Investigating a unique motorcycle crash cluster and planning evidence-based interventions

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Robert Frost
The Road Not Taken

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Then took the other, as just as fair,
And having perhaps the better claim
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I —
I took the one less traveled by,
And that has made all the difference.
NC Motorcycle Crashes, 2005-09

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatalities</th>
<th>MC Crashes</th>
<th>Crashes/1000*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>152</td>
<td>3,664</td>
<td>22.8</td>
</tr>
<tr>
<td>2006</td>
<td>150</td>
<td>4,099</td>
<td>23.2</td>
</tr>
<tr>
<td>2007</td>
<td>201</td>
<td>4,390</td>
<td>22.7</td>
</tr>
<tr>
<td>2008</td>
<td>169</td>
<td>4,877</td>
<td>23.1</td>
</tr>
<tr>
<td>2009</td>
<td>155</td>
<td>4,162</td>
<td>20.7</td>
</tr>
</tbody>
</table>

* Rate/registered motorcycle
MC crash rate/reg. MC – top 50 counties

Graham County:
17x the average NC county crash rate!
## Counties with highest MC crash rate 2005-09

<table>
<thead>
<tr>
<th>County</th>
<th>Crashes</th>
<th>Reg. MC</th>
<th>Rate/1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graham</td>
<td>380</td>
<td>1183</td>
<td>321.2</td>
</tr>
<tr>
<td>Swain</td>
<td>189</td>
<td>2568</td>
<td>73.6</td>
</tr>
<tr>
<td>Alleghany</td>
<td>55</td>
<td>1354</td>
<td>40.6</td>
</tr>
<tr>
<td>Macon</td>
<td>183</td>
<td>5112</td>
<td>35.8</td>
</tr>
<tr>
<td>Madison</td>
<td>87</td>
<td>2913</td>
<td>29.9</td>
</tr>
<tr>
<td>Jackson</td>
<td>120</td>
<td>4157</td>
<td>28.9</td>
</tr>
<tr>
<td>Transylvania</td>
<td>119</td>
<td>4159</td>
<td>28.6</td>
</tr>
</tbody>
</table>
Why?

- Dangerous roads
- Risky riders
- Inexperienced (esp. in mountains)
- Motorcycle type
- Dangerous curves/locations
- Exposure
Graham County, NC

- 2010 Pop: 8,861; **236 reg. MC**
- Elevation: 1,177 to 5,560 ft
Graham County, NC
Popular Motorcycling Tourist Destination
Location of Graham County Motorcycle Crashes, 2005-09

- NC 143: 54%
- NC 28: 22%
- US 129: 17%
- Other: 7%

Roadway
Roads of Graham County
Selecting Study Sites (roads)

- Topographic maps, travel guides to identify potential study roads
- Crash locations mapped
- Drove all roads
- Identified 4 case and 4 comparison roads with similar characteristics
Data

- Statewide crash data
- Observations (bike type, state)
- Rider interviews (rider age, exper.)
- Automated traffic & speed measures
<table>
<thead>
<tr>
<th>Case Roads</th>
<th>Crash/mi.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 129s</td>
<td>11.03</td>
</tr>
<tr>
<td>NC 143</td>
<td>7.00</td>
</tr>
<tr>
<td>NC 28g</td>
<td>3.71</td>
</tr>
<tr>
<td>US 129g</td>
<td>2.22</td>
</tr>
</tbody>
</table>

*2005-2009 MC rate/mile of roadway
Rider Interviews (N=152)

- Mean age 47 (range 19-80)
- Years experience: 20 (1 mo. - 56 yrs.)
- 72% had ridden in the NC mountains
- 53% on first trip to mountains this year
Observations
Observation Data

Case & comparison
Same day/time
Variables:
- MC type
- License state
- Helmet use
- # of riders on bike

Sept., 2011
Observational Data

- 1,098 motorcyclists (764 case, 334 compar.)
  - Cruiser - 57%
  - Sport - 31%
  - Touring - 8%
- Helmet use: 100%
- 24% NC plates
  - 16% GA
  - 11% FL
  - 10% TN
Exposure

- Riders per hour (during riding hrs)
  - 77/hr on case roads
  - 21/hr on comparison roads
### Exposure Adjusted Crash Rate
#### 2005-2009

<table>
<thead>
<tr>
<th>Case Roads</th>
<th></th>
<th></th>
<th>Comparison Roads</th>
<th>Unadj.</th>
<th>Adj.*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road</strong></td>
<td><strong>Unadj.</strong></td>
<td><strong>Adj.</strong>*</td>
<td><strong>Road</strong></td>
<td><strong>Unadj.</strong></td>
<td><strong>Adj.</strong>*</td>
</tr>
<tr>
<td>US 129s</td>
<td>11.03</td>
<td>8.90</td>
<td>NC 28s</td>
<td>4.40</td>
<td>36.67</td>
</tr>
<tr>
<td>NC 143</td>
<td>7.00</td>
<td>12.79</td>
<td>NC 215</td>
<td>1.41</td>
<td>20.14</td>
</tr>
<tr>
<td>NC 28g</td>
<td>3.71</td>
<td>5.89</td>
<td>SR 1310</td>
<td>1.07</td>
<td>16.46</td>
</tr>
<tr>
<td>US 129g</td>
<td>2.22</td>
<td>2.54</td>
<td>US 276</td>
<td>1.67</td>
<td>7.27</td>
</tr>
</tbody>
</table>

*per 100 observed hourly riders*
Automated Traffic Count & Speed

- 2 case roads at high crash curves
- ~720 riders/day enter these curves in dangerous direction
Speed Data: Case Road: NC 28g

- Average: 38 mph
- 88% of riders entered curve \( \leq \) speed limit (45 mph)
Speed Data: Case Road: NC 143

- Average: 43 mph
- 72% of riders entered curve \( \leq \) speed limit (45 mph)
- 25 riders/day
  \( \geq 2\sigma \) above the mean
Preliminary Summary

- **Exposure**
  - Explains much of the high rate per reg. MC
- **GC Riders are experienced**
  - Not so much in mountains
- **Speed entering specific curves is a concern**
Potential Interventions

- **Challenges**
  - High proportion of out-of-state riders
  - Continually changing population (tourism)

- **Interventions must be road-based,**
  - not person/population-based
  - Optical Speed bars
Optical Speed Bars
Optical Speed Bars

- Installed on high crash curves spring 2012
Thank you!
Advance Warning Signs
Loose Gravel/Unsafe Conditions

- The suggestion that these conditions may be present may lead to particularly alert and cautious riding.
- These signs may catch riders’ attention more than the ubiquitous curve speed advisory signs.
- Such warnings promise to be more credible for riders.

Sample informational warning sign to control excessive motorcycle speeds when entering curves.