9th Annual (Edmonton) International Conference on Urban Traffic Safety

&

4th International Conference on Transportation Information and Safety

August 8-10, 2017

Banff, Alberta, Canada
50 Years of Impaired Driving Research: What Have We Learned?

James C. Fell
National Opinion Research Center
Bethesda, MD, USA
2017
Early History of Alcohol-Impaired Driving in the U.S.

- 1899 – First recorded motor vehicle fatality
- 1904 - First editorial on drinking and driving
- 1910 – First DWI Law enacted in NY
- 1914 – Widmark (Sweden) correlates alcohol in bodily fluids and impairment
- 1919 – Prohibition
- 1932 – Widmark establishes impairment based upon BAC
- 1933 – Prohibition repealed
- 1934 – Heise publishes research on effects of alcohol on driving
- 1936 – Norway adopts first illegal per se law based upon BAC at .05 g/dL
Middle History of Alcohol-Impaired Driving in the U.S.

- 1938 – AMA recommends .15 BAC as under the influence
- 1938 - Alcohol breath test invented
- 1939 – IN enacts first illegal per se law at .15 BAC
- 1940 – 34,500 traffic fatalities in the U.S.
- 1950 – 34,800 traffic fatalities in the U.S.
- 1953 – First implied consent law enacted in NY
- 1954 – Borkenstein introduces Breathalyzer as evidential test
- 1960 – AMA recommends DUI at .10 BAC
- 1964 – Borkenstein Grand Rapids study establishes risk of crash at various BAC levels
Modern History of Alcohol-Impaired Driving in the U.S.

- 1966 – Congress enacts National Highway Safety Act creating NHSB (NHTSA predecessor)
- 1968 – Report to Congress on Alcohol and Highway Safety
- 1969 - Insurance Institute for Highway Safety (IIHS) established
- 1970 – National Highway Traffic Safety Administration (NHTSA) and National Institute on Alcohol Abuse and Alcoholism (NIAAA) established
- 1970 – Alcohol Safety Action Programs (ASAP) initiated
- 1970 – 55,000 traffic fatalities in the U.S.
Modern History of Alcohol-Impaired Driving in the U.S.

- 1975 – Fatality Analysis Reporting System (FARS) established by NHTSA
- 1976 – MN adopts first administrative license revocation (ALR) law at .10 BAC
- 1978 – Remove Intoxicated Drivers (RID) established
- 1980 – Mothers Against Drunk Driving (MADD) founded
- 1980 – 51,091 traffic fatalities
Recent History of Alcohol-Impaired Driving in the U.S.

- 1982 - Presidential Commission Against Drunk Driving established
- 1984 – Minimum Drinking Age (MDA) 21 Law adopted by Congress
- 1990 – U.S. Supreme Court approves of sobriety checkpoints
- 1995 – Zero Tolerance Law for drivers under 21 adopted
- 2000 - .08 BAC National standard adopted by Congress
Current History of Alcohol-Impaired Driving in the U.S.

- 2005 – NM adopts Mandated Interlocks for all convicted DWI offenders
- 2006 – SAFETEA-LU Reauthorization
- 2006 – STOP ACT Legislation
- 2006 – MADD Campaign to Eliminate Drunk Driving
- 2008 – DADSS Research Funding Initiated
- 2012 – Moving Ahead for Progress in the 21st Century (MAP-21) reauthorization
- 2015 – Flexible Affordable Safe Transportation FAST Act
Impaired Driving Problem in the United States

- 10,000 killed by intoxicated drivers.
- 300,000 people injured in drinking driving crashes.
- $125 billion in annual costs to society.
- 1,100,000 drivers arrested annually for DWI or DUI.
Blood Alcohol Concentration (BAC) and Impairment

<table>
<thead>
<tr>
<th>BAC</th>
<th>Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>.10</td>
<td>Concentrated attention, speed control</td>
</tr>
<tr>
<td>.09</td>
<td>Information processing, judgment</td>
</tr>
<tr>
<td>.08</td>
<td>Coordination</td>
</tr>
<tr>
<td>.07</td>
<td>Eye movement control, standing steadiness, emergency responses</td>
</tr>
<tr>
<td>.06</td>
<td>Tracking and steering</td>
</tr>
<tr>
<td>.05</td>
<td>Divided attention, choice reaction time, visual function</td>
</tr>
<tr>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>.02</td>
<td></td>
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<tr>
<td>.01</td>
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</tr>
</tbody>
</table>
Crash Risk and Alcohol

- Case – Control Study.

- Odds of being in a crash for drivers (adjusted for age & gender):
  - with a BAC = .15 is 12.18
  - with a BAC = .08 is 3.93
  - with a BAC = .05 is 2.07
  (all statistically significant)

Source: NHTSA, Compton & Berning (2015), DOT HS 812-117
Crash Risk and Drugs

- Case-Control Study.

- Odds of being in a crash for drivers (adjusted for age & gender):
  - with sedatives in their systems is 1.27
  - with narcotic analgesics in their systems is 1.14
  - with THC (marijuana) in their systems is 1.05
  - with stimulants in their systems is .94

  (Not statistically significant.)

Source: NHTSA, Compton & Berning (2015), DOT HS 812-117
Relative Crash Risk by BAC and Driver Age (adapted from Blomberg et al., 2005)
National Survey of Drinking & Driving-2008
[Moulton et al., 2010, DOT HS 811 343]

Drove Within 2 Hours after Drinking Alcoholic Beverages, Past Year

Q33: In the past 12 months, have you ever driven a motor vehicle within two hours after Drinking alcoholic beverages? [Base: all respondents age 16-64; 1999 n=2406, 1993 N=3590, n=3471, 1997 n=3358, 1999 n=4264, 2001 n=5073]
Q31: How many [drinks of alcoholic beverages drunk most often] could you drink in two hours before you should not drive? [Base: drivers who drink**]
Percent of Drivers on the Road with Positive BAC Levels (BAC ≥ .01) (Weekend Evenings)

Source: National Roadside Surveys
Percentage of Weekend Nighttime Drivers with BACs ≥ 0.08 g/dL* in the Five National Roadside Surveys

*During the period from 1973 through 1996, the States had BAC limits that ranged from 0.08 to 0.15 g/dL.
Percentage of Drivers on U.S. Roads in 2007 and 2013-14 with Drugs Other than Alcohol (Oral Fluid and Blood)

- Drug Positive, 2007: 16.3%
- Drug Positive, 2013-14: 20.0%
- Marijuana (THC), 2007: 8.6%
- Marijuana (THC), 2013-14: 12.6%
Proportion of All Drivers Involved in Fatal Crashes Estimated to Have Been Legally Intoxicated (BAC ≥ .08)

1982-2013

43% Reduction

No Reduction
Alcohol-Impaired Driving Fatalities (Driver BAC ≥ .08), 1982-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Traffic Fatalities</th>
<th>Alcohol-Impaired Fatalities</th>
<th>Percent</th>
<th>Year</th>
<th>Total Traffic Fatalities</th>
<th>Alcohol-Impaired Fatalities</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>1982</td>
<td>43,945</td>
<td>21,113</td>
<td>48</td>
<td>1998</td>
<td>41,501</td>
<td>12,546</td>
<td>30</td>
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<tr>
<td>1983</td>
<td>42,589</td>
<td>20,051</td>
<td>47</td>
<td>1999</td>
<td>41,717</td>
<td>12,555</td>
<td>30</td>
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<tr>
<td>1984</td>
<td>44,257</td>
<td>19,638</td>
<td>44</td>
<td>2000</td>
<td>41,945</td>
<td>13,324</td>
<td>32</td>
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<tr>
<td>1985</td>
<td>43,825</td>
<td>18,125</td>
<td>41</td>
<td>2001</td>
<td>42,196</td>
<td>13,290</td>
<td>31</td>
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<tr>
<td>1986</td>
<td>46,087</td>
<td>19,554</td>
<td>42</td>
<td>2002</td>
<td>43,005</td>
<td>13,472</td>
<td>31</td>
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<tr>
<td>1987</td>
<td>46,390</td>
<td>18,813</td>
<td>41</td>
<td>2003</td>
<td>42,884</td>
<td>13,096</td>
<td>31</td>
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<tr>
<td>1988</td>
<td>47,087</td>
<td>18,611</td>
<td>40</td>
<td>2004</td>
<td>42,836</td>
<td>13,099</td>
<td>31</td>
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<tr>
<td>1989</td>
<td>45,582</td>
<td>17,521</td>
<td>38</td>
<td>2005</td>
<td>43,510</td>
<td>13,582</td>
<td>31</td>
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<tr>
<td>1990</td>
<td>44,599</td>
<td>17,705</td>
<td>40</td>
<td>2006</td>
<td>42,708</td>
<td>13,491</td>
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<tr>
<td>1991</td>
<td>41,508</td>
<td>15,827</td>
<td>38</td>
<td>2007</td>
<td>41,059</td>
<td>12,998</td>
<td>32</td>
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<tr>
<td>1992</td>
<td>39,250</td>
<td>14,049</td>
<td>36</td>
<td>2008</td>
<td>37,423</td>
<td>11,711</td>
<td>31</td>
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<tr>
<td>1993</td>
<td>40,150</td>
<td>13,739</td>
<td>34</td>
<td>2009</td>
<td>33,808</td>
<td>10,839</td>
<td>32</td>
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<tr>
<td>1994</td>
<td>40,716</td>
<td>13,390</td>
<td>33</td>
<td>2010</td>
<td>32,885</td>
<td>10,228</td>
<td>31</td>
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<tr>
<td>1995</td>
<td>41,817</td>
<td>13,478</td>
<td>32</td>
<td>2011</td>
<td>32,367</td>
<td>9,878</td>
<td>31</td>
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<tr>
<td>1996</td>
<td>42,065</td>
<td>13,451</td>
<td>32</td>
<td>2012</td>
<td>32,561</td>
<td>10,322</td>
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<tr>
<td>1997</td>
<td>42,013</td>
<td>13,757</td>
<td>30</td>
<td>2013</td>
<td>32,719</td>
<td>10,076</td>
<td>31</td>
</tr>
</tbody>
</table>
Percentage of fatally injured drivers with a BAC of .05 or more in Australia, Sweden, and the United States

United States — Fatality Analysis Reporting System.
Sweden — Department of Forensic Genetics and Forensic Toxicology, Linköping, Sweden
# 20 Key Components of Underage Drinking Laws in the United States

<table>
<thead>
<tr>
<th>MLDA 21 Law Components</th>
<th># States with Law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CORE LAWS:</strong></td>
<td></td>
</tr>
<tr>
<td>• Apply to Youth</td>
<td></td>
</tr>
<tr>
<td>- <strong>Possession</strong></td>
<td>51</td>
</tr>
<tr>
<td>- <strong>Purchase/ attempt to purchase</strong></td>
<td>48</td>
</tr>
<tr>
<td><strong>EXPANDED LAWS:</strong></td>
<td></td>
</tr>
<tr>
<td>• Apply to Youth</td>
<td></td>
</tr>
<tr>
<td>- <strong>Consumption</strong></td>
<td>35</td>
</tr>
<tr>
<td>- <strong>Internal possession</strong></td>
<td>9</td>
</tr>
<tr>
<td>- <strong>Use and lose driving privileges</strong></td>
<td>40</td>
</tr>
<tr>
<td>- Use of fake ID illegal</td>
<td>51</td>
</tr>
<tr>
<td>• Apply to Youth Driving</td>
<td></td>
</tr>
<tr>
<td>- <strong>Zero tolerance</strong></td>
<td>51</td>
</tr>
<tr>
<td>- <strong>GDL with night restrictions</strong></td>
<td>51</td>
</tr>
</tbody>
</table>
# 20 Key Components of Underage Drinking Laws in the United States

## MLDA 21 Law Components

<table>
<thead>
<tr>
<th>MLDA 21 Law Components</th>
<th># States with Law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply to Providers</strong></td>
<td></td>
</tr>
<tr>
<td>- Furnishing/selling</td>
<td>51</td>
</tr>
<tr>
<td>- Age 21 for on-premises Server (all 3 beverage types)</td>
<td>13</td>
</tr>
<tr>
<td>- <strong>Age 21 for on-premises Bartender (all 3 beverage types)</strong></td>
<td>24</td>
</tr>
<tr>
<td>- Age 21 for off-premises Seller</td>
<td>23</td>
</tr>
<tr>
<td>- Keg registration</td>
<td>31</td>
</tr>
<tr>
<td>- <strong>Beverage Service Training</strong></td>
<td>38</td>
</tr>
<tr>
<td>- <strong>Retail Support Provisions for Fake ID</strong></td>
<td>45</td>
</tr>
<tr>
<td>- Hosting underage drinking parties</td>
<td>28</td>
</tr>
<tr>
<td>- <strong>Dram Shop Liability</strong></td>
<td>45</td>
</tr>
<tr>
<td>- <strong>Social Host Civil Liability</strong></td>
<td>33</td>
</tr>
</tbody>
</table>
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<thead>
<tr>
<th>MLDA 21 Law Components</th>
<th># States with Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Apply to Manufacturers of Fake ID</td>
<td></td>
</tr>
<tr>
<td>- Transfer/production of Fake ID illegal</td>
<td>24</td>
</tr>
<tr>
<td>• Apply to State</td>
<td></td>
</tr>
<tr>
<td>- State control of alcohol</td>
<td></td>
</tr>
<tr>
<td>(at least 1 beverage)</td>
<td>11</td>
</tr>
</tbody>
</table>
20 Key Components of Underage Drinking Laws in the United States

• Utah has all 20 MLDA-21 Components
• Kentucky has only 9 out of the 20 laws
• Maryland only has 12 of the 20 laws
• Only 5 laws have been adopted by all 50 States and DC
5 MLDA-21 Laws Adopted by All States and DC in the United States

• Illegal to possess alcohol
• Illegal to use a fake ID to purchase alcohol
• Zero Tolerance (BAC > .02) for driving
• Graduated Driver Licensing System
• Illegal to furnish alcohol to persons under age 21
Drunk Drivers (BAC≥.08+) in Fatal Crashes: 2004 (N=11,813)

- No prior DWIs: 10,435 (92%)
- One prior DWI in past 3 years: 806 (7%)
- Two or more prior DWIs in past 3 years: 140 (1%)
Drunk Drivers (BAC=.08+) in Fatal Crashes: 2004 (N=11,813)

Driving:  
  - 599 (5%)
- Last 5 years (2000+)
  - 3,547 (30%)
- 10 years or older pre-1995
  - 4,534 (38%)
Main Factors Contributing to Decline from 1982-1997

- Deterrence, including enforcement practices, administrative license revocation, and lower BAC limits [Secondary Prevention]
- Raising the drinking age to 21 [Primary Prevention]
- Increased public awareness and activism [Primary, Secondary, Tertiary Prevention]
- Reduction in per capita alcohol consumption [Primary Prevention]
- Socioeconomic factors (age of drivers; unemployment rates; recessions; etc.)
## Graduated Driver Licensing Effectiveness

### Reductions in 16-17 year old drivers in fatal crashes

<table>
<thead>
<tr>
<th>Study</th>
<th>Effect Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fell, Jones, Romano, Voas, 2011</td>
<td>-7% GDL when other laws present</td>
</tr>
<tr>
<td></td>
<td>-11% when GDL alone</td>
</tr>
<tr>
<td>Fell, Todd, Voas, 2011</td>
<td>-10% in nighttime fatal crashes</td>
</tr>
<tr>
<td></td>
<td>-13% for drinking 16-17 year old driver in nighttime fatal crashes</td>
</tr>
<tr>
<td>Fell, Todd, Voas, 2011</td>
<td>-9% in fatal crashes with teen passengers</td>
</tr>
</tbody>
</table>

**GDL effects**

**Nighttime restriction effects**

**Passenger limitation effects**
Laws That Have Shown Impact

- Illegal Per Se BAC laws (lowering to .10 and then to .08)
- Administrative License Revocation (ALR)
- Minimum Legal Drinking Age (MLDA-21)
- Zero Tolerance (.02 BAC) for Youth
- Vehicle Sanctions (interlock, impoundment, immobilization, etc)
- Primary Seat Belt Laws (recent evidence)
Changes in Motor Vehicle Front-Seat Occupant Fatalities in Five States that Adopted Primary Safety Belt Laws

-28% (p<.05)
-15%
-16%
-13%
-24% (p<.05)

CA IL MD MI WA

-35% -30% -25% -20% -15% -10% -5% 0% 5% 10% 15% 20% 25% 30% 35%

Percent decrease in occupant fatalities

Alcohol-related
Non-alcohol-related

(p <.05)
Research Shows that Increased Enforcement Works

- General deterrence:
  - Routine, daily enforcement of impaired-driving laws
  - Highly visible enforcement campaigns
  - Sobriety checkpoints wherever possible
  - Media campaigns to make the public aware

_Studies show that checkpoints reduce alcohol-related crashes by 9% (4-17%)._
Effectiveness of Statewide Sobriety Checkpoint Programs

-55% in proportion of drivers on roads with BACs >.08

-20% in drunk-driving fatal crashes

-14% in ratio of drinking drivers to nondrinking drivers

-50% in proportion of drivers who reported driving after drinking too much

North Carolina (1994)

Tennessee (1995)

Georgia (2001)
Low-Staff Checkpoints Results

- Relative to drivers in the 2 comparison counties in West Virginia, the proportion of drivers on the roads in the experimental counties with BACs>=.05+ was 70% lower.

- The proportion of drivers on the roads in the checkpoint counties with BACs>=.08+ was 64% lower than the comparison counties.
Georgia’s Operation Zero Tolerance
A Statewide Highly Publicized Sobriety Checkpoint Program (Checkpoints 2000-2001)

- Checkpoints conducted 2,837
- Drivers checked 280,082
- Drivers arrested for DUI 2,322
- Seat belt violations 5,348
- Drug violation arrests 1,001
- Felony arrests 236
- Stolen vehicles recovered 57
- Suspended/Revoked Licenses 2,481
- Other traffic citations 14,776
Which Sanctions Work?

- **Licensing Actions** – especially ALR
- **Vehicle Actions** – separating the vehicle from the driver
- **Intensive Supervision Probation** – frequent monitoring of offender compliance with program
- **Mandatory Fines** – especially if fine money can be used to pay for DWI offender programs
- **DUI Court** – frequent contact with the judge, treatment, ISP, lifestyle changes
Alcohol Ignition Interlocks

- Reduces DWI recidivism by about 65% for offenders with interlocks (who sometimes use alternative vehicles) compared to similar offenders who did not get the interlock.
- Reduces recidivism by 70% for first-time DWI offenders (on, then off).
- Reduces recidivism by 55% for multiple DWI offenders (on, then off).
- If installed on all vehicles of offenders, would probably prevent 95% of DWI behavior during installation period.
What Has Worked Worldwide?
Transportation Research Board (TRB) Review

- Activism
- Legislation
- Enforcement
- Sanctions
- Public Information

Result has been a change in the norm!
Laws That Have Shown Impact

- Illegal Per Se
- Administrative License Revocation (ALR)
- Minimum Legal Drinking Age (MLDA)
- .08 Illegal Per Se
- Zero Tolerance for Youth
- Vehicle Sanctions
- Primary Seat Belt Laws (recent)
Where Are We Now?

- Progress has clearly leveled off
- Awareness and concern has declined
- Enforcement has declined
- Youth laws not being enforced
- Many laws being eroded
- Seat belt use among drinking drivers low
- Other priorities and competing public health issues

(note that nothing has changed in several years.)
NHTSA Priority Strategies for Reducing Impaired Driving

- High-Visibility Enforcement
- DWI Courts & Special Prosecutors
- Screening & Brief Intervention
- Primary Seat Belt Laws
MADD Campaign to Eliminate Drunk Driving

High-Visibility Enforcement
Increased Use of Ignition Interlocks
Research Advanced Interlock Technology
Grassroots Support
Alcohol Ignition Interlocks
Passive Alcohol Sensor
Driver Alcohol Detection System for Safety [DADSS]

- Funding from the government and auto industry

Two Prototypes being developed:

- Tissue Spectrometry – touch-based system using near infrared to identify BAC in the dermis
- Breath-Based – Infrared spectroscopy sensors measure BAC in driver’s breath only (not passenger)

- Objective: Reliable system to be standard in all vehicles in the future (~10 years). Vehicle will not start if driver BAC is over the illegal limit
Transportation Fatalities 2010

Source: National Transportation Safety Board, 2010
Transportation Expenditures FY 2011

- All Transportation: $72.8 billion
- Highway Safety: $872 million (≈1%

US Federal Research Budgets
2013

Public Health:
- National Heart, Lung & Blood Institute - $3.1 billion
- National Cancer Institute - $1.8 billion
- National Institute of Dental and Craniofacial Research - $408 million

Public Safety:
- Federal Highway Administration – Highway Safety Program (guard rails; impact attenuators; signs; delineation; etc.) - $2.5 billion
- National Highway Traffic Safety Administration – Highway Safety Research (Impaired driving; Safety Belt Use; Speeding; etc.) - $150 million
Transportation Research Board
National Academies of Sciences, Engineering and Medicine

- Results of a Workshop Sponsored by the Transportation Research Board Committee on Alcohol, Other Drugs and Transportation (ANB50) held on August 24-25, 2015.

- Workshop was attended by 26 experts in impaired driving research and policy. 16 of the 26 submitted their top three priorities after the workshop.
Eight Effective Alcohol Policy Strategies Discussed

1. Increase alcohol taxes
2. Re-engage the public
3. Lower illegal BAC limit for driving to .05
4. Implement in-vehicle alcohol detection systems (DADSS)
5. Expand screening and brief interventions in medical facilities
6. Impose administrative sanctions for BACs=.05-.08
7. Require alcohol ignition interlocks for all alcohol impaired driving offenders
8. Increase the frequency of sobriety checkpoints including legislation to allow them in states where prohibited
Three Top Priority Alcohol Policy Strategies

1. Impose administrative sanctions for drivers with BACs = .05 to .08

2. Adopt All Offender Alcohol Ignition Interlock Laws

3. Increase the frequency of sobriety checkpoints
Questions?
Contact Information

James C. Fell
Principal Research Scientist
National Opinion Research Center (NORC) at the University of Chicago
4350 East-West Highway, 8th Floor
Bethesda, MD 20814
301-634-9576
fell-jim@norc.org