

Driver Distraction: 100 Car Naturalistic Study Results

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What are the advantages of Naturalistic Driving approach?

- More detailed driver behavior information in the seconds leading up to:
 - Incidents
 - Near crash
 - Crash

- Greater external validity
 - Information about driver behavior under normal day-to-day pressures
- Rich data set
 - Vehicle data
 - Driver data (demographic/questionnaire)
 - Video

100 Car Naturalistic Driving Study

- Collected data on 100 private and leased vehicles in metro Washington, DC.
- Drivers were not coached or instructed to perform any specific actions other than drive as they normally would.
- Instrumentation is unobtrusive
 - Face camera behind smoked glass
 - Other cameras are 1" x 1"
- Collect continuous data for 12 months

100 Car Study Vehicle Instrumentation

- Five channels of continuous digital, compressed video
- Machine vision-based lane tracker
- Many other sensors: GPS, glare, RF, acceleration, yaw rate, controls, etc.
- Cell phone, hardwire download
- Tie into vehicle network to obtain other sensor information
- Radar sensors front, rear, and side
- Ruggedized, crash tested, all solid state



Driver Distraction Defined

- Driver distraction, defined here as engaging in a secondary task or activity that is not central to the primary task of driving, has been shown to be a contributing factor for many crashes.
- Secondary tasks and other activities in which drivers choose to engage while driving is also known to be highly varied, including very complex activities (e.g., text messaging on a cellular device) to very simple activities (e.g., selecting a radio preset).

Analysis Approach

- Data analyses were conducted utilizing the “100 car” naturalistic driving databases.
- These data were specifically analyzed for the purpose of assessing secondary task distraction.
- From these data, an “event” database of crashes and near crashes was created with 830 crashes, minor collisions and near crashes.
 - 42,000 hours of driving/over 2 MVMT
- These data were also used to develop a “non-event” or baseline database to assess exposure.
 - Used both a case-control and case-crossover baseline databases, which did not produce significant differences in risk calculations.

VTTI Data Tools

VTTI

Driving Transportation with Technology



100 Car Study Results

- Fatigue contributed to crashes/collisions at much higher rates than is reported using existing crash databases.
 - Fatigue was a contributing factor in 20% of all crashes and 12% of near crashes
 - Most current database estimates place fatigue-related crashes at approximately 2 to 4% of total crashes.
 - Fatigue increased crash/near-crash involvement by 4-6 times that of an alert driver.

Results on Driver Distraction

- Drivers aged 18-20 were over 4 times more likely to be involved in a distraction-related crash or near-crash than any other age group.
- Engaging in tasks, such as dialing a cell phone, manipulating an iPod, or reading, increased crash risk by 3 times that of an alert driver.
- Engaging in tasks, such as eating, inserting a CD, etc. increased crash risk by 2 times that of an alert driver.

Results: Crash/near-crashes occur when drivers expectations are violated.

- Total time eyes off the forward roadway increases crash/near-crash involvement by 2 times that of an alert driver.
- Driver's sometimes do not know what happened or why they lost control.
- Crashes/near-crashes happen very quickly.
- Police accident reports suggest following too closely...not always the case.

Odds Ratios from 100-Car Study

Type of Secondary Task	Odds Ratio	Lower CL	Upper CL
Reaching for a moving object	8.8	2.5	31.2
Insect in vehicle	6.4	0.8	53.1
Looking at external object	3.7	1.1	12.2
Reading	3.4	1.7	6.5
Applying make-up	3.1	1.3	7.9
Dialing hand-held device	2.8	1.6	4.9
Inserting/retrieving CD	2.3	0.3	17.0
Eating	1.6	0.9	2.7
Reaching for non-moving object	1.4	0.8	2.6
Talking/listening to hand-held device	1.3	0.9	1.8
Drinking from open container	1.0	0.3	3.3
Other personal hygiene	0.7	0.3	1.5
Adjusting radio	0.6	0.1	2.2
Passenger in adjacent seat	0.5	0.4	0.7
Passenger in rear seat	0.4	0.1	1.6
Combing hair	0.4	0.1	2.7
Child in rear seat	0.3	0.04	2.4

- These results have significant implications for the design of driver-vehicle interfaces, as well as the need for future integration of nomadic devices into the driver-vehicle interface in a manner which will minimize crash and near crash risk.

- Cognitive-only, or auditory-voice secondary task interfaces will generally be less risky than visuo-manual secondary tasks.
 - The tasks with the highest crash risk are those that require multiple glances away from the road.

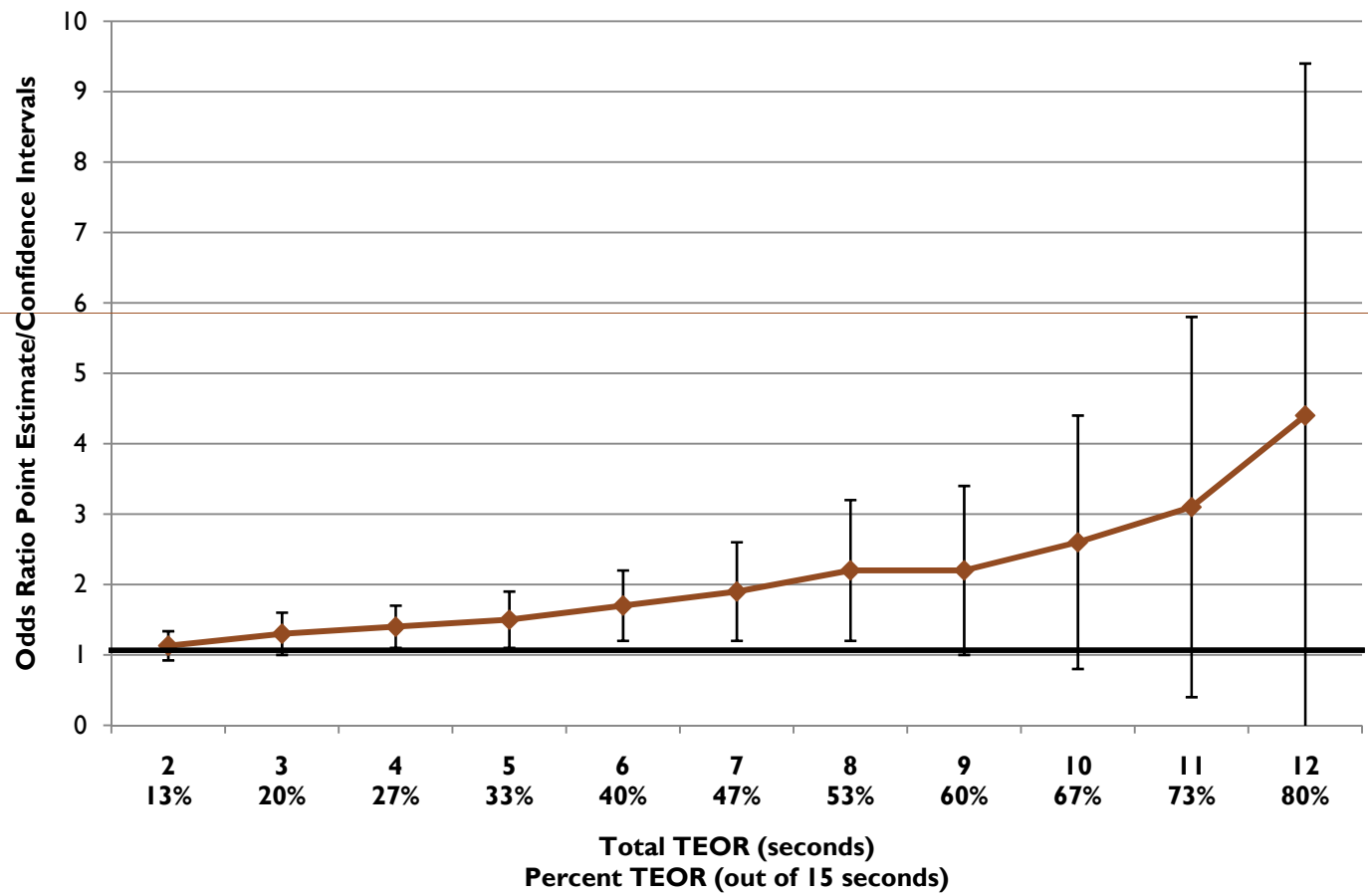
Hand-held is substantially riskier than “true” hands-free.

- Operating a complex hand-held device is significantly more risky than a hands-free counterpart.
- Dialing and answering a hand-held phone were both higher risk tasks, even in comparison to the often longer task of talking on a hand held phone.
- Greatest proportion of risk does not come from the conversation or act of holding a phone to one's ear, it comes from the complex task components of dialing, answering, texting, etc. that require multiple glances away from the roadway.

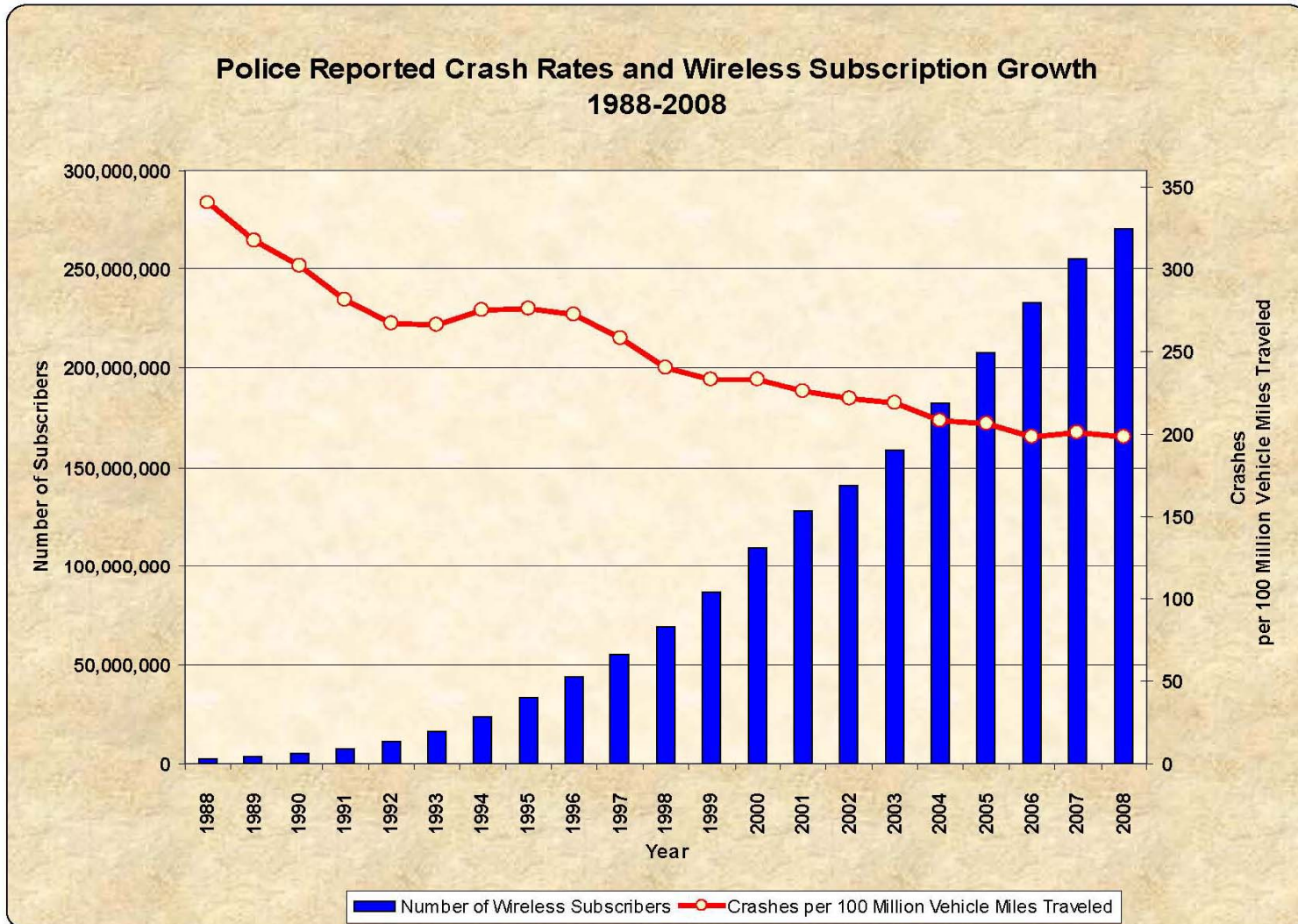
An “interruptible” task is risky if it involves eyes-off-road.

- Recent research indicates that if an in-vehicle secondary task is “interruptible”, the driver can manage the task while driving without increasing crash risk.
- Results show no indication of a constant, or nearly constant, crash/near crash risk, for a broad range of in-vehicle tasks given that multiple glances away from the roadway are required.
- Crash/near crash most often involves an unexpected external event occurring when the driver is not looking in the direction of the event.

Time Eyes Off-Road (TEOR) OR For Case-Crossover versus Case-Control (con't)



Cell Phones Trends and Crash Rates



Sources: Traffic Safety Facts, DOT HS 811 002, NHTSA, 2007
Traffic Safety Annual Assessment, DOT HS 811 172, NHTSA, 2008
CTIA, ANNUALIZED WIRELESS INDUSTRY SURVEY RESULTS - DECEMBER 1985 TO DECEMBER 2008

Conclusions

- Visual/manual secondary tasks increase driver's crash/near-crash risk significantly higher than purely cognitive secondary tasks.
 - The results presented here have been replicated with naturalistic driving from truck drivers and teen drivers.
- With the increase in cell phone subscriptions and use while driving, we must design methods that reduce the visual/manual aspects of the task to improve safety.