What Does the Research Tell Us?

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- Trucking fleets and drivers who participated in the naturalistic truck studies
- DriveCam
What is Driver Distraction and Inattention?

- Driver distraction:
  - Diversion of attention away from activities critical for safe driving toward non-driving activities (e.g., talking on a cell phone, texting, etc.)

- Driver inattention
  - Diminished attention to activities that are critical for safe driving in the absence of a non-driving activity (e.g., fatigue, alcohol, etc.)
What is an Occupational Driver?

- An occupational driver is defined as someone who drives at least once per week for occupational purposes (Murray et al., 2003)
  - Truck driver
  - Bus/transit driver
  - Taxi driver
  - Sales (e.g., pharmaceutical representatives)
  - Emergency services
  - Taxi driver
  - Police
Occupational Driving Crashes

- Crashes are the leading cause of occupational death (BLS, 2004)
- Occupational drivers are over-involved in road crashes compared to non-occupational drivers (Haycock et al., 1996)
  - Similar results when controlling for exposure (large trucks vs. passenger cars; see Traffic Safety Facts)
- Reason for this discrepancy is unclear
  - Unique factors operating within the organizational context
    - Willis et al. (2006) found that work pressure was related to driving while distracted
Driver Distraction Research

- Few studies on driver distraction until 2000 (~30 total articles)
  - Now roughly 50 articles per year
- Few of these studies address occupational driver distracted driving
  - However, results are still pertinent to this area
• Precise knowledge about crash risk
• Information about important circumstances and scenarios that lead to crashes

**Epidemiological Data Collection**

• Reactive
• Very limited pre-crash information

**Large-Scale Pseudo Naturalistic Data Collection**

• “Natural” driver behavior
• Detailed pre-crash/crash info
  • Distraction
  • Fatigue
  • Aggressive driving
  • Driver errors
  • Vehicle dynamics
• Potential validation of surrogate measures

**Empirical Data Collection**

• Proactive
• Provides important ordinal crash risk info

• Imprecise, relies on unproven safety surrogate
• Experimental situations modify driver behavior
Naturalistic Method

- Study participants use an instrumented vehicle for an extended period (e.g., several months to one year)
- No experimenter present; no specific instructions
- Highly capable data acquisition systems (well beyond EDRs)
- Data collected continuously
- Able to get detailed pre-crash/crash information along with routine driving behaviors
Empirical Simulator Studies

- Studies found that drivers while talking had (NSC, 2010):
  - Longer brake response times of 130 ms - 250 ms
  - Did not scan their mirrors as much
  - Failed to detect objects in the environment
- Same studies found that drivers:
  - Reduced their speed
  - Increased their forward headway to the lead vehicle
- 58% or drivers talk on a cell phone while driving, yet the crash rate has shown a downward trend
In 2008, 22% of all crashes in GES involved distraction

Naturalistic driving study with 100 passenger cars found distraction/inattention in (Klauer et al., 2006):

- 78% of crashes
- 65% of near-crashes

11% of large truck crashes in the LTCCS were attributed to internal or external distraction

- Percentage reflects the primary reason and not an associative factor
Occupational Driving Research Gap

- Of the distraction research, most directed at non-occupational drivers
- Is driver distraction a safety issue in occupational driving?
- VTTI studies focused on commercial motor vehicle (CMV) drivers and used continuously collected naturalistic data
  - Using video, able to determine what driver was doing *prior* to safety-critical events
  - “Instant replay”
Olson et al. (2009) used recent data from two separate studies:

- 203 drivers, 7 fleets, 55 trucks, 3 million miles
- Study 1: ~12 weeks per driver
- Study 2: ~4 weeks per driver
- 4,452 safety-critical events
  - 21 crashes
  - 197 near-crashes
  - 3,019 crash-relevant conflicts
  - 1,215 unintentional lane deviations
- 19,888 baseline epochs (normal driving)
Analysis Approach

- Video review of all safety-critical events \( (n = 4452) \) and baselines/normal driving \( (n = 19,888) \)
- Determination made as to what driver was doing just prior to event onset (e.g., when lead vehicle began to brake)
  - Some events and baseline epochs involved drivers engaged in non-driving (distraction) tasks
- Odds ratios used to assess risk associated with different tasks (comparing event data with non-event data)
- Eye glance analysis conducted to determine where driver was looking prior to event (6 second epoch)
Is Distraction an Issue in CMV Drivers?

- 60% of the safety-critical events had some type of driver distraction

<table>
<thead>
<tr>
<th>Event Type</th>
<th>All Safety-Critical Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>All safety-critical events</td>
<td>59.9%</td>
</tr>
<tr>
<td>Crashes</td>
<td>71.4%</td>
</tr>
<tr>
<td>Near-crashes</td>
<td>46.2%</td>
</tr>
<tr>
<td>Crash-relevant conflicts</td>
<td>53.6%</td>
</tr>
<tr>
<td>Unintentional lane deviations</td>
<td>77.5%</td>
</tr>
</tbody>
</table>
### Sample of Non-Driving Tasks

<table>
<thead>
<tr>
<th>Task</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
<th>Frequency of Safety-Critical Events</th>
<th>Frequency of Baselines</th>
<th>Mean Eyes Off Forward Road Time (out of 6 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text message on cell phone</td>
<td>23.24</td>
<td>9.69 - 55.73</td>
<td>31</td>
<td>6</td>
<td>4.6 sec</td>
</tr>
<tr>
<td>Interact with/look at dispatching device</td>
<td>9.93</td>
<td>7.49 - 13.16</td>
<td>155</td>
<td>72</td>
<td>4.1 sec</td>
</tr>
<tr>
<td>Write on pad, notebook, etc.</td>
<td>8.98</td>
<td>4.73 - 17.08</td>
<td>28</td>
<td>14</td>
<td>4.2 sec</td>
</tr>
<tr>
<td>Use calculator</td>
<td>8.21</td>
<td>3.03 - 22.21</td>
<td>11</td>
<td>6</td>
<td>4.4 sec</td>
</tr>
<tr>
<td>Look at map</td>
<td>7.02</td>
<td>4.62 - 10.69</td>
<td>56</td>
<td>36</td>
<td>3.9 sec</td>
</tr>
<tr>
<td>Dial cell phone</td>
<td>5.93</td>
<td>4.57 - 7.69</td>
<td>132</td>
<td>102</td>
<td>3.8 sec</td>
</tr>
<tr>
<td>Talk/listen to hand-held phone</td>
<td>1.04</td>
<td>0.89 - 1.22</td>
<td>195</td>
<td>837</td>
<td>1.3 sec</td>
</tr>
<tr>
<td>Talk/listen to hands-free phone</td>
<td>0.44</td>
<td>0.35 - 0.55</td>
<td>91</td>
<td>901</td>
<td>1.6 sec</td>
</tr>
<tr>
<td>Talk/listen to CB radio</td>
<td>0.55</td>
<td>0.41 - 0.75</td>
<td>50</td>
<td>399</td>
<td>1.3 sec</td>
</tr>
</tbody>
</table>
Video provided by DriveCam
Video provided by DriveCam
Video provided by DriveCam
Video provided by DriveCam
| Front | FWD 0.03 | LAT -0.07 | Time -8.00 | 6 MPH GPS | Rear |
Driving Transportation With Technology
Olson et al. Limitations

- Relatively few crashes
- Relatively few drivers/trucks/miles
- FMCSA-funded study using DriveCam data was conducted to address these limitations...
Hickman et al. (2010) Distracted Driving Study

- 13,305 vehicles (trucks and buses)
- 1,085 crashes; 39,036 near-crashes and events
- 211,171 baselines

<table>
<thead>
<tr>
<th>Tertiary Task</th>
<th>Odd Ratio</th>
<th>Lower Conf Limit</th>
<th>Upper Conf Limit</th>
<th>Freq of Safety Critical Events</th>
<th>Freq of Baselines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialing Cell Phone</td>
<td>3.51*</td>
<td>2.89</td>
<td>4.24</td>
<td>165</td>
<td>256</td>
</tr>
<tr>
<td>Talk/Listen Hands-Free Cell Phone</td>
<td>0.65*</td>
<td>0.56</td>
<td>0.76</td>
<td>194</td>
<td>1,626</td>
</tr>
<tr>
<td>Talk/Listen Hand Held Cell Phone</td>
<td>0.89</td>
<td>0.80</td>
<td>1.00</td>
<td>372</td>
<td>2,266</td>
</tr>
<tr>
<td>Reaching for Bluetooth Device</td>
<td>3.38*</td>
<td>2.64</td>
<td>4.31</td>
<td>104</td>
<td>168</td>
</tr>
<tr>
<td>Reaching for Cell Phone</td>
<td>3.74*</td>
<td>2.97</td>
<td>4.71</td>
<td>122</td>
<td>178</td>
</tr>
</tbody>
</table>
## Comparison of Results

<table>
<thead>
<tr>
<th>Tertiary Task</th>
<th>Odds Ratios for Tractor Trailers/Tankers Only in Hickman et al. (2010)</th>
<th>Odds Ratios in Olson et al. (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialing Cell Phone</td>
<td>5.44*</td>
<td>5.93*</td>
</tr>
<tr>
<td>Talk/Listen Hands-Free Cell Phone</td>
<td>0.58*</td>
<td>0.44*</td>
</tr>
<tr>
<td>Talk/Listen Hand-Held Cell Phone</td>
<td>1.01</td>
<td>1.04</td>
</tr>
<tr>
<td>Reaching for Bluetooth Device</td>
<td>4.43*</td>
<td>6.72*</td>
</tr>
<tr>
<td>Reaching for Cell Phone</td>
<td>7.60*</td>
<td>Included in dial cell phone</td>
</tr>
<tr>
<td>Text/Email/Web</td>
<td>+</td>
<td>23.24*</td>
</tr>
<tr>
<td>Food/Drink</td>
<td>1.53*</td>
<td>1.01</td>
</tr>
</tbody>
</table>

* Asterisk indicates a significant odds ratio. These ratios are also shown in bold.
+ odds ratio calculation was only performed across all vehicle types
### Odds Ratios for Cell Phone Policy/Law

<table>
<thead>
<tr>
<th>Cell Phone Policy</th>
<th>Frequency of Cell Phone Use with Policy/Law</th>
<th>Frequency of No Cell Phone Use without Policy/Law</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet Cell Phone Policy</td>
<td>8,787</td>
<td>1,897</td>
<td>0.83*</td>
<td>0.78 - 0.87</td>
</tr>
<tr>
<td>State Cell Phone Law</td>
<td>4,526</td>
<td>2,987</td>
<td>0.97</td>
<td>0.94 - 1.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy/Law</th>
<th>Obeyed Cell Phone Law/Policy</th>
<th>Violated Cell Phone Law/Policy</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only a State Hand-Held Law</td>
<td>12,120</td>
<td>521</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Only a Carrier No Cell Phone Policy</td>
<td>56,502</td>
<td>1,428</td>
<td>1.7</td>
<td>1.5 - 1.9</td>
</tr>
<tr>
<td>Only a Carrier Hand-Held Policy</td>
<td>8,689</td>
<td>89</td>
<td>4.2</td>
<td>3.3 - 5.3</td>
</tr>
</tbody>
</table>
Study Conclusions

- Driver distraction is a prevalent contributing factor
  - Occupational drivers engaged in work-related tasks while driving
  - High-risk tasks had the highest eyes off road time
- Enforcement is critical in distraction policy and legislation
  - Hand-held cell phone use rate in New York rebounded to pre-law levels after law enacted (McCurtt & Geary, 2003, 2004)
    - Relationship between the frequency of safety-belt citations and safety-belt use (Campbell, 1988; Kim, 1991)
    - Perception of being ticketed for a safety-belt infraction was enough to alter safety-belt use (Chaudhary et al. 2004)
Research Recommendations

- Education to highlight the importance of eyes on forward roadway and scanning
  - Dangers of performing work-related tasks
- Policies to curb use of in-vehicle devices that draw attention away from forward roadway
  - Cell phone, texting, dispatching device
  - Enforcement is critical
- Is talking OK?
  - Dialing and/or reaching are necessary to operate hand-held phone
  - “true hands-free” and CB appear to be safe
- Re-design of dispatching devices
Thank you!

Questions?

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