Exploring the Role of Marijuana Legalization on Fatal Crashes in the United States: FARS Analysis

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Points of Discussion

• Project Background
• Methods
• Results
• Limitations
• Findings and Conclusions
Project Background
Marijuana’s Impact on Driving

• Recent marijuana use approximately doubled one’s risk of traffic crash
• Marijuana use impairs:

- Road tracking
- Brake latency
- Ability to gauge time and distance
- Recognition of lights
- Divided attention tasks
- Ability to pass
- Inhibitory control
- Ability to maintain headway
Opinion of Marijuana Use

• Marijuana is the most commonly used illicit drug in the United States
• Marijuana use is increasing over time
• Marijuana use among drivers exceeds the rate of alcohol use among drivers
Methods
Data

• Fatality Analysis Reporting System (FARS) crashes from 2008 – 2015
• Federal Highway Administration (FHWA)
  • Vehicle Miles Traveled (VMT)
  • Driver Demographics
• U.S. Department of Commerce Bureau of Economic Analysis – real Gross Domestic Product (GDP)
Data Classification

- States were classified based on marijuana legalization status:
  - Legalized Medicinal and Recreational Marijuana
  - Legalized Medicinal Marijuana Only
  - Neighboring States with Legalized Recreational Marijuana
  - Control States
Data Analysis

• Descriptive Statistics
  • Frequency of fatal drug-related crashes and rate of toxicology testing by drug test status
  • Legalization status descriptive statistics

• Safety Performance Function (SPF) estimations were developed to predict the frequency for:
  • 1) cannabinoids positive driving (CPD) fatal crashes per year
  • 2) CPD fatal crashes per 100 all type fatal crashes per year
  • 3) CPD fatal crashes per 100 alcohol-impaired (where the driver had a BAC ≥ 0.08) fatal crashes per year in the United States
Results
Descriptive Statistics

• Annually, there are approximately 30,000 fatal crashes
• However, only 40% of drivers are tested for drugs
• Approximately one-third of drivers tested had a positive drug test result
## Most Common Drug Types Detected

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Drivers of Drug Positive Tested</th>
<th>Cannabinoid</th>
<th>Stimulant</th>
<th>Depressant</th>
<th>Narcotic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Drivers (%) of Total</td>
<td>With alcohol (%)</td>
<td>No. of Drivers (%) of Total</td>
<td>With alcohol (%)</td>
</tr>
<tr>
<td>2008</td>
<td>5,422</td>
<td>1,982 (37%)</td>
<td>720 (36%)</td>
<td>445 (34%)</td>
<td>1,138 (21%)</td>
</tr>
<tr>
<td>2009</td>
<td>5,500</td>
<td>1,956 (36%)</td>
<td>748 (38%)</td>
<td>421 (34%)</td>
<td>1,216 (22%)</td>
</tr>
<tr>
<td>2010</td>
<td>5,946</td>
<td>2,110 (35%)</td>
<td>805 (38%)</td>
<td>418 (33%)</td>
<td>1,452 (24%)</td>
</tr>
<tr>
<td>2011</td>
<td>6,096</td>
<td>2,055 (34%)</td>
<td>742 (36%)</td>
<td>384 (31%)</td>
<td>1,379 (23%)</td>
</tr>
<tr>
<td>2012</td>
<td>6,572</td>
<td>2,369 (36%)</td>
<td>803 (34%)</td>
<td>412 (31%)</td>
<td>1,404 (21%)</td>
</tr>
<tr>
<td>2013</td>
<td>6,540</td>
<td>2,413 (37%)</td>
<td>848 (35%)</td>
<td>422 (28%)</td>
<td>1,492 (23%)</td>
</tr>
<tr>
<td>2014</td>
<td>6,640</td>
<td>2,577 (39%)</td>
<td>826 (32%)</td>
<td>427 (28%)</td>
<td>1,422 (21%)</td>
</tr>
<tr>
<td>2015</td>
<td>6,833</td>
<td>2,805 (41%)</td>
<td>828 (30%)</td>
<td>389 (24%)</td>
<td>1,476 (22%)</td>
</tr>
</tbody>
</table>
## Cannabinoid Positive Drivers, by Gender and Age

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Ratio of Male vs. Female</th>
<th>16 to 24 yrs. (%)</th>
<th>25 to 34 yrs. (%)</th>
<th>35 to 54 yrs. (%)</th>
<th>55 yrs. or older (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1,982</td>
<td>1,659</td>
<td>322</td>
<td>5.15</td>
<td>863 (40%)</td>
<td>571 (26%)</td>
<td>617 (28%)</td>
<td>112 (5%)</td>
</tr>
<tr>
<td>2009</td>
<td>1,956</td>
<td>1,636</td>
<td>320</td>
<td>5.11</td>
<td>853 (39%)</td>
<td>556 (25%)</td>
<td>636 (29%)</td>
<td>131 (6%)</td>
</tr>
<tr>
<td>2010</td>
<td>2,110</td>
<td>1,731</td>
<td>378</td>
<td>4.58</td>
<td>890 (38%)</td>
<td>644 (28%)</td>
<td>606 (26%)</td>
<td>170 (7%)</td>
</tr>
<tr>
<td>2011</td>
<td>2,055</td>
<td>1,728</td>
<td>327</td>
<td>5.28</td>
<td>866 (37%)</td>
<td>638 (27%)</td>
<td>640 (27%)</td>
<td>176 (8%)</td>
</tr>
<tr>
<td>2012</td>
<td>2,369</td>
<td>1,975</td>
<td>393</td>
<td>5.03</td>
<td>1,019 (38%)</td>
<td>745 (28%)</td>
<td>703 (26%)</td>
<td>223 (8%)</td>
</tr>
<tr>
<td>2013</td>
<td>2,413</td>
<td>2,009</td>
<td>403</td>
<td>4.99</td>
<td>947 (34%)</td>
<td>825 (30%)</td>
<td>712 (26%)</td>
<td>255 (9%)</td>
</tr>
<tr>
<td>2014</td>
<td>2,577</td>
<td>2,156</td>
<td>421</td>
<td>5.12</td>
<td>1,039 (35%)</td>
<td>849 (29%)</td>
<td>817 (28%)</td>
<td>249 (8%)</td>
</tr>
<tr>
<td>2015</td>
<td>2,805</td>
<td>2,350</td>
<td>454</td>
<td>5.18</td>
<td>1,094 (34%)</td>
<td>987 (30%)</td>
<td>836 (26%)</td>
<td>313 (10%)</td>
</tr>
</tbody>
</table>
Fatal Crashes Over Time

![Graph showing fatal crashes over time with data points for each year and percentage increase.](image-url)
Fatal Crash Trends by Legalization Status

States with Recreational Use

- Washington
- Colorado
- Avg 2008 to 2013
- Avg 2014 to 2015

States with Medicinal Use

- Delaware
- Illinois
- Massachusetts

Neighboring States

- Oklahoma
- Idaho
- Utah
- Avg 2008 to 2013
- Avg 2014 to 2015

Control States

- Florida
- Ohio
- Pennsylvania
- Texas
- Avg 2008 to 2013
- Avg 2014 to 2015
## Results of Generalized Linear Crash Model

<table>
<thead>
<tr>
<th>Category</th>
<th>CPD fatal crashes/year</th>
<th>CPD fatal crashes/100 fatal crashes/year</th>
<th>CPD fatal crashes/100 alcohol impaired fatal crashes/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Pr &gt; ChiSq</td>
<td>Estimate</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.6836</td>
<td>0.844</td>
<td>14.9807</td>
</tr>
<tr>
<td>Log(VMT)</td>
<td>0.1021</td>
<td>0.5487</td>
<td>-0.998</td>
</tr>
<tr>
<td>Log(DRV)</td>
<td>0.7485</td>
<td>&lt;.0001</td>
<td>0.9042</td>
</tr>
<tr>
<td>Duration of Medicinal Use</td>
<td>0.2325</td>
<td>0.0012</td>
<td>0.3416</td>
</tr>
<tr>
<td>Duration of Recreation Use</td>
<td>0.273</td>
<td>0.3518</td>
<td>0.2536</td>
</tr>
<tr>
<td>Neighboring Condition</td>
<td>-0.176</td>
<td>0.0061</td>
<td>-0.0859</td>
</tr>
<tr>
<td>Year Factor</td>
<td>0.3676</td>
<td>&lt;.0001</td>
<td>0.3022</td>
</tr>
<tr>
<td>Log(per capita)</td>
<td>-0.7487</td>
<td>0.0004</td>
<td>-0.0245</td>
</tr>
</tbody>
</table>
Limitations
FARS Limitations

- Not all drivers involved in fatal crashes are drug tested
- Reporting of toxicology results to FARS varies
- Testing varies by state
- A positive drug test result does not indicate the driver was impaired at the time of the crash
- FARS does not indicate that the number of fatal crashes involving a driver positive for cannabinoids has increased, but instead supports the number of drivers who tested positive for cannabinoids reported to FARS has increased
Findings and Conclusions
Findings and Conclusions

• Total number of fatal crashes with a cannabinoid positive driver increased 42%

• Male drivers and younger drivers are more likely to test positive for cannabinoids

• Total number of fatal crashes with a cannabinoid positive driver increased in 2014 and 2015 – regardless of legalization status

• Among all estimates:
  • Number of young drivers aged 16 to 24 years old,
  • Duration of medicinal use,
  • Year factor (2014 and 2015) were statistically significant at p<0.01.