* diagnosis corresponding to an injury ICD-9-CM code were selected

• Barell Matrix defines:
  – Injury -- (ICD-9CM) 800.00-909.2, 909.4, 909.9-994.9, 995.5, 995.80-995.85
  – Body regions
    • TBI
    • Upper and Lower Extremities
Methods—Survival Risk Ratio (SRRs)

Injury severity measured using SRR

- Number of patients with any injury related ICD-9-CM codes were obtained for each code from HCUP-NIS by discharge status (dead or alive)
- SRRs for each ICD-9-CM injury diagnosis code calculated as:
  \[ SRR = \frac{\text{Number discharged (alive)}}{\text{Number discharged (dead+ alive)}} \]
  SRR values range from 0 (no patients survived) to 1 (all patients survived)
Methods—Injury Severity

• Discharge severity score
  – Severity score for each discharge in NHDS is the minimum SRR among all injury related ICD-9-CM codes for the discharge.

<table>
<thead>
<tr>
<th>Example</th>
<th>Diagnosis 1</th>
<th>Diagnosis 2</th>
<th>Diagnosis 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD-9-CM Codes</td>
<td>800.25</td>
<td>806.00</td>
<td>415.19</td>
</tr>
<tr>
<td>SRR</td>
<td>0.236</td>
<td>0.865</td>
<td>Not injury</td>
</tr>
</tbody>
</table>

The minimum SRR=Min(0.236, 0.865)=0.236

• Discharge categorized into 3 levels of severity
  – Least Severe: \[0.99 \leq \text{minimum SRR} \leq 1.0\]
  – Moderately Severe: \[0.95 < \text{minimum SRR} < 0.99\]
  – Most Severe: \[0.0 \leq \text{minimum SRR} \leq 0.95\]
Methods—Analyze trends

- Annual injury discharge rates per 10,000 population calculated for 3 severity levels for NHDS 1988-2007
- Standard errors calculated using SUDAAN
- Estimate and test average annual percent change in discharge rates using Joinpoint regression program
Injury rates -- hospital discharges and deaths: Persons 25-64 years of age, 1988-2007
Injury hospital discharge rates by level of severity
United States, Ages 25-64, 1988-2007

Data source: HCUP / AHRQ Nationwide Inpatient Sample and NCHS / CDC National Hospital Discharge Survey
Average annual percent change in hospital discharge rates
United States, Ages 25-64, 1988-2007

<table>
<thead>
<tr>
<th></th>
<th>Least severe</th>
<th>Moderately Severe</th>
<th>Most Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>All injury</td>
<td>-4.4*</td>
<td>-1.7*</td>
<td>-1.6*</td>
</tr>
<tr>
<td>Traumatic Brain Injury</td>
<td>-6.6*</td>
<td>-1.9*</td>
<td>.9</td>
</tr>
<tr>
<td>Extremity injuries</td>
<td>-4.5*</td>
<td>-1.9*</td>
<td>-1.0</td>
</tr>
</tbody>
</table>

* Average Annual Percentage change is statistically significant from zero.
Injury hospital discharge rates for lower and upper extremity injuries United States, Ages 25-64, 1988-2007

Data source: HCUP / AHRQ Nationwide Inpatient Sample and NCHS / CDC National Hospital Discharge Survey

Data source: HCUP / AHRQ Nationwide Inpatient Sample and NCHS / CDC National Hospital Discharge Survey
Discussion – Severity measure

Overall, trends in injury hospital discharges by empirically derived severity measures provide insight into the decreasing rates.

Limitations of severity measure:

- Severity is measured by probability of death while hospitalized.
  - Deaths occurring outside of the hospital account for at least two thirds of all injury deaths.
  - Using this measure, injuries which are disabling but are unlikely to lead to death are not considered severe.

- SRRs were calculated using the data for 2003-2007. Changes in the probability of survival during the time period might bias the severity rankings.
Discussion - Trends

• Trends in injury hospital rates indicate
  – Least Severe injuries decreased at a faster rate than Moderately Severe and Most Severe from 1988-2007.
  – Much of the decrease from 1988–2000 in injury hospital discharge rates for persons 25–64 years of age is due to a decrease in the rates of least severe injury hospital discharges.

• Fewer minor (least severe) injuries being discharged over time could be explained by the following:
  – Decreases in minor injury incidence due to prevention measures.
  – Changes in the health care delivery for minor injuries.