Influence of Crossing Controls and Crossing Location on Severity of Injury Among Urban Pedestrians

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BACKGROUND

- Downward trend in fatalities and severe injuries from road traffic crashes in Canada, however, pedestrian collisions continue to be significant burden especially in urban areas.

- 2007 Canada
  - 376 pedestrian fatalities, 1,674 severe injuries

- 2004-2005 Canada
  - 2,507 pedestrians hospitalized, accounting for 13% of all hospitalizations due to MVA

- 2004-2006 Canada
  - 75% of pedestrian traffic fatalities occurred on urban roads

3. Quick Look at Fatally Injured Vulnerable Road Users. Transport Canada. Fact Sheet TP 2436E RS-2010-02 June 2010
BACKGROUND

- Crossing controls, effective in reducing pedestrian injury risk
- Location
  - Younger children (<5) more at risk midblock, older children, more at risk at intersection\(^1\)
  - Younger children (ages 0–9) more frequently severely injured on neighborhood roads compared with adults and older children, who are more frequently severely injured on major roads\(^2\)

OBJECTIVE

To determine the relationship between severity of pedestrian injury and presence of crossing controls at intersections and midblock locations in the City of Toronto
METHODS

Data sources:
- City of Toronto’s Traffic Data Centre and Safety Bureau (January 1, 2000 to December 31, 2005) Police-reported motor vehicle vs. pedestrians collisions
- 2001 Census from Statistic Canada

Primary Outcomes
- Injury Severity
  - No injury
  - Minimal injury - no hospital visit
  - Minor injury - treated in ED, not admitted
  - Major injury - required hospital admission
  - Fatal - died within 30 days as result of collision
- Severe injury: major or fatal injury versus other
- Fatal injury: fatal injury alone versus other
Covariates:

- Location
  - Intersection versus midblock
- Traffic control
  - Traffic control: traffic signals, stop and yield signs, pedestrian crossing and police and school guards versus none
- Age
  - Children: under 18 years old
  - Adults: 18 – 64 years old
  - Seniors: 65 years and older

Logistic regression used to assess age-specific relationships between injury severity and location of the collision and presence of a traffic control.
## RESULTS
### Average Yearly Rates (2000 – 2005)

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
<th>Overall Rate/100,000 (95% CI)</th>
<th>Severe Rate/100,000 (95% CI)</th>
<th>Fatal Rate/100,000 (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>453</td>
<td>87.3 (79.3-95.4)</td>
<td>7.7 (5.3-10.1)</td>
<td>0.4 (0.0-0.9)</td>
</tr>
<tr>
<td>Adults</td>
<td>1577</td>
<td>97.0 (92.3-101.8)</td>
<td>9.8 (8.3-11.3)</td>
<td>1.0 (0.5-1.5)</td>
</tr>
<tr>
<td>Senior</td>
<td>298</td>
<td>86.7 (76.8-96.7)</td>
<td>18.9 (14.3-23.6)</td>
<td>5.0 (2.6-7.4)</td>
</tr>
<tr>
<td>Overall</td>
<td>2446</td>
<td>98.6 (94.7-102.5)</td>
<td>11.0 (9.7-12.3)</td>
<td>1.4 (0.9-1.9)</td>
</tr>
</tbody>
</table>
Proportions of Collisions by Severity, Location and Traffic Control

**Intersections**

- **N = 859**
  - Severe: 84.1%
  - None/Minor: 90.4%
  - Fatal: 69.6%
  - None/Minor/Severe: 90%

- **N = 7281**
  - Severe: 8.3%
  - None/Minor: 7.6%
  - Fatal: 6.5%
  - None/Minor/Severe: 7.7%

**Midblock**

- **N = 8025**
  - Severe: 84.1%
  - None/Minor: 90.4%
  - Fatal: 69.6%
  - None/Minor/Severe: 90%

- **N = 4681**
  - Severe: 8.3%
  - None/Minor: 7.6%
  - Fatal: 6.5%
  - None/Minor/Severe: 7.7%

Legend:
- ■ No Traffic Control
- □ Traffic Control
## Odds of Severe and Fatal Injury Logistic Regression

<table>
<thead>
<tr>
<th></th>
<th>Severe Injury</th>
<th>Fatal Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Exp (B)</td>
</tr>
<tr>
<td><strong>Intersection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(with control)</td>
<td>72</td>
<td>Reference</td>
</tr>
<tr>
<td><strong>Midblock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(with control)</td>
<td>52</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>Intersection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(no control)</td>
<td>137</td>
<td>1.78</td>
</tr>
<tr>
<td><strong>Interaction term</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>(Midblock</em></td>
<td>(no control)*</td>
<td>574</td>
</tr>
</tbody>
</table>
DISCUSSION

- Rate of motor vehicle vs. pedestrian collisions: 98.6/100,000
  - Injuries 11.0/100,000 – problems with comparison
    - U.S. 23/100,000
    - Overall Ontario 43.3/100,000 (2001)
  - Fatality 1.4/100,000 in line with:
    - U.S. 2.1/100,000
    - Netherlands 1.9/100,000
    - Ontario 1.0/100,000 (2001)

- Adults (18-64) had highest collision rate
- Seniors (65+) had highest severe and fatal collisions
DISCUSSION Cont’d…

- Burden of fatal injury:
  - Midblock no control- 86
  - Intersection with control - 80
  - Intersection no control- 35
  - Midblock with control- 6

- Severe and fatal generally more likely at any other configuration other than controlled intersections

- More fatalities at locations without traffic controls

- Highest odds of fatalities at intersection with no controls

- Midblock control not as effective as intersection controls
DISCUSSION

- Severity higher at uncontrolled locations, and at midblock crossing

- Contrary to intersection controls, midblock controls don’t appear to work

Future work

- Analysis done by age, focusing on children, seniors
- Look specifically at what is happening at midblock, and types of crossing controls
LIMITATIONS

- Police data underestimates the number of motor vehicle collisions
  - More severe traffic-related incidents requiring hospital care are more likely to be reported to police

- No measure of exposure for evaluating the collision risk for different conditions
CONCLUSION

Crossing controls decrease odds of severe and fatal injuries at intersections, but not at midblock crossing locations where a large proportion of the fatality burden lies.