Motorcycle Safety and Alcohol

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Traffic Fatalities

4,502 Motorcyclist Deaths
17% All Occupant Fatalities
3% Registered Vehicles
0.6% VMT
30 x Fatality Risk
$16 Billion Cost

[Source: www.iihs.org, GAO-13-42]
Fatality Risk (vehicles)

Occupant Fatality Rate (per 100,000 registered vehicles)

- Passenger Vehicle: 15.8 in 2001, 9.2 in 2010, change -41.6
- Light Truck: 14.9 in 2001, 9.5 in 2010, change -36.1
- Motorcycle: 65.2 in 2001, 54.8 in 2010, change -15.9

[Source: NHTSA DOT HS 811 639]
Alcohol Involvement

% Vehicle Operators involved in Fatal Crash with BAC >= .08

- Passenger Car: 23% (2001), 23% (2010)
- Light Truck: 23% (2001), 22% (2010)
- Motorcycle: 29% (2001), 28% (2010)

[Source: NHTSA DOT HS 811 606]
Alcohol Fatalities

[Source (2000-2004): NHTSA DOT HS 810 754]
BAC Risk Curve

[Source: Keall et al, 2013]
Operating Skills

Driving
- car
- lane
- make
- may
- must
- road
- stop
- traffic
- turn
- vehicle

Riding
- ahead
- behind
- brake
- driver
- may
- front
- lane
- motorcycle
- see
- road
- rear
- stop
- turn
- space
- traffic
Alcohol Impairment
Research Questions

How does alcohol affect riding skills?

At what level do these effects appear?
Effects of Alcohol on Motorcycle Riding Skills

Final Report

U.S. Department of Transportation
National Highway Traffic Safety Administration

Summary

Traffic Safety Facts
Traffic Tech – Technology Transfer Series

Effects of Alcohol on Motorcycle Riding Skills

Preliminary estimates indicate that there were 6,610 motorcycle deaths in 2008, an increase of 3.5 percent from 2007. Motorcyclist deaths have increased for the sixth consecutive year and now represent 13 percent of all traffic fatalities in the United States. Moreover, the number of motorcycle fatalities has more than doubled since 1997.

One factor that continues to be associated with motorcycle fatalities is alcohol. In 2005, a higher percentage of motorcycle operators had blood alcohol concentrations (BACs) of 0.08 grams per deciliter or higher than any other type of motor-vehicle driver. Twenty-seven percent of motorcycle operators were at 0.08 or higher versus 22 percent for passenger car operators, and 17 percent for light-truck operators.

Despite the relevance of alcohol to motorcycle safety, only limited information is available on the impairing effects of alcohol on motorcycle operator performance is available. To address this issue, NHTSA sponsored a research study to assess the impairing effects of alcohol to the current per se limit of 0.08 BACs, on rider performance involving a broad set of basic motorcycle riding skills.

Methods

Twenty-four male participants age 21 to 35 (mean=32 years) completed three test days for this experiment. All participants had a minimum of five years of riding experience (mean=11 years), drank alcohol at least once a week, and had no history of medical or psychological problems. Alcohol-dependent riders were excluded from participating in the study. The study design consisted of a balanced incomplete block design (BIBD), where participants were randomly assigned to one of five possible conditions. Participants in each condition experienced one out of four possible levels of alcohol consumption (0.02, 0.05, 0.10, and 0.16), and completed one level per test day.

A motorcycle test course was developed in conjunction with two certified motorcycle coaches from the Minnesota Motorcycle Safety Center based on standard Cincinnati within the Motorcycle Safety Foundation (MSF) training program, including the MSF Basic Rider Course and the Experienced Rider Course. The test course was designed to include specific "risk scenarios" from those training programs that tested performance of riding skills deemed relevant to the safe control of motorcycles. The resulting set of risk scenarios that comprised the test course included wearing (fail to) Awareness Points included awareness of, curve depression, and emergency stops. The test motorcycle was an instrumented 2000 Honda Shadow VT750 equipped with accelerometers and sensor equipment for data collection.

Results

Data was collected for two sober baseline rides and two test rides each day at one of four conditions (BACs of 0.02, 0.05, 0.10, and 0.16). Data was also collected for a set of subjective measures that evaluated mental workload for the riding tasks and the rider’s perceived level of intoxication and impairment.

NHTSA
April 2001
Acknowledgements

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Partners
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MHSRC
MMSC
St. Cloud State University
Skills

• Offset Weave
  – Balance (slow speed)
  – Control (turning)
  – Safety Margin
Skills

- Hazard Avoidance
  - Reaction Time
  - Control (avoidance)
  - Safety Margin
Skills

Experienced Rider Course

- Curve Circuit
  - Control (speed choice, lane position)
## Skills

### Exercise 9

**30 minutes – Riding Demo, Simulated Practice, 2 Parts**

1. **Read objective**
   - To be able to stop quickly
2. **Explain range setup**
   - 2 lanes on each side of the range
   - 2 crossed pause markers in middle of the range
3. **Provide instructions**
   **Part 1 – Stop using cue cones**
   - On signal, ride down the middle of the range through the crossed pause markers
   - Ride to a start point for stop line
   - On signal and one at a time, approach stopping area at about 15 mph in 2nd gear
   - Shift to neutral early
   - As front wheel passes the cue cones, downshift keeping the clutch squeezed, and make a quick stop using both brakes
   - Once coached, make the percent turn and ride through the crossed pause markers
   **Part 2 – Stop on RiderCoach signal**
   - When a RiderCoach moves inside stopping area, stop quickly on command
4. **With class at stop point, provide demo**
   - Cover evaluations and provide signals
     - Keep head and eyes up
     - Use brakes firmly, not grabbing the front brake or locking the rear brake
     - Shift with precision
     - Maintain a safety margin
5. **Provide simulated practice of stop procedure**
6. **Conduct exercise**
   - To start, distribute rides evenly
   - Part 1: use cue cones
   - Part 2: use stop signal
7. **Stage riders in parking area**
8. **Debrief**

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### Stopping Quickly

- **Reaction Time**
- **Control (braking)**

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**Basic RiderCourse**

**End of Level 1**
Environment

Track

Circuit
Motorcycle
## Method

<table>
<thead>
<tr>
<th>Day</th>
<th>Order</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.00</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.02</td>
<td>0.05</td>
<td>0.08</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.05</td>
<td>0.08</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- 24 male subjects
  - Moderate drinkers
  - 21-50 years old
  - 5+ years experience
- Three days
- Random BAC order
- Two test laps
## Dosing

<table>
<thead>
<tr>
<th>Target BAC</th>
<th>Acceptable BAC Ranges</th>
<th>Pre-Ride Mean (SD)</th>
<th>Post-Test Mean (SD)</th>
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<tbody>
<tr>
<td>0.02</td>
<td>0.01-0.03</td>
<td>0.025 (0.007)</td>
<td>0.013 (0.008)</td>
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<tr>
<td>0.05</td>
<td>0.04-0.06</td>
<td>0.052 (0.006)</td>
<td>0.046 (0.009)</td>
</tr>
<tr>
<td>0.08</td>
<td>0.07-0.09</td>
<td>0.080 (0.007)</td>
<td>0.079 (0.009)</td>
</tr>
</tbody>
</table>
Results

Offset Weave

- BAC 0.08 produced more missed or hit pylons.
- BAC 0.08 resulted in closer passing distance (shorter safety margin).
Results

Hazard Avoidance

- BAC 0.08 produced more errors (direction).
- BAC 0.08 and 0.05 produced slower reaction time.
- BAC 0.08 and 0.05 resulted in closer passing distance (shorter safety margin).
Results

Curve Circuit

- All alcohol levels produce faster maximum speeds.
- All alcohol levels produce more speed variability.
- BAC 0.08 resulted in more lane boundary violations.
Results

Stopping Quickly

- Alcohol increased maximum deceleration rate.
- Higher alcohol (BAC 0.08, 0.05) produce more deviation in stopping path than low alcohol (BAC 0.02).
## Results

### Subjective Reports

<table>
<thead>
<tr>
<th></th>
<th>BAC0.02</th>
<th>BAC0.05</th>
<th>BAC0.08</th>
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<tbody>
<tr>
<td>Intoxicated</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Impaired</td>
<td>↑</td>
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<tr>
<td>Willing</td>
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<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Effort</td>
<td></td>
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<td>↑</td>
</tr>
</tbody>
</table>
Discussion

• Alcohol effects on rider skills consistent with motorcycle crash types:
  – Speeding
  – Delayed reaction
  – Rider Error
  – Road departure

• Effects apparent at BAC 0.05
• Subjective intoxication at BAC 0.02
Thank You!