IMPACT OF GRADUATED DRIVER LICENSING PROGRAMS PASSENGER RESTRAINT USE: CAN STRICTER LEGISLATION HELP FOSTER A CULTURE OF SAFETY?

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MOTOR VEHICLE CRASHES

- **MVCs Prevalence 2010**
  - 5,419,000 crashes
  - 32,885 deaths
  - 2,239,000 injured

- **Disproportionately involve young drivers**
  - 6-7% of population
  - 10% of Fatal Crashes
  - 14% of all crashes

[Leading Causes of Death for Teens diagram]

CDC. WISQARS (Web-based Injury Statistics Query and Reporting System). Atlanta, GA: US Department of Health and Human
NHTSA Traffic Safety Facts 2010
FATALITY NUMBERS

• 2012 NHTSA Projections - 34,080 Motor Vehicle Crash Fatalities [+5.3% from last year]

• 2011 - 19,987 15-20yo drivers died in MVCs [+1% from 2010]
What is known?

- Young Drivers are at increased risk
  - 4x crash rates of >20 yo
- More severe consequences when in a crash
- Lowest safety restraint usage

...not just numbers
GRADUATED DRIVER LICENSING

- First Implemented in FL in 1996
- Stepwise Licensure targeting known risk factors
  - Learners
  - Intermediate
  - Unrestricted

Learners Permit
- Holding Period
- Practice Hours

Intermediate
- Night Restrictions
- Passenger Restrictions
- Holding Period

Unrestricted
GDL STRENGTH - 1996
GDL STRENGTH - 2003
GDL STRENGTH 2010

[Map showing GDL strength across the United States with different shades indicating various values of GDL strength.]
EFFECTS OF GDL

- 16 year-olds: 10-30 percent crash reduction
  - (Fohr et al., 2005; Foss et al., 2001; Hallmark et al., 2008; Mayhew, Simpson, Desmond, et al., 2003; Neyens et al., 2008; Shope and Molnar, 2004; Ulmer et al., 2000)

- Night-time restrictions- 40-60 percent crash reduction during restricted hours
  - (Foss et al., 2001; Masten and Hagge, 2004; Mayhew, Simpson, Desmond, et al., 2003; Shope and Molnar, 2004; Ulmer et al., 2000)

- IIHS GDL Strength and 15-17 yo drivers
  - Good- 19% decrease in fatalities
  - Fair- 13% decrease
  - Marginal-no significant effect
    - Morrisey et al 2006

- Inc Unlicensed Driving?
QUESTION: DO PASSENGERS IN STATES WITH WEAKER GDL LAWS WEAR THEIR SEAT BELT LESS?
CALIFORNIA DRIVER 2003-“GOOD”
CONNECTICUT DRIVER- 2003 “FAIR”
METHODS

- National Highway Traffic Safety Administration (NHTSA)- Fatality Analysis Reporting System (FARS)
- Fatal Crash 1996-2010 involving young driver and passenger (15-24yo)
- Multivariate Logistic Regression with Generalized Estimating Equations
IIHS Rating System for GDL strength

**Learner’s Phase Criteria Points**
- Minimum Permit Age 16 or older: 1 point
- Permit Holding Period: 6+ months: 2 points
- 3-5 months: 1 point
- <3 months: 0 points
- Required Practice Hours: 30+ hours: 1 point
- <30 hours: 0 points

**Intermediate Phase Criteria Points**
- Restriction on Night Driving:
  - Driving 10pm or earlier: 2 points
  - After 10pm: 1 point
  - No Restriction: 0 points
- Restriction on Underage Passengers:
  - 0-1 passenger: 2 points
  - 2 passengers: 1 point
  - 3+ passengers or no restriction: 0 points
- Duration of Night Driving Restriction:
  - 12+ months from minimum licensing age: 1 point
  - <12 months: 0 points
- Duration of Passenger Restriction:
  - 12+ months from minimum licensing age: 1 point
  - <12 months: 0 points
WHY GENERALIZED ESTIMATING EQUATIONS

- Cluster on the vehicle
- Bootstrap VCE standard error estimates
GENERALIZED ESTIMATING EQUATIONS

Try AirForce One.

My Tesla is safer!
# Univariate Analysis - Restraint Use by State GDL Strength

<table>
<thead>
<tr>
<th>GDL Strength</th>
<th>Restraint Use</th>
<th>n</th>
<th>Unadjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>34.30%</td>
<td>8,497</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>33.60%</td>
<td>6,460</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>43.30%</td>
<td>13,421</td>
<td>1.29</td>
<td>[1.28, 1.30]</td>
</tr>
<tr>
<td>Good</td>
<td>51.50%</td>
<td>14,663</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Multivariate Regression - Passenger Restraint Use (N=113,376)

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>SE</th>
<th>[95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDL Strength</td>
<td>1.15</td>
<td>0.01</td>
<td>[1.13, 1.18]</td>
</tr>
<tr>
<td>Never Licensed Driver</td>
<td>0.74</td>
<td>0.02</td>
<td>[0.70, 0.79]</td>
</tr>
<tr>
<td>Invalidly Licensed Driver</td>
<td>0.84</td>
<td>0.03</td>
<td>[0.78, 0.89]</td>
</tr>
<tr>
<td>Driver Restrained</td>
<td>14.95</td>
<td>0.30</td>
<td>[14.38, 15.54]</td>
</tr>
<tr>
<td>Male Passenger</td>
<td>0.81</td>
<td>0.01</td>
<td>[0.78, 0.84]</td>
</tr>
<tr>
<td>Front-Seated Passenger</td>
<td>3.55</td>
<td>0.06</td>
<td>[3.44, 3.67]</td>
</tr>
<tr>
<td>Number of Occupants</td>
<td>0.85</td>
<td>0.01</td>
<td>[0.84, 0.86]</td>
</tr>
<tr>
<td>Driver Drinking</td>
<td>0.72</td>
<td>0.02</td>
<td>[0.69, 0.76]</td>
</tr>
<tr>
<td>Rural Crash Location</td>
<td>0.73</td>
<td>0.02</td>
<td>[0.70, 0.76]</td>
</tr>
<tr>
<td>Crash Year</td>
<td>1.02</td>
<td>0.01</td>
<td>[1.02, 1.03]</td>
</tr>
</tbody>
</table>
MULTIVARIATE ANALYSIS

Increased Odds of Restraint Use

• Crash Factors
  • State GDL Strength: 1.15
  • Crash Year: 1.02

• Driver Factors
  • Driver Restraint Use: 14.95

• Passenger Factors
  • Front Seat Position: 3.55
MULTIVARIATE ANALYSIS

**Decreased Odds of Restraint Use**

- **Driver Factors**
  - Never Licensed: 0.74
  - Invalid License: 0.84
  - Driver Alcohol Use: 0.72

- **Passenger Factors**
  - Male Passenger: 0.81

- **Crash Factors**
  - Increased Number of Passengers: 0.85
  - Rural Crash Area: 0.73
SUMMARY

**Increased Odds**
- **Crash Factors**
  - State GDL Strength: 1.15
  - Crash Year: 1.02
- **Driver Factors**
  - Driver Restraint Use: 14.95
- **Passenger Factors**
  - Front Seat Position: 3.55

**Decreased Odds**
- **Crash Factors**
  - Increased Passengers: 0.85
  - Rural Crash Area: 0.73
- **Driver Factors**
  - Never Licensed: 0.74
  - Invalid License: 0.84
  - Driver Alcohol Use: 0.72
- **Passenger Factors**
  - Male Passenger: 0.81

Culture of Safety
ADDING PIECES TO THE PUZZLE: HOW DO WE UNDERSTAND RISK?

Strong GDL

- Emotionality
- Sensation Seeking
- Impulsivity
- Optimistic Bias
- Risk Behavior
- Peer Influence
LIMITATIONS

• Limitations
  • FARS
  • Limited to Fatal Crashes
  • Missing data points

• Strengths
  • Large dataset
  • Robust data cleaning
CONCLUSIONS

1. Stronger GDL laws are associated with increased passenger restraint usage.
2. State level GDL programs may help foster a culture of safety in states that have adopted stronger restrictions.
3. Our study provides evidence that stronger legislation in states with weaker GDL laws may reduce risk to young drivers and their passengers.
ACKNOWLEDGEMENTS

• Injury Prevention Team
  • Federico Vaca
  • Craig Anderson
  • Jim Dziura
  • Michael Crowley

• Funding From:
  • Yale University Office of Student Research
  • Safe States/SAVIR Annual Meeting Scholarship
QUESTIONS? THOUGHTS?